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Status of F/H Area Radioactive Liquid Waste Tanks Being Removed from Service
CY2021 Annual Report

March 2022

Savannah River Remediation
AMENTUM | BECHTEL | JACOBS | BWXT

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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) 2021 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 2021, DOE continued to make progress regarding waste removal and closure. In CY2021, Tank Closure Cesium Removal (TCCR) Unit 1 process upgrades and enhancements were completed to allow processing higher curie Tank 9H waste. The ion exchange columns were upgraded to a smaller diameter to improve heat removal and a smaller bead size Crystalline Silicone Titanate (CST) resin was selected to enhance cesium adsorption. In CY2021, a flush bypass line, passive ventilation modification, and a supplemental ventilation modification were added. Additional upgrades included a new design for the pre-filters with a smaller pore size and increased surface area, as well as the relocation of the TCCR control room to a low-dose area. The revised TCCR Safety Basis was approved by DOE, implemented in CY2021, and included a modification that allowed the relocation of columns between spots in the TCCR Process Enclosure, allowing for increased column utility. These modifications enhance the TCCR unit ability to remove cesium from the Tank 9H waste.

Tank 9H readiness activities for providing feed to TCCR were completed in CY2021 and dissolved salt solution from two Tank 9H salt dissolution campaigns was sent to Tank 10H. Failure of the Tank 10H Submersible Transfer Pump and mixing issues within Tank 10H during batch qualification impacted TCCR operations. In December 2021, the CST coupons required for batch qualification were retrieved from Tank 10H and sent to Savannah River National Laboratory for analysis. At the end of CY2021, analysis of the CST coupons was in progress.

Extensive balance of plant modifications and procurements were made, as well as assembly/installation of new equipment for Tanks 3F, 15H, 27F, 31H, 33F, 35H, 39H, and 44F in preparation for waste removal and treatment. Additional waste removal preparation work in CY2021 included design work for future waste removal in Tank 2F, 28F, 47F, and 14H as well as initiation of long lead engineering procurements to support these projects.

Tank Farm Operations were in place to support full operations of Salt Waste Processing Facility (SWPF). SWPF completed hot commissioning and began full operations on January 18, 2021. Five one-million-gallon salt batches have been qualified for SWPF waste feed. Tank 21H and Tank 41H served 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. SWPF treated over 2,000,000 gallons of salt solution during CY2021.

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. In CY2021, DOE worked with SCDHEC and EPA in development of the FDB-5 and FDB-6 Closure Module and on June 17, 2021, after completion of the public comment period, SCDHEC approved the Closure Module. Final agreement that waste removal activities may cease in FDB-5 and FDB-6 was received from SCDHEC on July 12, 2021, and from the EPA on July 29, 2021. On October 26, 2021, internal grouting of FDB-5 was initiated and on November 10, 2021, the diversion box filling was completed with riser cover core drill holes and the flush water valve box being topped off manually using buckets to make final fills. On November 15, 2021, grouting of FDB-6 was initiated and on December 2, 2021 the diversion box was filled to just below the cell covers. At the end of CY2021, all that remained to complete internal grouting of FDB-6 was to manually fill using buckets the following components: the valve box, main cell, and access ports. Operational closure will be completed in CY2022 when the diversion boxes are entombed in concrete.

The United States Nuclear Regulatory Commission (NRC) did not perform any on-site monitoring visits in CY2021 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 Pathways release
ARM	Area Radiation Monitor
BWRE	Bulk Waste Removal Efforts
CGCP	Consolidated General Closure Plan for Waste Tank Systems
CSMP	Commercial Submersible Mixer Pump
CST	Crystalline Silicone Titanate
CY	Calendar Year
D&R	Disassembly and Removal
DOE	United States Department of Energy
ECSMP	Enhanced Commercial Submersible Mixer Pump
EPA	United States Environmental Protection Agency Region 4
FFA	Federal Facility Agreement for the Savannah River Site
FDB	F-Area Diversion Box
FTF	F-Area Tank Farm
GRM	Gas Release Mode
H&V	Heating and Ventilation
HIH	Hose-in-Hose
HLW	High-Level Waste
HTF	H-Area Tank Farm
LVMJ	Low Volume Mixing Jet
NDAA	Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005
NRC	United States Nuclear Regulatory Commission
PA	Performance Assessment
ROD	Record of Decision
SCDHEC	South Carolina Department of Health and Environmental Control
SMP	Submersible Mixing Pump
SRNL	Savannah River National Laboratory
SRS	Savannah River Site
STP	Submersible Transfer Pump
SWPF	Salt Waste Processing Facility
TCCR	Tank Closure Cesium Removal

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 CY2021 Activities and Accomplishments

As of the end of Calendar Year (CY) 2021, 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) have been declared complete on six additional old-style tanks: Tanks 4F, 7F, 8F, 10H, 11H, and 15H. Salt Waste Processing Facility (SWPF) completed hot commissioning and began full operations on January 18, 2021. Five one-million-gallon salt batches have been qualified for SWPF waste feed. Tank 21H and Tank 41H served 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, via the gravity drain lines for each tank. SWPF treated over 2,000,000 gallons of salt solution during CY2021.

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

Based on the information obtained and evaluated during Tank Closure Cesium Removal (TCCR) operations in 2019, DOE made the decision to process salt waste from at least one additional waste tank in addition to Tank 10H using TCCR Unit 1, Tank 9H. In CY2021, TCCR Unit 1 process upgrades and enhancements were completed to allow processing higher curie Tank 9H waste under the project name of "TCCR 1A". The ion exchange columns were upgraded to a smaller diameter to improve heat removal and a smaller bead size Crystalline Silicone Titanate (CST) resin was selected to enhance cesium adsorption. In CY2021, a flush bypass line, passive ventilation modification, and a supplemental ventilation modification were added. Additional upgrades included a new design for the pre-filters with a smaller pore size and increased surface area, as well as the relocation of the TCCR control room to a low-dose area. The TCCR- 1A Safety Basis was approved by DOE and implemented in CY2021 and included a modification that allowed the relocation of columns between spots in the TCCR Process Enclosure, allowing for increased column utility. These modifications enhance the TCCR unit ability to remove cesium from the Tank 9H waste. In addition, two additional Interim Safe Storage pads were constructed to hold ion exchange columns once they are spent. Figure 1 shows new resin columns received to support Tank 9H processing.

Tank 9H readiness activities for providing feed to TCCR were completed in CY2021. Salt dissolution activities in Tank 9H in support of TCCR-1A were restarted in April 2021 with recirculation of the liquid in the tank. After recirculation, the Tank 9H dissolved salt solution was transferred to Tank 10H on May 7, 2021 via an above ground hose-in-hose (HIH). Additional water was then added to Tank 9H, recirculated, and the resulting dissolved salt solution transferred to Tank 10H via the HIH on June 25, 2021. Tank 9H salt dissolution activities then experienced a delay due to a failure of the Tank 10H Submersible Transfer Pump (STP) and changeout of the TCCR columns. Replacement of the Tank 10H STP was completed on October 21, 2021 and recirculation of the material in Tank 10H started on October 27, 2021. At the completion of recirculation, CST coupons were deployed in Tank 10H to support batch qualification, however, based on sample results it was determined the Tank 10H contents were not well mixed. Additional recirculation was performed, and a second set of CST coupons were deployed. On December 12,

2021 the CST coupons were retrieved from the tank and sent to Savannah River National Laboratory (SRNL) for analysis. At the end of CY2021, analysis of the CST coupons was in progress.

Figure 1: Receipt of New TCCR Columns

Since the saltcake dissolution technique in Tank 10H was no longer efficient or effective at dissolving the saltcake in the tank, two Commercial Submersible Mixer Pumps (CSMPs) will be added to Tank 10H for salt/Burkeite dissolution, and to increase Tank 10H qualification space for Tank 9H dissolved salt solution. Design work for modifications to Tank 10H Risers 1 and 8 to accept CSMPs, turntables, and electrical utilities has been completed. Procurement activities for the pump assemblies, Rotek bearings, variable frequency drives, and power equipment for the two CSMPs continues. Disassembly and Removal (D&R) of existing equipment in the Tank 10 risers which will receive the CSMPs was completed in CY2021 and preparation of the risers to receive the CSMPs continues.

Tank 3F activities continued making progress toward the execution of salt dissolution activities with the completion of mechanical fabrication of the Gas Release Mode (GRM) skid and the CSMP assemblies, completion of the concrete pad installations to support the GRM skid and the CSMP Contactor skid, and the installation of the flush ring at Riser 6 to support D&R of the Low Volume Mixing Jet (LVMJ). Figure 2 shows Tank 3F concrete pad installation in progress.

Figure 2: Concrete Pad for Tank 3F GRM Skid

Activities at Tank 15H included replacement of four Submersible Mixing Pump (SMP) thermocouple spade connectors, and completion of the Ready for Mixing Readiness Self-Assessment. In addition, four Area Radiation Monitors (ARMs) were installed along the route of the above-grade HIH transfer line from Tank 15H to Tank 13H and the transmitter/receiver assemblies on each ARM were replaced to facilitate communications with the control room. In parallel with this a failed SMP was replaced, the purge ventilation system was upgraded, and the well water hoses to the Tank 15 SMPs were replaced. Repairs to the transfer line from Tank 13H to H-Area Diversion Box-2 were initiated and rerouting of the Chromate Water from the East Pump House to the existing distribution piping near Tank 11H was also initiated and that will provide cooling water to Tanks 9H-11H and Tanks 13H-15H. Figure 3 shows work in progress for Chromate Water reroute.

Figure 3: Pier Excavations for Chromate Water Reroute

After execution of a multiyear project to install equipment and tank top modifications, including the complex below-grade transfer line connection under challenging radiological conditions, the Tank 27F salt removal preparations were completed, and salt dissolution was initiated in August 2021 to support future feed preparation for SWPF. Dissolution activities were put on hold to replace the Tank 27 STP which failed in September 2021. The STP was removed at the end of December 2021 and installation of a new STP anticipated in early CY2022. Additionally, shop fabrication and non-intrusive field work supporting CSMP installation activities continued to support future salt removal once the LVMJs have reduced the salt level in the waste tank. The Project Team continued installation of the B2 Riser cover to support the CSMP installation and fabricated the CSMP contactor skid for GRM operations. Figure 4 shows the water addition pump skid.

Figure 4: Tank 27F Water Addition Pump Skid

At Tank 31H, activities included D&R and installation of a new cover at Riser B9, Heating and Ventilation (H&V) system upgrades to the primary tank ventilation system, removal of the Snell House and initiation of D&R activities at the C2 Riser, initiation of transfer line activities with the installation of anchors on the tank top for the support piers, and continued fabrications on the GRM skid. Figures 5, 6, and 7 show these activities.

