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Revision 0

TANKS 18 AND 19 FINAL CONFIGURATION REPORT FOR F-TANK FARM AT THE SAVANNAH RIVER SITE

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LIST OF ACROYNMS

ADMP	Advanced Design Mixer Pump
CM	Closure Module
DOE	Department of Energy
FCR	Final Configuration Report
FFA	Federal Facility Agreement
FTF	F-Tank Farm
GCP	General Closure Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SSC	Structures, Systems, and Components
SRS	Savannah River Site
TTJ	Telescoping Transfer Jet
WTS	Waste Transfer System

1.0 EXECUTIVE SUMMARY

The Department of Energy (DOE) documented completion of operational closure of Tanks 18 and 19 located in the F-Tank Farm (FTF) on September 5, 2012. [WDPD-12-75] The final as-built configuration of the closed waste tanks is in accordance with the isolation process and stabilization strategy described in the *Industrial Wastewater Closure Module for the Liquid Waste Tanks 18 and 19 F-Area Tank Farm, Savannah River Site* (hereinafter referred to as: Tanks 18 and 19 Closure Module [CM]) (SRR-CWDA-2010-00003) with minor exceptions/clarifications described within this document. Each waste tank has been isolated from the waste transfer system (WTS) and FTF support systems. Based on visual inspections performed and recorded during grouting, and estimated grout volume delivered to the waste tanks, no appreciable void space is present inside the waste tanks. In-tank equipment void space was sufficiently filled with grout based on actual grout volume delivered as compared to calculated void space.

This final configuration report (FCR) is submitted to meet the requirements of the *Industrial Wastewater General Closure Plan for F-Area Waste Tank Systems* (hereinafter referred to as: FTF General Closure Plan [GCP]) (LWO-RIP-2009-00009), the Tanks 18 and 19 CM, and to satisfy requirements of Section IX of the Savannah River Site Federal Facility Agreement. [SRR-CWDA-2010-00003, WSRC-OS-94-42] The purpose of this report is to document the final configuration of the closed Tanks 18 and 19 in FTF at the Savannah River Site. Field conditions that differ from those described in the Tanks 18 and 19 CM, as approved by South Carolina Department of Health and Environmental Control (SCDHEC) March 7, 2012, are herein described. [SRR-CWDA-2010-00003, DHEC_03-07-2012]

2.0 INTRODUCTION/BACKGROUND

The submittal of this FCR satisfies the requirement in Section 3.3.8 of the FTF GCP, which states: "Following completion of stabilization of the individual waste tank system, DOE will provide a Final Configuration Report to SCDHEC describing the final configuration of that system." [LWO-RIP-2009-00009] This FCR includes certification by a South Carolina Professional Engineer that all work has been completed in accordance with the approved FTF GCP and Tanks 18 and 19 CM. [LWO-RIP-2009-00009] This FCR primarily addresses tank isolation, stabilization, and future monitoring information discussed in the Tanks 18 and 19 CM.

The Tanks 18 and 19 CM was prepared to document the processes by which waste has been removed from Tanks 18 and 19, residual contaminants were sampled, remaining inventory characterized and waste tank systems isolated from the FTF facility and prepared for closure. The Tanks 18 and 19 CM provides a mechanism for SCDHEC to review and approve each individual tank removal from service activity. Sections of the Tanks 18 and 19 CM applicable to this FCR, for which it addresses are described below:

Closure Configuration - Describes the end state of the waste tanks, including the following:

- Waste tank system isolation process and final configuration of the waste tank system
- Description of structures and equipment that are part of this removal from service activity including any equipment that will remain in a waste tank
- Stabilization strategy including type and characteristics of fill material, as appropriate

Maintenance and Monitoring - Describes maintenance and monitoring requirements for stabilized waste tanks following operational closure. [SRR-CWDA-2010-00003]