Figure 5: Tank 31H Snell House Removal

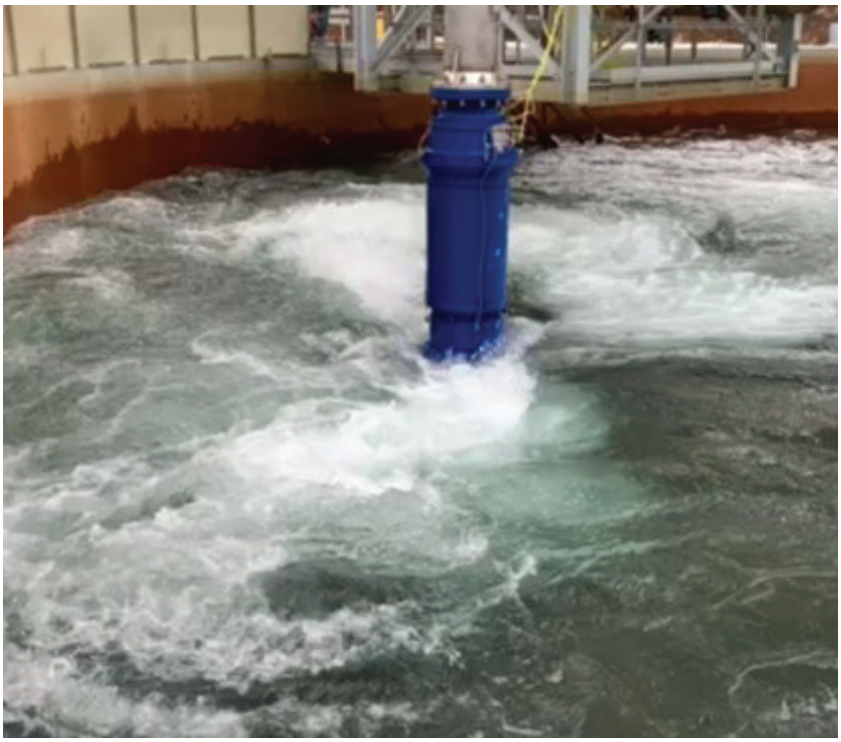
Figure 6: Tank 31H H&V Upgrades

Figure 7: Tank 31H Riser B9 Cover

The Tank 33F project completed the vendor design, assembly, and initiated testing at the TNX facility of the first of a kind Enhanced Submersible Mixing Pump (ECSMP). Testing was put on hold when the pump was determined to have unacceptable levels of vibration and a plan developed to return the pump to the vendor for repair. The pump can be installed in Risers that have an approximate opening of 34 inches and is designed to disturb and suspend solids in two quadrants

of the waste tank with the Effective Cleaning Radius of the old-style SMPs. Figure 8 shows the ECSMP undergoing testing at the TNX Facility.

Figure 8: ECSMP Testing at TNX Facility



Field work to support upcoming sludge removal activities in Tank 35H continued with tank top D&R activities, installation of three of four CSMPs, and activities to support connection of the CSMPs to the Variable Frequency Drives. Figure 9 shows a CSMP installed in Riser B8.

Figure 9: Tank 35H CSMP Installation at Riser B8

At Tank 39H, D&R of the existing ventilation stack and installation of a new stack to minimize the impacts of mercury vapor during the sludge removal activities was completed in CY2021. Activities to support future installation of CSMPs were initiated and the four primary and two spare CSMPs were received. Figure 10 shows the Tank 39H stack extension.

Figure 10: Tank 39H Stack Extension

The Tank 44F Salt Dissolution modifications continued with removal of the C1 Riser steam transfer jet and subsequent installation of a new caisson and transfer pump. A GRM skid was fabricated and installed along with three LVMJs and a stack extension. This completed the Tank 44F field work needed for salt dissolution. Startup testing was performed with associated procedures, self-assessment, and Operations Acceptance Checklists. The original STP installed in C1 Riser failed in November 2021 and replacement STP was installed on December 10, 2021. Tank 44F dissolution activities were initiated on December 17, 2021 with the Tank 44F to Tank 26F free supernate removal transfer. Figure 11 shows the Tank 44F Water Addition Pump Skid (typical designed used for other FTF tanks including Tank 27F) and Figure 12 shows the replacement STP.

Figure 11: Tank 44F Water Addition Pump Skid Piping/Valves

Figure 12: Tank 44F Replacement STP

Additional waste removal preparation work in CY2021 included design work for future waste removal in Tank 2F, 28F, 47F, and 14H as well as initiation of long lead engineering procurements to support these projects.

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 BWRE and operational closure of waste tanks, except one BWRE milestone to complete Tank 10H BWRE by November 30, 2019. The Tank 10H BWRE milestone was completed on October 31, 2019. New milestones associated with the Liquid Waste program were added to the FFA as part of this agreement:

1. Issue a F-Tank Farm Deactivation Plan by June 30, 2020;
2. Water addition to Tank 9H to begin saltcake dissolution by September 30, 2020;
3. Operational Closure of FDB-5 and FDB-6 by December 31, 2022; and
4. FTF Operable Unit Record of Decision (ROD) acceleration including issuance of a ROD by January 2040 and a Remedial Action Start by April 2041.

DOE completed two of the FFA milestones added under the agreement including the completion of water addition to Tank 9H to begin saltcake dissolution and issuance of the F-Tank Farm Deactivation Plan previously in CY2020. In addition, in CY2020 DOE, SCDHEC, and EPA agreed to proceed to the sample and analysis phase of the operational closure process for FDB-5 and FDB-6.

In CY2021, DOE continued to make progress towards the operational closure of FDB-5 and FDB-6. DOE requested SCDHEC approval of the use of low-sump concrete and zero-bleed Controlled Low Strength Material for use in FTF and HTF ancillary structure closures. On February 25, 2021 SCDHEC approved the request for using the alternate fill materials. SCDHEC approval of alternate fill materials is required by the *Consolidated General Closure Plan for F-Area and H-Area Waste Tank Systems* (CGCP).

DOE worked with SCDHEC and EPA in development of the FDB-5 and FDB-6 Closure Module and on June 17, 2021, after completion of the public comment period, SCDHEC approved the Closure Module. Final agreement that waste removal activities may cease in FDB-5 and FDB-6 was received from SCDHEC on July 12, 2021, and from the EPA on July 29, 2021. On October 6, 2021, DOE approved the F-Area Diversion Boxes 5 and 6 Tier 2 Closure Plan, which was the final approval needed to initiate stabilization of the diversion boxes. On October 26, 2021, grouting of FDB-5 was initiated with the placement of low-slump concrete into the diversion box sump to seal the drain and overflow lines. On October 27, 2021 the bulk of the interior was filled with the zero-bleed high flow grout and the diversion box was then filled to the bottom of the cell covers on November 1, 2021. Finally, on November 10, 2021, the diversion box filling was completed with riser cover core drill holes and the flush water valve box being topped off manually using buckets to make final fills. Figures 13-16 provide photos of the grouting arrangement and views inside FDB-5 during grouting.

Figure 13: FDB-5 Equipment Setup

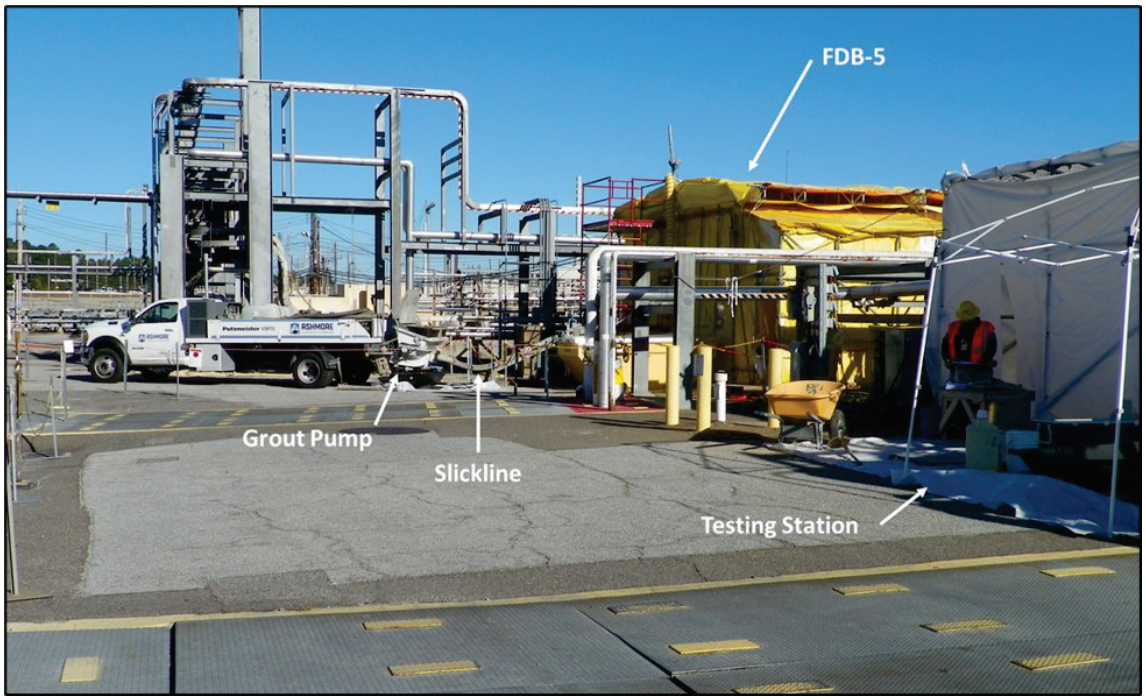


Figure 14: FDB-5 Equipment Setup Inside Hut

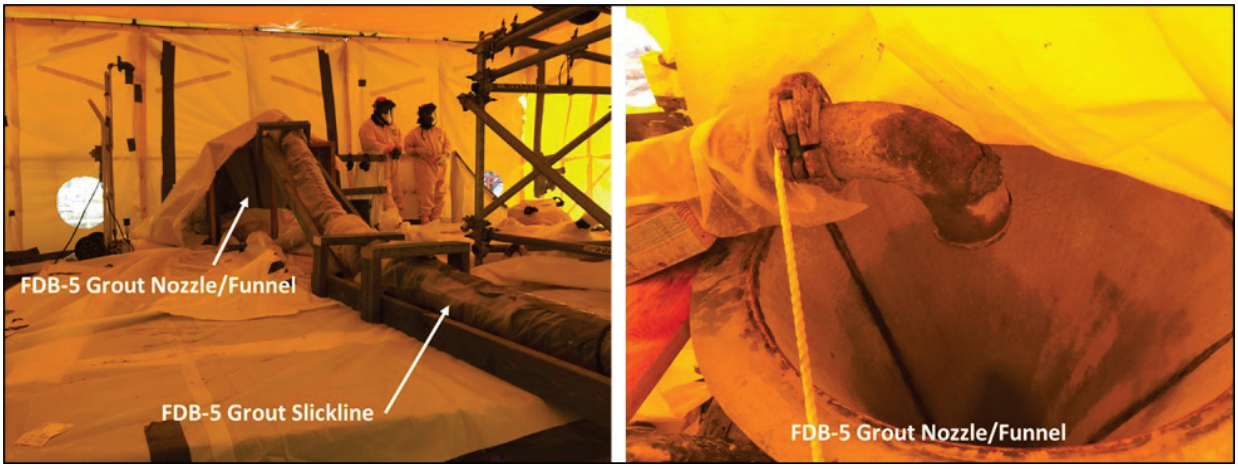
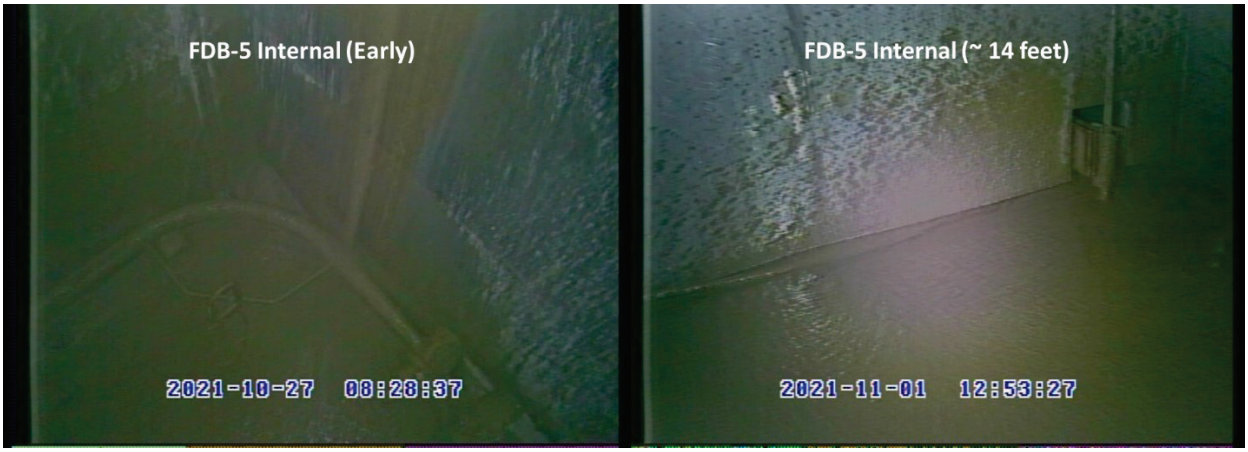


Figure 15: FDB-5 Grout Delivery

Figure 16: View Inside FDB-5 During Grouting



On November 15, 2021, grouting of FDB-6 was initiated with the placement of low-slump concrete into the diversion box sump to seal the drain and overflow lines. On November 18, 2021, filling of FDB-6 with zero-bleed high flow grout was initiated. Grouting was halted when pieces of debris, later identified to be pieces of the bulk plant hopper liner, were discovered on the grout pump screen. Corrective actions implemented included stopping grout deliveries, an inspection of the batch plant, and subsequent vendor removal of the hopper liner. Once all corrective actions were completed, grouting was resumed on December 2, 2021, and the diversion box was filled to just below the cell covers. At the end of CY2021, all that remained to complete internal grouting of FDB-6 was to fill using buckets the following components: the valve box, main cell, and access ports. Operational closure will be completed in CY2022 when the diversion boxes are entombed in concrete. Figures 17 and 18 provide photos of FDB-6 grouting arrangement.