Tanks 18 and 19 are part of the group of four Type IV waste tanks (Tanks 17 through 20) in FTF. There is no secondary containment for Type IV tanks. The Type IV tank primary container is an 85-foot diameter by 34-foot 6.75-inch high open-topped liner with walls and floor of 0.375-inch thick carbon steel plates. The waste tanks have sidewall penetrations near the top for 3-inch and 4-inch diameter stainless steel transfer lines. The Type IV primary containers are completely enclosed in concrete vaults. The roof is a self-supporting, hemispherical dome made of 7-inch to 10-inch thick concrete with a maximum rise of 10 feet 7.5 inches above the springline. The waste tank rests on a 7-inch thick waste tank basemat. Type IV tanks do not have installed cooling coils. [SRR-CWDA-2010-00003]

Figures 2.1-1 and 2.1-2 depict the cross section and plan view outlining the general arrangement of waste tank equipment. The figures depict equipment typical of a Type IV tank and are not intended to represent a specific waste tank configuration.

Figure 2.1-1: Typical FTF Type IV Tank Cross Section

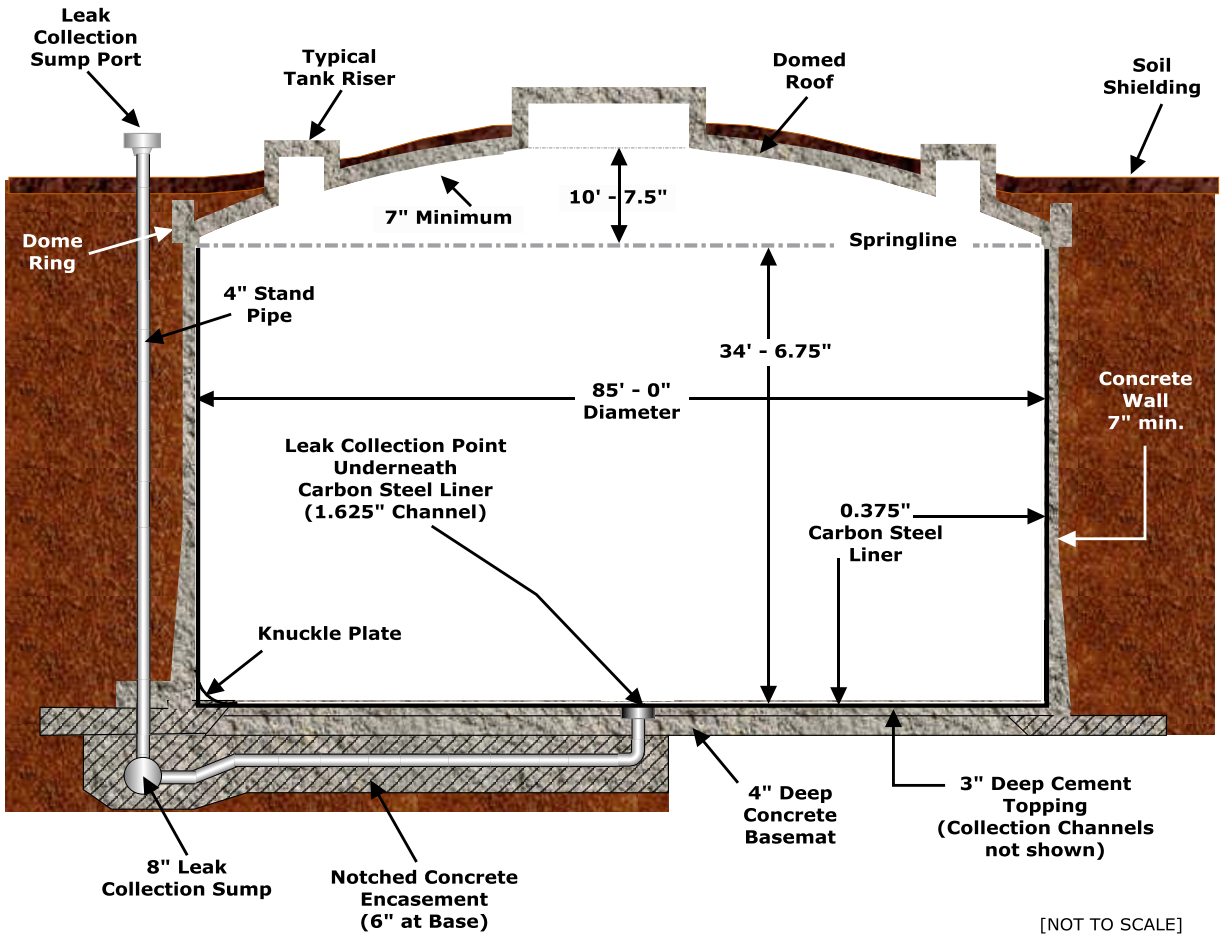
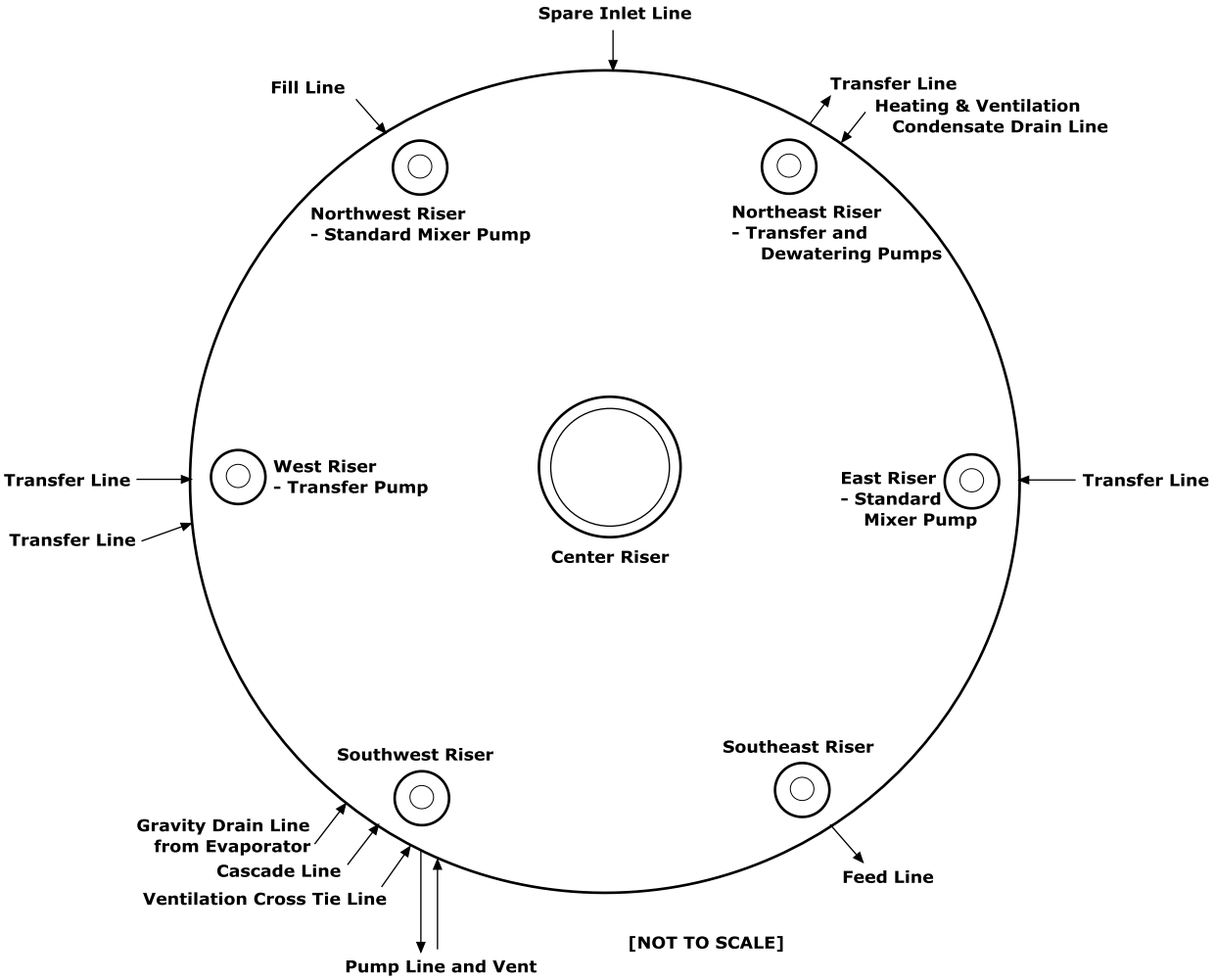