Figure 17: FDB-6 Equipment Setup

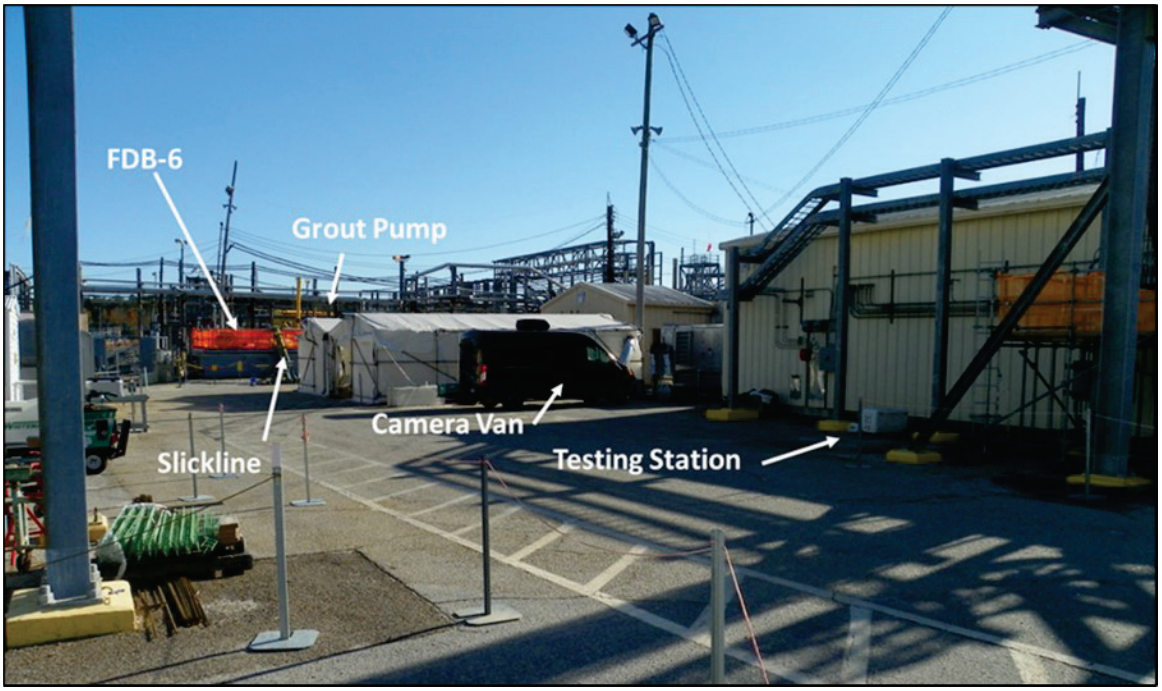


Figure 18: FDB-6 Grouting In Progress

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

No revisions or updates to the CGCP occurred during CY2021. As discussed above, DOE continues to make progress towards 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 Determinations Activities

As part of the ongoing performance assessment (PA) maintenance program consistent with DOE Manual 435.1-1, DOE has initiated work on an update to the HTF PA. The PA update will incorporate results and analyses of all Special Analyses and Unreviewed Waste Management Question Evaluations associated with the current HTF PA, updates to key modeling parameters, new models, improvements addressing stakeholder recommendations on the current HTF PA and the latest DOE technical standard guidance. Emphasis in CY2021 was on an extensive update of the HTF PORFLOW model. Key PA reports and studies issued in CY2021 in support of the HTF PA update 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 compliance case 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).

The HTF PORFLOW model update involved defining the elements/configurations that must be included in the model and how the various cases are differentiated. The modeling details will help address the dose impact of potential deviations that arise during closure operation.

Table 1 - HTF PA Modeling Reports Issued in CY2021

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 relate to the conceptual models, either through explicit modeling descriptions or through other approaches.
SRNL-STI-2021-00017	SRNL issued SRNL-STI-2021-00017, *Geochemical Data Package for Performance Assessment Calculations Related to the Savannah River Site*. This report documents updates to solute distribution coefficient and solubility limit recommendations for soils and cementitious materials.
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 structures at the presumed time of closure to support PA modeling.
SRR-CWDA-2021-00034	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.
SRNL-STI-2021-00187	SRNL issued a technical report , SRNL-STI-2021-00187, on steel tank liner and concrete reinforcing bar corrosion entitled *Corrosion of Steel in Evolving Concrete Environments*, This study was coordinated with SRR-CWDA-2021-00034, *Chemical and Physical Evolution of Tank Closure Cementitious Materials*, and provides failure times for the key steel components within closed waste storage tanks based on consideration of multiple potential modes of corrosion (e.g., anoxic, chloride-induced, carbonation-induced).

SRR-CWDA-2021-00042 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 IEI 2024-002, *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*. The recommendations contained in IEI 2024-002 are based on an updated Nuclear Energy Agency thermodynamic database published in 2020, and insights gained from review of laboratory experiments involving real tank waste samples conducted over the past decade.
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 Saltstone Disposal Facility analysis, SRR-CWDA-2021-00035, *Erosion Analysis for the Saltstone Disposal Facility*. The analysis utilizes the Revised Universal Soil Loss Equation 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.

DOE also performed FTF PA model updates in support of operational closure of FDB-5 and FDB-6, with these analyses captured in a new FTF SA, SRR-CWDA-2020-00055, *FDB-5 and FDB-6 Special Analysis for the Performance Assessment for the F-Tank Farm at the Savannah River Site*. The FDB-5 and FDB-6 Special Analysis reports that the results and conclusions presented in the FTF PA and supporting Special Analyses are not impacted by the final residual inventories that will be grouted in-place in FDB-5 and FDB-6.

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 CY2021, effluent continued to be collected and analyzed for RadFLEx's active lysimeters (including the 15 new lysimeters installed in 2020). Additionally, a technical document detailing different analytical techniques for measuring radium and iodine in lysimeter effluent was issued by Clemson University in support of the RadFLEx project. The document discusses the detection limits, ease, and cost associated with each analytical method to support decisions regarding what analytical method best suits the needs of the research both scientifically and financially.

The NRC did not perform any on-site monitoring visits related to FTF or HTF in CY2021, however, a virtual meeting was held in CY2021 to discuss several aspects of the HTF PA Goldsim model. SRR 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: CY2021 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 CY2021.

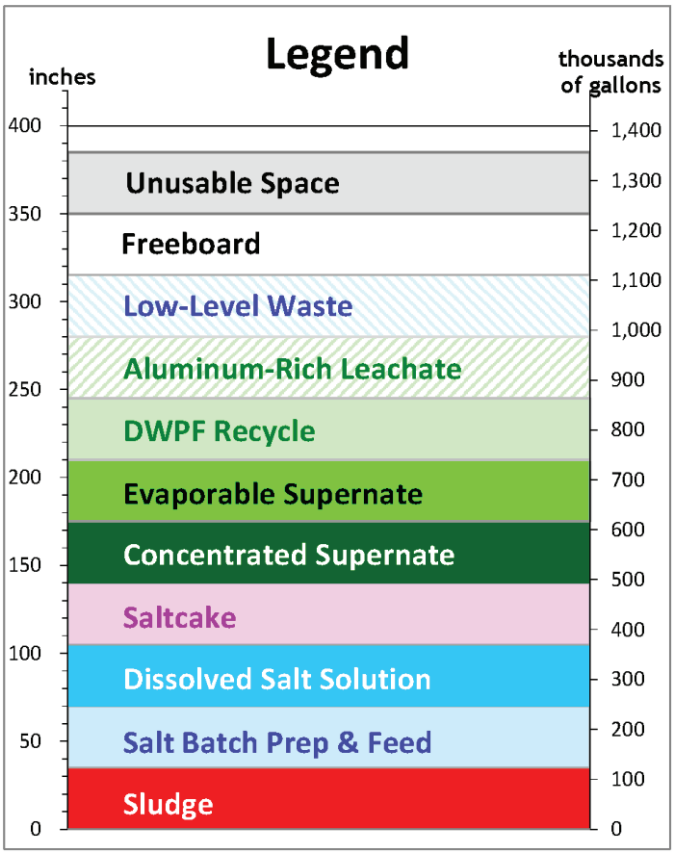
Several of the tanks experienced leakage in the past. A dark green background in the tank diagram indicates a tank that has a leakage history; tank storage liquid levels are currently maintained below the lowest known leak site.

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

Acronyms:

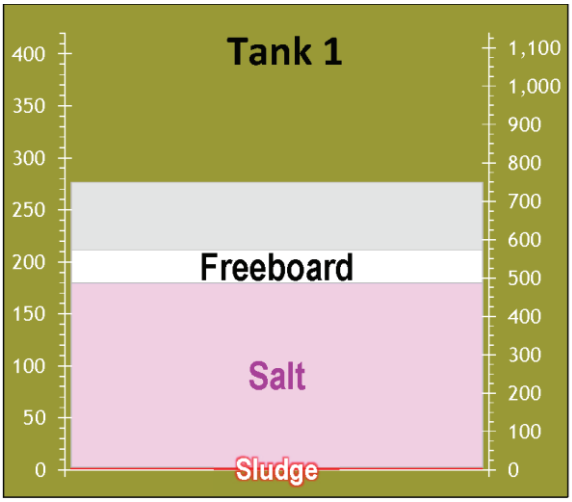
BWRE:	Bulk Waste Removal Efforts
DSS	Decontaminated Salt Solution
DWPF:	Defense Waste Processing Facility
EOY:	End of Year (December 31, 2021)
EPA:	Environmental Protection Agency
LTAD	Low Temperature Aluminum Dissolution
SCDHEC:	South Carolina Department of Health & Environmental Control
SWPF	Salt Waste Processing Facility
TCCR	Tank Closure Cesium Removal



Tank 1:

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

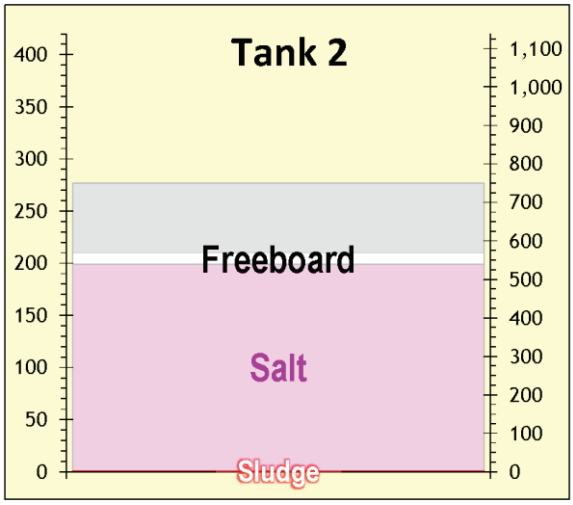
Status: There were no transfers in or out of Tank 1 during 2021.



Tank 2:

Area: F-Area
Service: BWRE activities planning have been initiated
Type: I
EOY Volume: 540,100 gallons

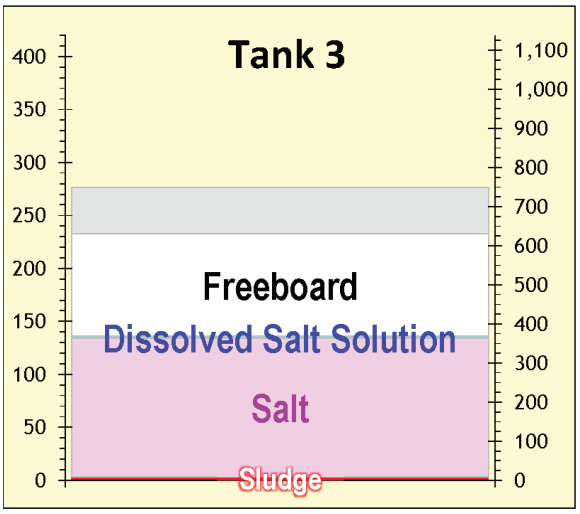
Status: There were no transfers in or out of Tank 2 during 2021.



Tank 3:

Area: F-Area
Service: BWRE activities are ongoing
Type: I
EOY Volume: 368,290 gallons

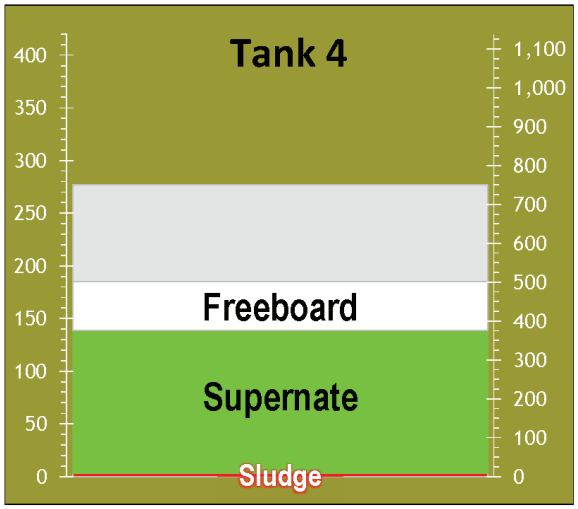
Status: During 2021, approximately 9,000 gallons of rainwater were transferred from the F-Area Catch Tank to Tank 3. Tank 3 transferred 30,000 gallons to Tank 7 to provide rainwater receipt space.



Tank 4:

Area: F-Area
Service: BWRE Complete – In 2011, SCDHEC and EPA approved the continued use of Tank 4 for storage of supernate for the purpose of keeping the remaining sludge hydrated to facilitate future tank cleaning activities.
Type: I
EOY Volume: 376,690 gallons

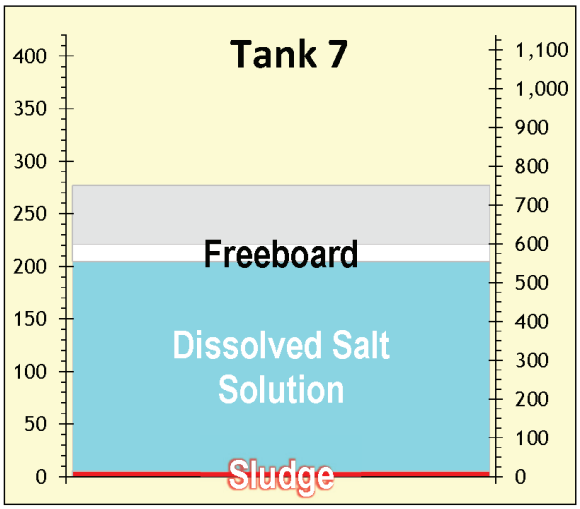
Status: Tank 4 received 254,000 gallons from Tank 37F Salt Dissolution. An additional 7,800 gallons of sodium hydroxide were added for chemical adjustment.



Tank 7:

Area: F-Area
Service: BWRE Complete – Approved by SCDHEC and EPA in 2018 for use as hub tank to receive Tank 3 dissolved salt solution.
Tank Type: I
EOY Volume: 554,740 gallons

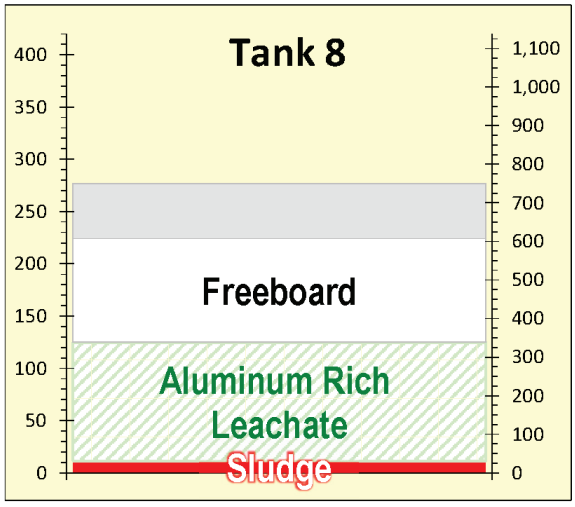
Status: Tank 7 received approximately 30,000 gallons of dissolved salt solution from Tank 3.



Tank 8:

Area: F-Area
Service: BWRE Complete – Approved by SCDHEC and EPA in 2018 for storage of aluminum-rich leachate from LTAD in support of Sludge Batch 10 preparation.
Type: I
EOY Volume: 338,210 gallons

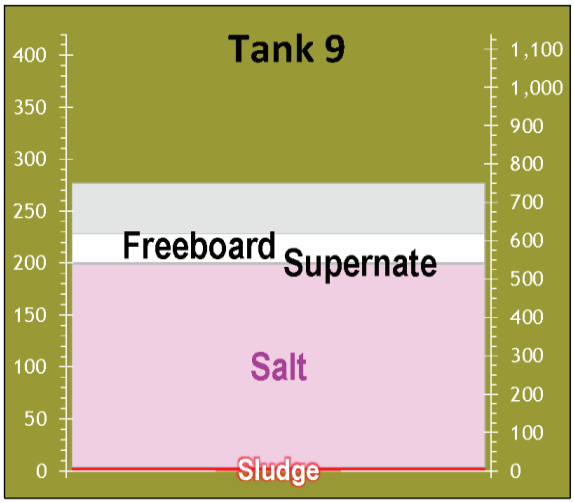
Status: Tank 8 transferred approximately 83,000 gallons to Tank 21F for SWPF Batch 4 formation.



Tank 9:

Area: H-Area
Service: BWRE planning activities have been initiated
Type: I
EOY Volume: 542,000 gallons

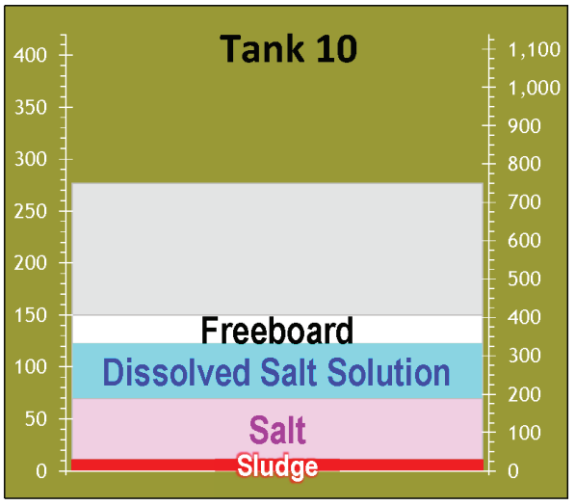
Status: During 2021, approximately 48,000 gallons of domestic water was added to dissolve salt. Approximately 111,000 gallons was transferred to Tank 10 for TCCR processing.



Tank 10:

Area: H-Area
Service: BWRE activities are complete
Type: I
EOY Volume: 332,790 gallons

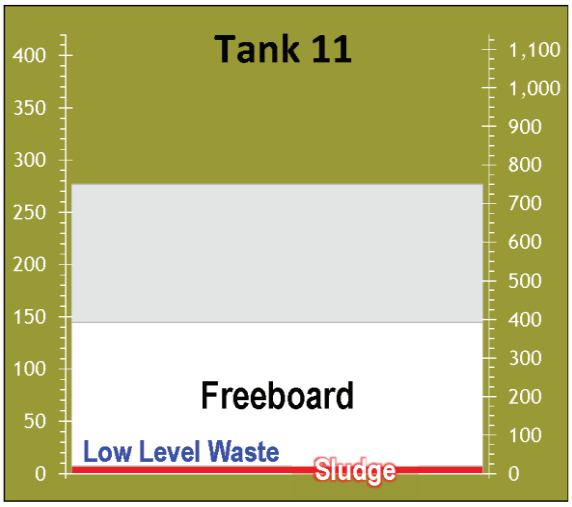
Status: In preparation for resumption of TCCR operations, approximately 111,000 gallons was received from Tank 9, 32,000 gallons of domestic water was added, and 11,000 gallons of sodium hydroxide added for chemical adjustments.



Tank 11:

Area: H-Area
Service: BWRE Complete – Approved by SCDHEC and EPA in 2017 for receipt and storage of DSS from TCCR
Type: I
EOY Volume: 19,512 gallons

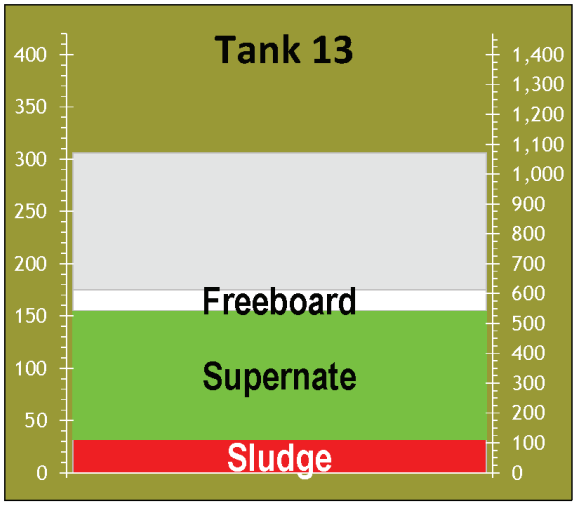
Status: There were no transfers in or out during 2021.



Tank 13:

Area: H-Area
Service: Active Waste Tank that will be used as a Hub Tank in the support of future cleaning activities for Tanks 9, 10, 11, 14, and 15
Type: II
EOY Volume: 538,650 gallons

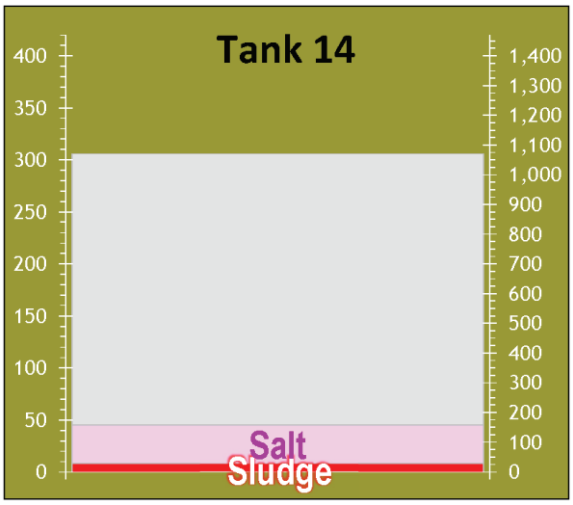
Status: There were no transfers in or out of Tank 13 during 2021.