Figure 2.1-2: Typical FTF Type IV Tank Plan View



3.0 SUMMARY OF ISOLATION AND GROUTING ACTIVITIES

3.1 Isolation

Tanks 18 and 19 were isolated in accordance with the Tanks 18 and 19 CM and are consistent with their respective waste tank closure isolation plans except as noted in Section 3.1.1. Mechanical and electrical isolation consisted of demolition and removal of piping and components, plugging lines, removal of equipment, identifying components as "Out Of Commission", and removing obstructions from and around the risers. [M-CTP-F-00003 and M-CTP-F-00004] Each waste tank was isolated from the FTF WTS and the FTF support systems (e.g., water, steam, air). The isolation strategy consisted of identification and isolation of transfer lines, drain lines, water, air, and steam supply lines, ventilation lines, power and instrumentation lines, and all other penetrations into or out of the waste tank. Isolation of these systems was performed at the electrical control rooms for electrical and instrumentation and at the system supply headers located off the tank top for mechanical systems. For example, Figure 3.1-1 shows a transfer jet in Tank 19 that has been isolated from the steam system.

Figure 3.1-1: Transfer Jet Isolated from the Steam System (Tank 19)

Figure 3.1-2 shows electrical isolation at an electrical control room.

Figure 3.1-2: Electrical Isolation at an Electrical Control Room

Waste tank isolation includes cutting or blanking mechanical system components (e.g., transfer lines, water piping, air piping, steam piping) and disconnecting electrical power to all components on the waste tank. Descriptions of mechanical isolation in Tank 18 are found in M-DCP-F-10001 and electrical isolation in E-DCP-F-10001. Descriptions of mechanical isolation

in Tank 19 are found in M-DCP-F-10003 and electrical isolation in E-DCP-F-10007. These design packages (e.g., design changes, work instructions, radiological control checklists) may be retrieved from Savannah River Site (SRS) Records Management to provide details of the isolation modifications, if needed. The waste tanks were closed to waste processing activities by isolating transfer lines or plugging/capping the piping, thereby creating a physical break from the rest of the waste tank system. Federal Facility Agreement (FFA) Assessment Reports are required for modifications to specified waste tank systems and components. FFA Assessment Reports associated with isolation of Tanks 18 and 19 are M-ESR-F-00170 (isolation of Tank 18 transfer line and restoration of Tank 1 to Tank 7 transfer line), M-ESR-F-00176 (isolation of Tanks 18 and 19 instrument air to level sump dip tubes), and M-ESR-F-00183 (modification of modified leak detection boxes 10, 11 and 12 at Tank 18). Upon isolation from the transfer system the waste tanks were prepared for operational closure.

3.1.1 Exceptions/Clarifications to Isolation Plans

The following exception/clarification to the isolation plans specified in the Tanks 18 and 19 CM is described as follows:

Section 7.1 of the Tanks 18 and 19 CM specifies that isolation of electrical systems will be performed at the electrical control rooms; whereas, in fact, some electrical services were isolated in the field at a lighting panel. [SRR-LWE-2012-00217] Figure 3.1-3 shows electrical isolation at a lighting panel in the field.