Tank 14:

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

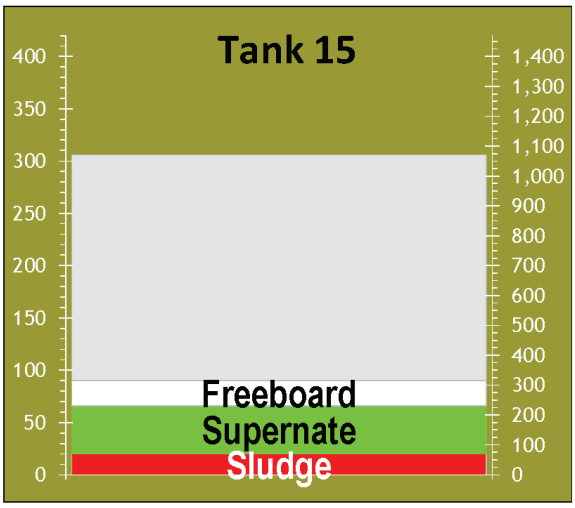
Status: There were no transfers in or out during 2021.



Tank 15:

Area: H-Area
Service: BWRE Complete; Heel Removal in preparation for grouting and removal from service is ongoing
Type: II
EOY Volume: 224,700 gallons

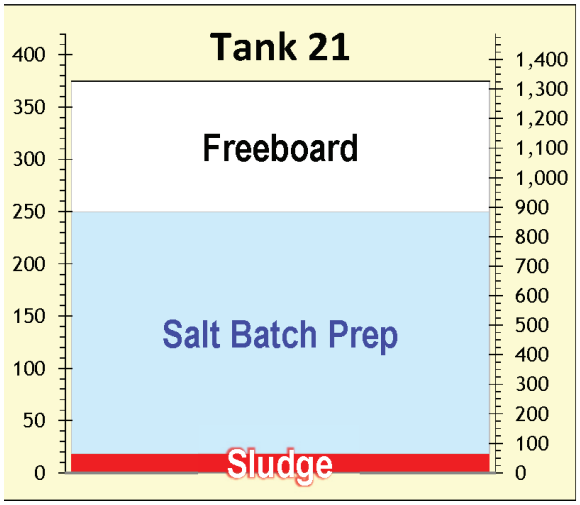
Status: There were no transfers in or out during 2021.



Tank 21:

Area: H-Area
Service: Salt Batch Blend Tank
Type: IV
EOY Volume: 883,580 gallons

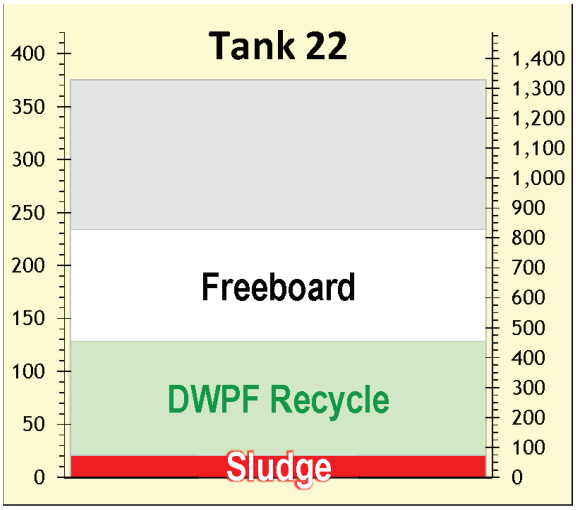
Status: Approximately 964,000 gallons of SWPF Batch 2 were transferred to the SWPF Feed Tank, Tank 49, in two transfers. Tank 21 subsequently received approximately 908,000 gallons in SWPF Batch 4 formation transfers from Tanks 8F, 22, 23, 26F, and 39. An additional 95,000 gallons of sodium hydroxide completed SWPF Batch 4 formation. 395,000 gallons of Batch 4 were subsequently transferred to Tank 49 for processing at SWPF.



Tank 22:

Area: H-Area
Service: Storage Tank for DWPF Recycle
Type: IV
EOY Volume: 455,240 gallons

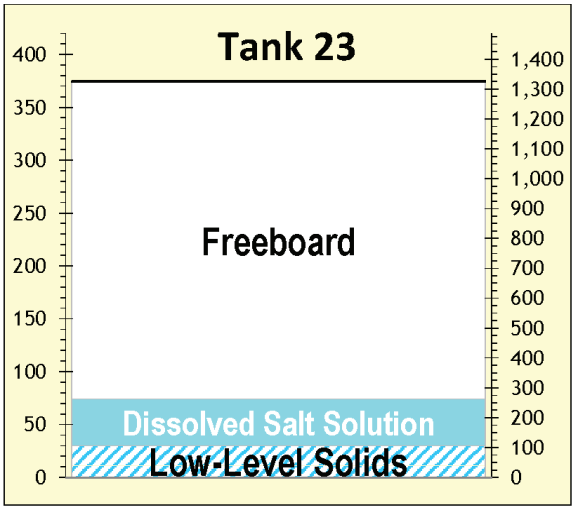
Status: In 2021, Tank 22 continued receiving and storing DWPF Recycle waste. This DWPF Recycle is volume reduced in the 2H Evaporator System. Approximately 273,000 gallons were transferred from Tank 22 to Tanks 21 and 41 for SWPF Batch formation.



Tank 23:

Area: H-Area
Service: Salt Solution Hold Tank
Type: IV
EOY Volume: 262,310 gallons

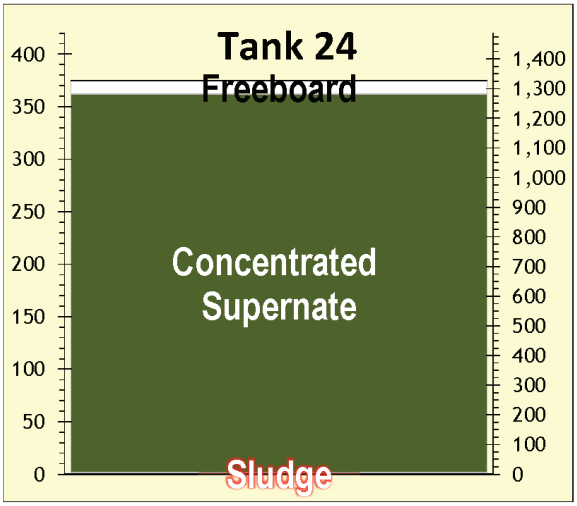
Status: In 2021, Tank 23 transferred 297,000 gallons to Tank 21 for SWPF Batch 4 formation and 347,000 gallons for SWPF Batch 5 formation.



Tank 24:

Area: H-Area
Service: Waste Storage Tank
Type: IV
EOY Volume: 1,269,400 gallons

Status: There were no transfers in or out during 2021.



APPENDIX B: CY2021 Federal Facility Agreement System / Component Assessment Reports

Report Number	Title
M-ESR-H-00535 / Rev. 0	Federal Facility Assessment Report For Transfer Hose In Hose Between Tank 9 and Tank 10
M-ESR-H-00558 / Rev. 0	Federal Facility Assessment Report For Tank 42 Transfer Line WEE-L-2708 Restoration
M-ESR-H-00506 / Rev. 1	Federal Facility Assessment Report For TCCR System
M-ESR-H-00596 / Rev. 0	Federal Facility Assessment Report For Modifications To Support Restoration Of Transfer Line WEE-L-3933

Savannah River Site

FEDERAL FACILITY AGREEMENT
ASSESSMENT REPORT

FOR

TRANSFER HOSE IN HOSE
BETWEEN TANK 9 AND TANK 10

M-ESR-H-00535

REVISION 0

DISCLAIMER

APPROVAL SIGNATURES / SUMMARY OF CHANGES

APPROVALS

	DATE
PREPARER james jones Digitally signed by james jones Date: 2020.05.18 10:21:07 -04'00' James Jones, Design Services Mechanical Engineer Project Management, Design and Construction Services	
REVIEWER Jeremy Brackman Digitally signed by Jeremy Brackman Date: 2020.05.18 10:44:17 -04'00' Jeremy Brackman, Design Services Mechanical Engineer Project Management, Design and Construction Services	
APPROVAL A5299 Digitally signed by A5299 Date: 2020.05.18 11:31:31 -04'00' Seth Campbell, Waste Transfer System Design Authority Tank Farm Engineering	
APPROVAL Michael Wood Digitally signed by Michael Wood Date: 2020.05.19 19:34:04 -04'00' Michael B. Wood, Design Services Project Engineer, Project Management, Design and Construction Services	

SUMMARY OF CHANGES

Rev. No	Reason for Change	Pages Affected	Issue Date
0	Initial Issue	N/A	

TABLE OF CONTENTS

1.0 Executive Summary

This Assessment Report is being submitted to satisfy requirements of Section IX and Appendix B of the Savannah River Site (SRS) Federal Facility Agreement (FFA, Ref. 2.5.1).

Waste Tank 9 is a salt tank located in H-Area Tank Farm Facility. Currently, Tank 9 does not have a viable transfer path or an installed system through which salt waste transfer can be performed. The bulk of the waste in Tank 9 must be removed and processed to continue its progress towards final tank closure. Waste Tank 10 will be the recipient of the transferred salt waste.

Temporary Modification Package HTF-TMC-18-005 (Ref. 2.5.3) installs a system that will consist of a Hose-In-Hose (HIH) transfer line from Tank 9 Center Riser to Tank 10 Riser 3 (see Attachment 9.1). The HIH line consists of a 1½ inch hose core line and a 3 inch hose jacket line and will be installed aboveground. The core hose and jacket hose of the HIH system are continuously aboveground with no hose fittings located outside of the tanks to prevent the possibility of leakage. The HIH system is supported between the tank risers such that there is a continuous slope from the high-point of the HIH system back to the tank risers.

This task is not divided into two or more FFA assessment reports.

2.0 Design Information

2.1 Temporary Modification Package HTF-TMC-18-005 (Ref. 2.5.3) installs:

2.1.1 One 1½ inch core hose with a 3 inch jacket HIH originating inside Tank 9 Center Riser and terminating inside Tank 10 Riser 3 for transferring of salt waste.

2.2 The Temporary Modification includes the following activities:

2.2.1 The 1½ inch core hose will be protected inside a 3 inch jacket hose to create the HIH piping system. Ensure the outer jacket hose is of sufficient length to extend into the vapor space of the tank risers. Similar hoses have been used for aboveground waste transfers.

2.2.2 Install supports for the HIH as required per design to ensure continuous slope from HIH system high point to each riser.

2.3 Applicable SRS Engineering Standards and Engineering Guides:

2.3.1 SRS Engineering Standard 15060, Rev. 20, Additional Requirements for SRS Piping Systems

2.3.2 SRS Engineering Standard 01064, Rev. 8, Radiological Design Requirements

2.3.3 SRS Engineering Standard 01060, Rev. 12, Structural Design Criteria

2.3.4 SRS Engineering Guide 15060-G, Rev. 8, Application of ASME B31.3

2.3.5 SRS Engineering Guide 15062-G, Rev. 0, Qualification and Maintenance of Nonmetallic Flexible Hose

2.4 Applicable National Codes & Standards:

2.4.1 ASME B31.3-2016 Edition, Process Piping

2.5 Reference Documents

2.5.1 WSRC-OS-94-42, Administrative Document Number 89-05-FF, Federal Facility Agreement for the Savannah River Site, August 16, 1993

2.5.2 U-TC-H-00018, Rev. 4, Tank 9 Salt Dissolution

2.5.3 HTF-TMC-18-005, Rev. 1, Tank 9 to Tank 10 Transfer Line Installation

2.5.4 Assessment Report, Phase II for the F and H Area High Level Radioactive Waste Tank Farms, Rev. 0, 1991

2.5.5 M-CLC-G-00459, Rev. 1, Unlisted Component Evaluation for Waste Transfer Hose-In-Hose (HIH) Assemblies

2.5.6 C-CLC-H-01601, Rev. 0, Pipe Supports for HIH Transfer Lines Tank 9 to Tank 10

2.5.7 M-ESR-H-00402, Rev. 2, Liquid Waste (LW) Transfer Hose-In Hose (HIH) Systems Service Life Evaluation

2.5.8 M-QIP-H-00393, Rev. 0, Tank 9 to Tank 10 Transfer Installation Quality Inspection Plan

3.0 Waste Compatibility

Waste characterization will remain unchanged. Hoses used in the Temporary Modifications are constructed of materials that have been proven to be compatible with the waste stream. The modifications will not introduce any other materials that will invalidate the existing waste characterization.

4.0 Foundation Support

The hose components of the HIH system are selected according to SRS hose requirements (Ref. 2.3.5). In addition, M-CLC-G-00459 (Ref. 2.5.5) evaluates any ASME B31.3 Code unlisted components to determine adequate design per ASME B31.3 Code (Ref. 2.4.1). The HIH aboveground support system was evaluated by calculation C-CLC-H-01601 (Ref. 2.5.6) and was shown to be adequately designed to support hoses and shielding. The salt waste transfer system modification meets the radiological design requirements as specified in Standard 01064 (Ref. 2.3.2) and it meets the structural design criteria specified in Standard 01060 (Ref. 2.3.3).

5.0 Leak Detection and Past Leaks

The HIH system will be installed such that it is continuously sloped from the high point of the waste transfer system back to the tanks. Leak detection for the HIH assembly will be by video inspections of the ends of the jacket hose (inside the waste tanks) during transfer. Video inspections will detect leakage of the transfer line core into the HIH jacket.

6.0 Inspections

Hose material, assembly, installation, inspection, examination, and testing shall be in accordance with:

- ASME Code B31.3 (Ref. 2.4.1)
- SRS Engineering Standard 15060 (Ref. 2.3.1)
- SRS Engineering Guide 15060-G (Ref. 2.3.4)
- SRS Engineering Guide 15062-G (Ref. 2.3.5)
- M-ESR-H-00402 (Ref. 2.5.7)

Examination and leak testing inspections for the HIH assembly are contained in the Quality Inspection Plan (M-QIP-H-00393, Ref. 2.5.8) of HTF-TMC-18-005 (Ref. 2.5.3).

7.0 Determination of Secondary Containment

Once the operation of Temporary Modification is complete and the HIH transfer line has been removed, the primary and secondary containments remain unchanged and satisfy FFA requirements and the requirements stated in Section 2.1 of the Phase II Assessment Report (Ref. 2.5.4) as previously evaluated in Section 3.6.6 of this same report. Therefore, no further assessment of the primary and secondary containment of this modification is required.

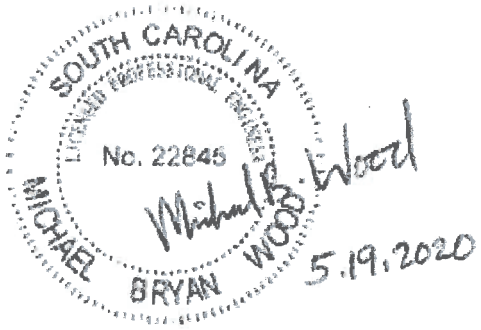
8.0 Professional Engineer Certifications (Design and Construction)

Design

This assessment report was prepared under my supervision and direction. I certify that the design for the modifications detailed in Temporary Modification HTF-TMC-18-005 and associated design documents comply with applicable engineering standards and the requirements of Appendix B of the Federal Facility Agreement. These standards have been generally accepted as adequate in demonstrating leak tightness.

Stamp

Name:
License Number:

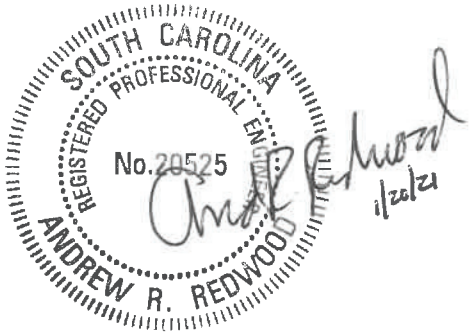


Construction and Installation

I have conducted an inspection, to the extent possible, of the completion of the modified system. Based upon the inspection, I certify that, to the best of my knowledge, information, and belief, the installation of the HIH transfer line was constructed in accordance with the approved design in Temporary Modification HTF-TMC-18-005 and associated design documents. I further certify that the modification was tested and inspected in accordance with requirements summarized in Section 6.0 of this Report. The tests conducted to demonstrate leak tightness were found acceptable.

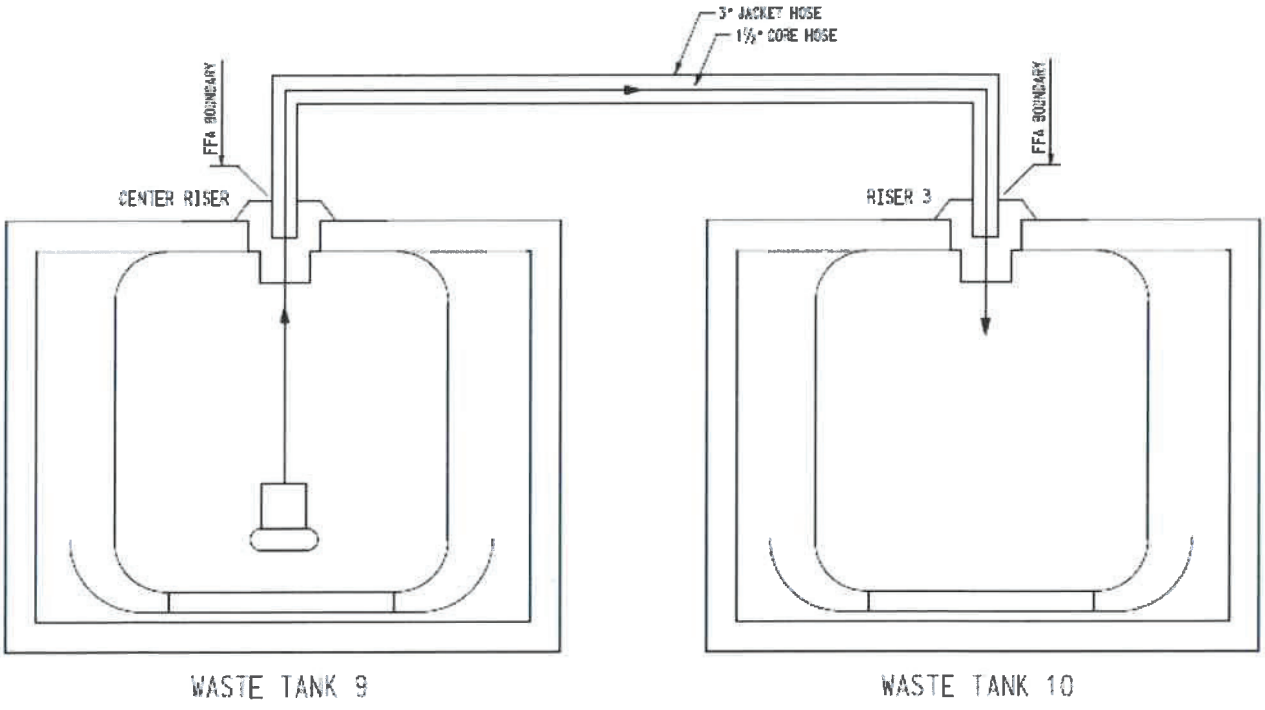
Stamp

Name: Andrew R. Redwood
License Number: 20525



9.0 ATTACHMENT

9.1 HIH Transfer Line



Savannah River Site

FEDERAL FACILITY AGREEMENT
ASSESSMENT REPORT

FOR

TANK 42 TRANSFER LINE
WEE-L-2708 RESTORATION

M-ESR-H-00558
REVISION 0

DISCLAIMER

APPROVAL SIGNATURES / SUMMARY OF CHANGES

APPROVALS

	DATE
PREPARER Jeremy Brackman Jeremy Brackman, Design Services Mechanical Engineer Project Management, Design and Construction Services	03/29/2021
REVIEWER psdesai Prashant Desai, Design Services Mechanical Engineer Project Management, Design and Construction Services	03/29/2021
APPROVAL G. B. Clendenen G. B. Clendenen, Tank 42 Design Authority Tank Farm Engineering	03/29/2021
APPROVAL Ashok Gupta Digitally signed by Ashok Gupta Date: 2021.03.30 08:50:02 -04'00' Ashok Gupta, Design Services Project Engineer, Project Management, Design and Construction Services	

SUMMARY OF CHANGES

Rev. No	Reason for Change	Pages Affected	Issue Date
0	Initial Issue	All	

TABLE OF CONTENTS

1.0 Executive Summary

This Assessment Report is being submitted to satisfy requirements of Section IX and Appendix B of the Savannah River Site (SRS) Federal Facility Agreement (FFA, Ref. 2.4.1).

To support long-term operations of Salt Waste Processing Facility (SWPF), Tank 42 will be converted from storage of concentrated salt solution to a blend tank. Transfer paths, transfer pumps, blend pumps, and controls will be added or modified as part of this conversion.

Underground transfer line WEE-L-2708 will be restored back to its' original design allowing waste to be transferred from Tank 42 through the evaporator cell to Tank 49. This restoration removes the neutralization tank flange connections and installs a straight length of pipe to tie the line together and will be conducted under Design Change Package M-DCP-H-19028 (Ref. 2.4.3).

This task is not divided into two or more FFA reports.

2.0 Design Information

2.1 The modification includes the following activities:

- 2.1.1 Remove the neutralization tank flange connections.
- 2.1.2 Install approximately 10 feet of new stainless steel waste transfer line core with carbon steel jacket piping as a secondary containment.

2.2 Applicable National Codes & Standards:

- 2.2.1 ASME B31.3-2016 Edition, Process Piping

2.3 Applicable SRS Engineering Standards and Engineering Guides:

- 2.3.1 SRS Engineering Standard 15060, Rev. 21, Additional Requirements for SRS Piping Systems
- 2.3.2 SRS Engineering Guide 15060-G, Rev. 8, Application of ASME B31.3

2.4 Reference Documents

- 2.4.1 WSRC-OS-94-42, Administrative Document Number 89-05-FF, Federal Facility Agreement for the Savannah River Site, August 16, 1993

2.4.2 M-TC-H-00092, Rev. 2, Task Requirements and Criteria Tank 42 Blend Tank Modifications

2.4.3 M-DCP-H-19028, Rev. 0, Tank 42 Transfer Line WEE-L-2708 Restoration

2.4.4 Assessment Report, Phase II for the F and H Area High Level Radioactive Waste Tank Farms, Rev. 0, 1991

2.4.5 T-CLC-H-00516, Rev. 1, Evaluation of piping from Evaporator 2H to Tank 42

2.4.6 M-ML-H-07377, Rev. 2, Waste Tank 42 Modifications Piping Data Sheet Package

2.4.7 M-QIP-H-00433, Rev. 1, Tank 42 Transfer Line WEE-L-2708 Restoration Quality Inspection Plan

3.0 Waste Compatibility

The modifications in the scope of this assessment and their waste characterization will remain unchanged. The materials of construction used in the modifications are compatible with the waste stream. The modifications will not introduce any other materials that will invalidate the existing waste characterization.

4.0 Foundation Support

The integrity of the waste transfer line WEE-L-2708 and all the pipe supports were evaluated and were found to be satisfactory, see T-CLC-H-00516 (Ref. 2.4.5).

5.0 Leak Detection and Past Leaks

The affected transfer lines will continue to meet Section IX and Appendix B of the FFA. These lines will still follow the design presented in Section 3.7.2 of the Phase II Assessment Report (Ref. 2.4.4) for Type II transfer lines.

6.0 Inspections

Piping material, fabrication, installation, inspection, examination, and testing shall be in accordance with:

- ASME Code B31.3-2016 (Ref. 2.2.1)
- SRS Engineering Standard 15060 (Ref. 2.3.1)
- SRS Engineering Guide 15060-G (Ref. 2.3.2)
- Piping Data Sheets Package M-ML-H-07377 (Ref. 2.4.6)

Examination and leak testing inspections for the transfer line restoration are contained in the M-QIP-H-00433 Quality Inspection Plan (Ref. 2.4.7).

7.0 Determination of Secondary Containment

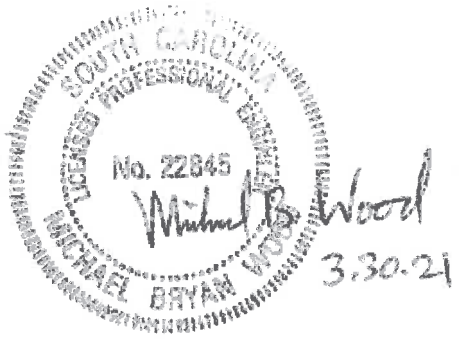
The primary and secondary containments associated with this modification will replicate the existing line arrangement which satisfies FFA requirements and the requirements stated in Section 2.1 of the Phase II Assessment Report (Ref. 2.4.4) as previously evaluated in Section 3.7.2.6 of this same report. Therefore, no further assessment is needed.

8.0 Professional Engineer Certifications (Design and Construction)

Design

This assessment report was prepared under my supervision and direction. I certify that the design for the modifications detailed in Design Change Package M-DCP-H-19028 comply with applicable engineering standards and the requirements of Appendix B of the Federal Facility Agreement. These standards have been generally accepted as adequate in demonstrating leak tightness.

Stamp



Name:
License Number:

Construction and Installation

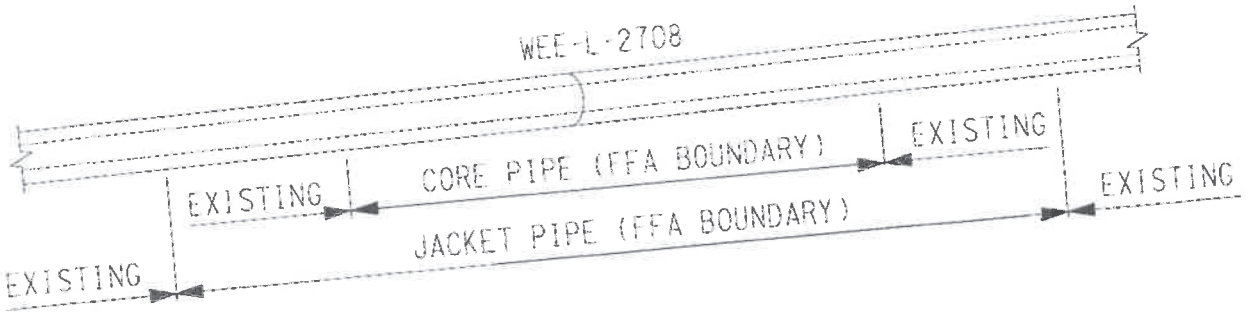
I have conducted an inspection, to the extent possible, of the completion of the modified system. Based upon the inspection, I certify that, to the best of my knowledge, information, and belief, restoration of WEE-L-2708 transfer line was constructed in accordance with the approved design in Design Change Package M-DCP-H-19028. I further certify that the modification was tested in accordance with requirements summarized in Section 6.0 of this Report. The tests conducted to demonstrate leak tightness were found acceptable.

Stamp

Name: Andrew R. Redwood
License Number: 20525

9.0 ATTACHMENT

9.1 Transfer Line



Savannah River Site

FEDERAL FACILITY AGREEMENT
ASSESSMENT REPORT

FOR

TCCR SYSTEM

M-ESR-H-00506
REVISION 1

DISCLAIMER

APPROVAL SIGNATURES / SUMMARY OF CHANGES

APPROVALS

	DATE
PREPARER Jeremy Brackman, Design Services Mechanical Engineer Project Management, Design and Construction Services	12-6-18
REVIEWER Oren Webb, Design Services Mechanical Engineer Project Management, Design and Construction Services	12/6/18
APPROVAL Robert Voegtlen, Waste Transfer System Design Authority Tank Farm Engineering	12/11/18
APPROVAL Michael B. Wood Michael B. Wood, Design Services Project Engineer, Project Management, Design and Construction Services	12.6.18

SUMMARY OF CHANGES

Rev. No	Reason for Change	Pages Affected	Issue Date
0	Initial Issue	All	10-23-18
1	Added/Updated References	6	

TABLE OF CONTENTS

1.0 Executive Summary

This Assessment Report is being submitted to satisfy requirements of Section IX and Appendix B of the Savannah River Site (SRS) Federal Facility Agreement (FFA, Ref. 2.3.1).

Waste Tank 10 has a planned operational closure date in accordance with the SRR Schedule. Based on N-TC-H-00001 (Ref. 2.3.3), Tank 10 contains approximately 194,000 gallons of salt cake and approximately 15,000 gallons of supernatant liquid with an inventory of 100,000 curies of radioactive cesium-137, and no viable transfer path or an installed system with which cesium extraction can be performed, a method of cesium removal is required.

The scope of this FFA is the installation of a Tank Closure Cesium Removal (TCCR) system used to facilitate the removal of cesium-137 from Tank 10 authorized per Design Change Package C-DCP-H-17001 (Ref. 2.3.4). After tank preparation, the supernatant liquid will be pumped to the TCCR system via hose-in-hose transfer lines to a group of ion exchange columns located inside the TCCR system housing where the radioactive cesium-137 is removed and solution is decontaminated. The decontaminated salt solution (DSS) is then discharged to Waste Tank 11 to allow emptying of Tank 10. In addition, a flush/recirculation line is required for TCCR system operation that will be routed back to Tank 10 and used as required.

Temporary Modification HTF-TMC-16-028 (Ref. 2.3.5) will install the hose-in-hose transfer, discharge and flush/recirculation lines under FFA M-ESR-H-00501 (Ref. 2.3.6).

This task is not divided into two or more FFA reports.

2.0 Design Information

2.1 This modification includes the following activity:

2.1.1 Installation of the TCCR system equipment. See Attachment 9.1 for FFA boundary.

2.2 Applicable National Codes & Standards:

2.2.1 Statement of Work X-SOW-H-00002 (Ref. 2.3.7) references all applicable National Codes and Standards

2.3 Reference Documents

2.3.1 WSRC-OS-94-42, Administrative Document Number 89-05-FF, Federal Facility Agreement for the Savannah River Site, August 16, 1993

2.3.2 Assessment Report, Phase II for the F and H Area High Level Radioactive Waste Tank Farms, Rev. 0, 1991

2.3.3 N-TC-H-00001, Rev. 5, Tank 10: Salt Dissolution & Cesium Removal via TCCR

2.3.4 C-DCP-H-17001, Rev. 0, TCCR Equipment and Foundation Siting

2.3.5 HTF-TMC-16-028, Rev. 4, TCCR Transfer Line Installation

2.3.6 M-ESR-H-00540, Rev. 0, Federal Facility Agreement Assessment Report for TCCR Transfer Hose In Hose

2.3.7 X-SOW-H-00002, Rev 4, Tank Closure Cesium Removal (TCCR) System

2.3.8 SRRA094421-000112, Rev D, TCCR Enclosure Structural Assembly (Part 1)

2.3.9 SRRA094421-000113, Rev D, TCCR Enclosure Structural Assembly (Part 2)

2.3.10 P-DCF-H-02220, Rev 0, TCCR HIH Penetration Detail Modification

3.0 Waste Compatibility

Waste characterization remains unchanged. The materials of construction used in this modification are compatible with the waste streams. The modification will not introduce any other materials that will invalidate the existing waste characterization.

4.0 Foundation Support

TCCR system equipment was designed in accordance with Statement of Work X-SOW-H-00002 (Ref. 2.3.7) and the structural integrity was evaluated by calculation SRRA094421-000112 (Ref. 2.3.8) and SRRA094421-000113 (Ref. 2.3.9). The results were found to be satisfactory.

5.0 Leak Detection and Past Leaks

The TCCR system will be provided with a leak detection system in the secondary containment designed and operated to detect the failure of the primary containment structure. Camera ports will also be provided at locations which have potential to leak (e.g. flanges, valves, pumps, etc.).

No past leaks exist as this is a new system.

6.0 Inspections

All TCCR system equipment inspection, examination, and testing shall be in accordance with the C-DCP-H-17001 (Ref. 2.3.4) and X-SOW-H-00002 (Ref 2.3.7).

7.0 Determination of Secondary Containment

This modification will add primary containment (piping, valves, vessels, etc.) and secondary containment (TCCR enclosure). Once installation of the TCCR system is installed, the primary and secondary containments will satisfy FFA requirements (Ref. 2.3.1) and the requirements stated in Section 2.1 of the Phase II Assessment Report (Ref. 2.3.2) as previously evaluated in Section 3.6.6 of this same report. Therefore, no further assessment of the primary and secondary containment of this modification is required.

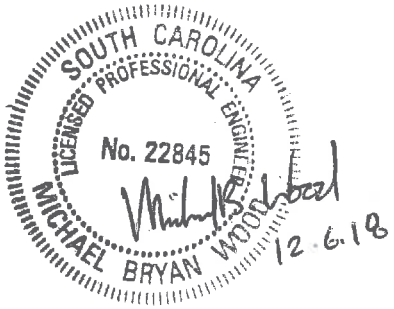
8.0 Professional Engineer Certifications (Design and Construction)

Design

This assessment report was prepared under my supervision and direction. I certify that the design for the modifications detailed in Design Change Package C-DCP-H-17001 comply with applicable engineering standards and the requirements of Appendix B of the Federal Facility Agreement. These standards have been accepted as adequate in demonstrating leak tightness.

Stamp

Name: MICHAEL B. WOOD
License Number: 22845

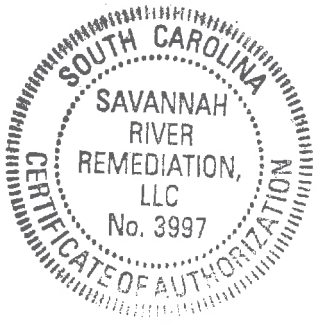


Construction and Installation

I have conducted an inspection, to the extent possible, of the completion of the modified system. Based upon the inspection, I certify that, to the best of my knowledge, information, and belief, the TCCR system equipment was constructed and installed in accordance with the approved design in Design Change Package C-DCP-H-17001. I further certify that the modification was tested in accordance with requirements summarized in Section 6.0 of this Report.

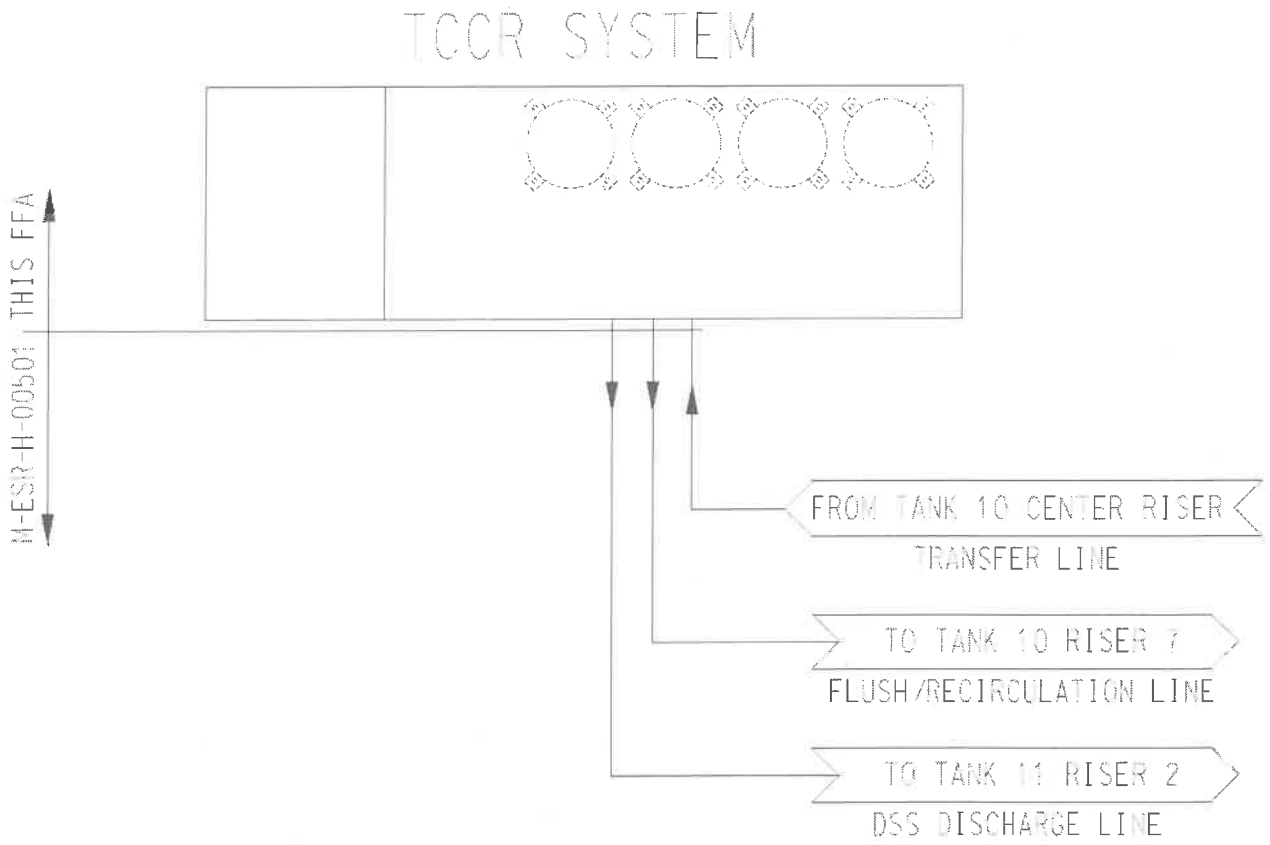
Stamp

Name: Andrew R. Redwood
License Number: 20525



9.0 ATTACHMENT

9.1 TCCR System



PRIMARY BOUNDARY - PIPING, VALVES, VESSELS, ETC. INSIDE TCCR ENCLOSURE
SECONDARY BOUNDARY - TCCR ENCLOSURE

Savannah River Site

FEDERAL FACILITY AGREEMENT
ASSESSMENT REPORT

FOR

MODIFICATIONS TO SUPPORT RESTORATION
OF TRANSFER LINE WEE-L-3933

M-ESR-H-00596
REVISION 0

DISCLAIMER

APPROVAL SIGNATURES / SUMMARY OF CHANGES

APPROVALS

PREPARER Jeremy Brackman Jeremy Brackman, Design Services Mechanical Engineer Project Management, Design and Construction Services	DATE 9/20/2021
REVIEWER Joshua Burgin Josh Burgin, Design Services Mechanical Engineer Project Management, Design and Construction Services	DATE 9/20/2021
APPROVAL Scott Wallace Scott Wallace, H-Tank Farm Engineering Tank Farm Engineering	DATE 9/21/2021
APPROVAL C. N. Combs Neil Combs, Design Services Project Engineer, Project Management, Design and Construction Services	DATE 9/22/2021

SUMMARY OF CHANGES

Rev. No	Reason for Change	Pages Affected	Issue Date
0	Initial Issue	All	

TABLE OF CONTENTS

1.0 Executive Summary

This Assessment Report is being submitted to satisfy requirements of Section IX and Appendix B of the Savannah River Site (SRS) Federal Facility Agreement (FFA, Ref. 2.4.1).

A line segment of the secondary containment was performed on the 2H Evaporator to Tank 49 transfer line WEE-L-3933 and failed. The results of the testing concluded that the 3" jacket on the Clean Out Port drain line WEE-L-8329 failed.

The WEE-L-3933 cleanout port will be removed and replaced with a new segment of core and jacket piping. A portion of the cleanout port drain line WEE-L-8329 will be removed and the remaining core and jacket piping will be capped. A segment of the leak detection line LD-L-8301 from the cleanout port drain line jacket will be removed at Leak Detection Box 5 (LDB-5) and capped on both ends.

This modification will be conducted per Design Change Package (DCP) P-DCP-H-21018 (Ref. 2.4.2). This task is not divided into two or more FFA reports.

2.0 Design Information

2.1 This modification includes the following activities:
- 2.1.1 Remove the WEE-L-3933 cleanout port.
- 2.1.2 Install a new core and jacket piping segment on WEE-L-3933.
- 2.1.3 Cap the remaining cleanout port drain line WEE-L-8329 core and jacket piping.
- 2.1.4 Remove a segment of leak detection line LD-L-8301 at LDB-5 and cap both ends.

2.2 Applicable SRS Engineering Standards and Engineering Guides:
- 2.2.1 SRS Engineering Standard 15060, Rev. 20, Additional Requirements for SRS Piping
- 2.2.2 SRS Engineering Guide 15060-G, Rev. 8, Application of ASME B31.3

2.3 Applicable National Codes & Standards:
- 2.3.1 ASME B31.3-2018 Edition, Process Piping

2.4 Reference Documents
- 2.4.1 WSRC-OS-94-42, Administrative Document Number 89-05-FF, Federal Facility Agreement for the Savannah River Site, August 16, 1993

2.4.2 P-DCP-H-21018, Rev. 1, Waste Transfer Line HM-242016-WEE-L-3933 from 2H Evaporator to Tank 49 Failed Pressure Test of the Secondary Containment

2.4.3 Assessment Report, Phase II for the F and H Area High Level Radioactive Waste Tank Farms, Rev. 0, 1991

2.4.4 M-ML-H-07332, Rev. 7, Piping Data Sheet - H Tank Farm Miscellaneous Lines

2.4.5 M-QIP-H-00471, Rev. 0, Waste Transfer Line WEE-L-3933 Restoration Quality Inspection Plan

2.4.6 T-QIP-G-00002, Rev. 0, Quality Inspection Plan for Backfilling Requirements in HTF/FTF Tank Farm Area

3.0 Waste Compatibility

The modifications in the scope of this assessment and their waste characterization will remain unchanged. The materials of construction used in the modifications are compatible with the waste stream. The modifications will not introduce any other materials that will invalidate the existing waste characterization.

4.0 Foundation Support

The integrity of the pipe supports and foundations for WEE-L-3933, WEE-L-8329 and LD-L-8301 were evaluated and were found to be satisfactory, see the Technical Justifications within P-DCP-H-21018 (Ref. 2.4.2).

5.0 Leak Detection and Past Leaks

The affected transfer lines will continue to meet Section IX and Appendix B of the FFA. These lines will still follow the design presented in Section 3.7.2 of the Phase II Assessment Report (Ref. 2.4.3) for Type II transfer lines.

6.0 Inspections

Piping material, fabrication, installation, inspection, examination, and testing shall be in accordance with:

- ASME Code B31.3-2018 (Ref. 2.3.1)
- SRS Engineering Standard 15060 (Ref. 2.2.1)
- SRS Engineering Guide 15060-G (Ref. 2.2.2)

Examination and leak testing inspections for the transfer line restoration are contained in the M-QIP-H-00471 and T-QIP-G-00002 Quality Inspection Plans (Ref. 2.4.5).

7.0 Determination of Secondary Containment

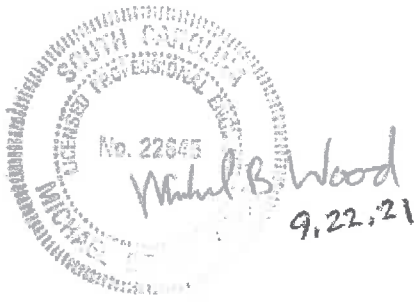
The primary and secondary containments associated with this modification will be modified but still satisfies FFA requirements and the requirements stated in Section 2.1 of the Phase II Assessment Report (Ref. 2.4.3) as previously evaluated in Section 3.7.2 of this same report. Therefore, no further assessment is needed.

8.0 Professional Engineer Certifications (Design and Construction)

Design

This assessment report was prepared under my supervision and direction. I certify that the design for the modifications detailed in Design Change Package P-DCF-H-21018 (Ref. 2.4.2) complies with applicable engineering standards and the requirements of Appendix B of the Federal Facility Agreement. These standards have been generally accepted as adequate in demonstrating leak tightness.

Stamp



9.22.21

Name:
License Number:

Construction and Installation

I have conducted an inspection, to the extent possible, of the completion of the modified system. Based upon the inspection, I certify that, to the best of my knowledge, information, and belief, modification of lines WEE-L-3933, WEE-L-8329 and LD-L-8301 was constructed in accordance with the approved design in Design Change Package P-DCP-H-21018 (Ref. 2.4.2). I further certify that the modification was tested in accordance with requirements summarized in Section 6.0 of this Report. The tests conducted to demonstrate leak tightness were found acceptable.

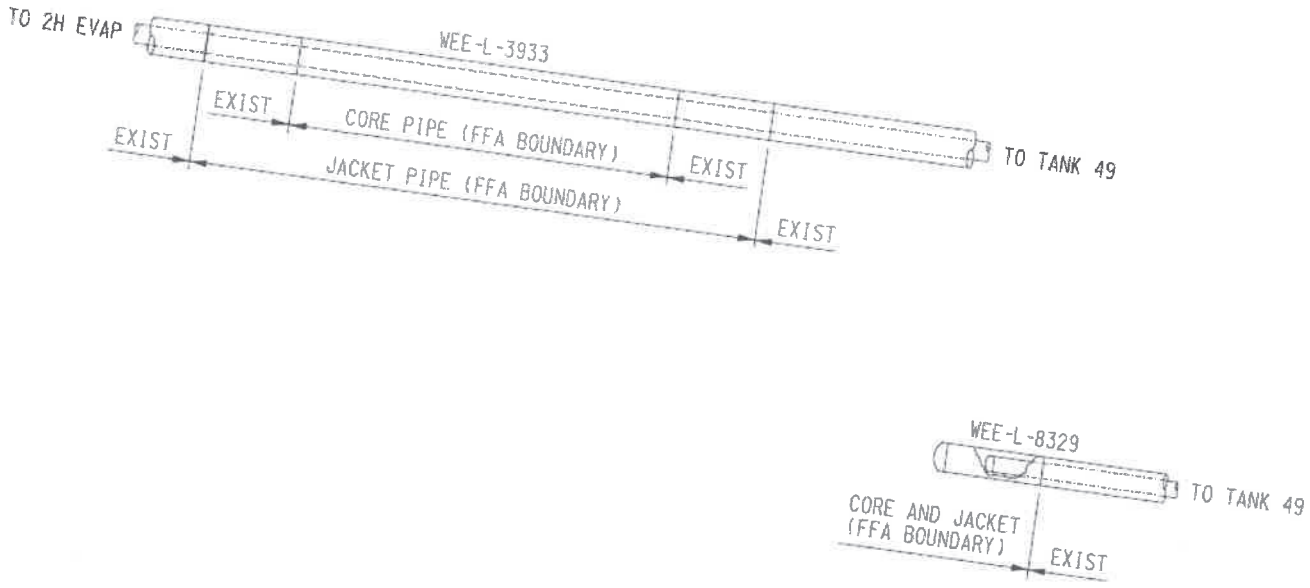
Stamp

Name: Andrew R. Redwood
License Number: 20525

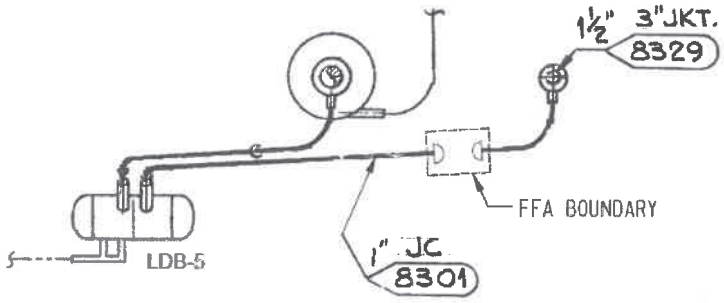
10/20/21

9.0 ATTACHMENT

9.1 Modifications to Support Restoration of WEE-L-3933



NEW WEE-L-3933 CORE AND JACKET PIPING
AND CAPPED DRAIN PIPING WEE-L-8329



CAPPED LEAK DETECTION PIPING LD-L-8301