Figure 3.1-3: Electrical Isolation at Lighting Panel

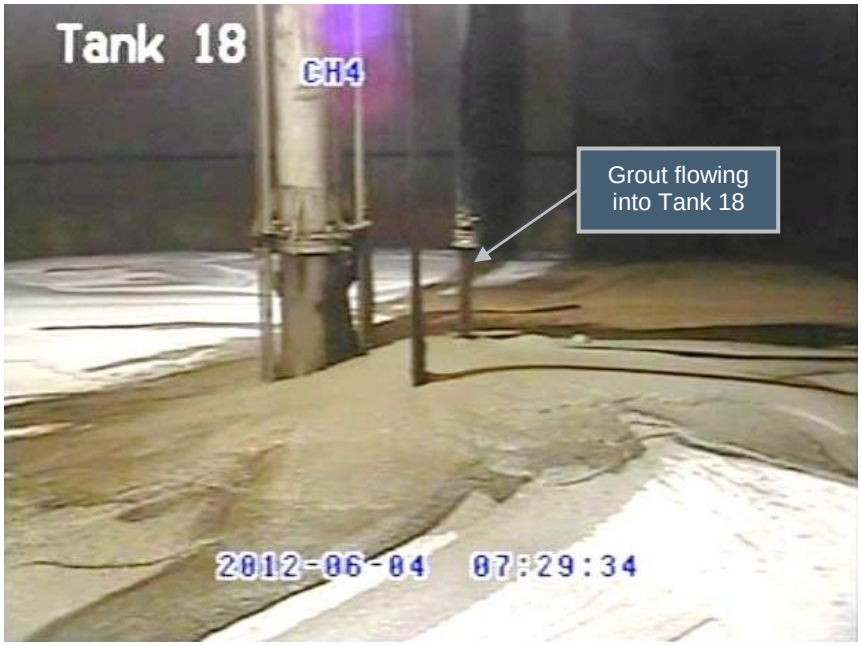
3.2 Grouting

Grouting activities were completed on Tank 18 and Tank 19 on September 5, 2012, and August 23, 2012, respectively. Tanks 18 and 19 were grouted in accordance with the Tanks 18 and 19 CM, consistent with the *Grout Strategy for Tanks 18 and 19 Closure*. [SRR-LWE-2010-00318]

3.2.1 Bulk Fill Summary

Reducing grout was used to fill the entire volume of the interior of Tanks 18 and 19. Grout was added to the waste tanks using portable grout pumps filled from cement mixer trucks. The pumps pushed the grout through slick lines to the center riser of each waste tank. Camera inspections of the interior of the waste tanks were typically performed and recorded at the beginning, middle, and end of each day during the grouting process. These inspections indicated that the reducing grout flowed over the residual material to stabilize and immobilize it at the bottom of the waste tanks. The grout adequately flowed from the center to the perimeter of the waste tank, and there was no evidence of void spaces in the interior of Tanks 18 and 19 (Figure 3.2-1).

Figure 3.2-1: Bulk Fill Grout in Tank 18 During the Filling Process



It was estimated that 8,343 cubic yards of grout would be required to fill each waste tank. The actual volume of grout used to fill each waste tank aligned well with the estimated volume. The very similar volume of grout used to fill each waste tank provides further evidence of the absence of significant voids. Approximately 8,094 cubic yards of grout were poured in Tank 18, and approximately 8,090 cubic yards of grout were poured in Tank 19. The actual volume of grout is estimated based on the number of grout trucks and a nominal volume of 8 cubic yards per truck. The exact volume of each grout truck was not verified. Some trucks may have contained more than 8 cubic yards, which may have resulted in the recorded volumes (8,094 and 8,090 cubic yards) being underestimated. Quality control of grout production and delivery was implemented in accordance with the grout procurement specification. [C-SPP-F-00055] The quality control program included documentation of grout component compliance with specified standards, testing of grout test cylinders, and surveillance and audits of grout production and delivery activities. During the grouting process, multiple grout test cylinders were collected from approximately every 100 cubic yards. Over 900 grout test cylinders (total from both waste tanks) were tested for

compressive strength. The average 90-day compressive strength was 4,680 psi, well above the value of 2,000 psi described in the Tanks 18 and 19 CM. [SRR-LWE-2012-00217]

3.2.1.1 Exceptions/Clarifications to Bulk Fill Grouting Plans

The exceptions/clarification to bulk fill grouting plans specified in the Tanks 18 and 19 CM is described as follows:

> The ventilation cross-tie associated with Tank 18 is described in Table 7.1-1 in the Tanks 18 and 19 CM as a 4-inch pipe in a 6-inch jacket; whereas, in fact, the ventilation cross-tie is a 6-inch pipe with no jacket. [SRR-LWE-2012-00217]

3.2.2 Equipment Fill Summary

The in-tank equipment internals were grouted utilizing a pre-blended mix designed and tested to flow into and fill small void spaces. Due diligence was exerted to inject the highly flowable grout into the equipment to ensure that voids were filled as much as reasonably possible. Preparations at the risers were implemented to facilitate effective grouting of equipment (e.g., motors were removed from the tops of the mixers in Tank 18 to provide access for grouting the columns). Grout flow into equipment was improved by venting equipment by drilling holes in the equipment or by removing components from equipment. When required, multiple attempts to fill equipment were made as the grout was allowed to flow and settle over time. [SRR-LWE-2012-00217] Calculated fill volumes of the internal void space of in-tank equipment was compared to actual grout volumes injected into the equipment in Table 3.2-1. Calculated fill volumes are theoretical values based on assumptions about internal void space and potential grout flow paths. Grout was required to flow through long, narrow, tortuous flow paths in several pieces of equipment. For example, the standard mixer slurry pump column contains many internal bearings with only one small opening for grout flow. If debris covered one opening, then grout flow was blocked. Debris may have potentially blocked grout flow in the standard mixer slurry pump in the Tank 18 East Riser.

As noted in the *Grout Strategy for Tanks 18 and 19 Closure* (SRR-LWE-2010-00318), the goal for grouting in-tank equipment was to minimize the potential for vertical fast flow paths down through the grout to the residual material on the tank floor. The grout placed in the transfer pump in the Tank 18 West Riser, the standard mixer slurry pump in the Tank 18 East Riser, and other equipment grouted in the closed tanks to minimize the potential for vertical fast flow path through this equipment to the waste tank floor.

In essence, the objective of the equipment fill efforts was to practice due diligence to ensure that as much grout as practical was placed into the equipment. Equipment grouting efforts did not cease until the equipment was unable to receive any more grout. Examples of due diligence included the formulation and testing of very flowable grout and the testing of equipment filling techniques by conducting equipment fill trials using mock-ups of some of the equipment anticipated to be more challenging to fill with grout. Equipment mock-ups were constructed of transparent material so that grout flow through the equipment could be assessed. Grout delivery flow rate, settling time and venting methods are examples of equipment filling techniques that were identified during mock-up testing and implemented during the grouting of in-tank equipment.

Based on this comparison, shown in Table 3.2-1, the filling of internal void space of in-tank equipment was acceptable..

Table 3.2-1: In-Tank Equipment Calculated vs. Actual Grout Fill Comparison

Equipment	Location	Calculated Fill Volume (Gallons)	Actual Grout Volume (Gallons)
Advanced Design Mixer Pump (ADMP)	Tank 18 Center Riser	493	490
Standard mixer slurry pump	Tank 18 Northwest Riser	457	424
Standard mixer slurry pump	Tank 18 East Riser	457	290
Evaporator feed pump and eductor	Tank 18 Southeast Riser	16	14
Sampling mast	Tank 18 Northeast Riser	2	2
Transfer pump	Tank 18 Northeast Riser	3	3
Transfer pump	Tank 18 West Riser	160	90
Telescoping transfer jet (TTJ)	Tank 19 Northwest Riser	38	66*
Dip tube assembly	Tank 19 Northwest Riser	1	2

* Grout flowed farther up into the TTJ discharge piping than assumed for the calculated fill volume.

3.2.2.1 Exceptions/Clarifications to Equipment Grout Fill Plans

The following exceptions/clarifications to the in-tank equipment grout plans specified in the Tanks 18 and 19 CM are described below. [SRR-LWE-2012-00217]

- When Tank 18 Center Riser was accessed for grouting, two 2-inch diameter pipes were identified in the riser that had not originally been identified. These two pipes were not listed in Table 7.2-1 of the Tanks 18 and 19 CM as equipment to remain in Tank 18. One pipe was grouted with 5 gallons of grout, and the other pipe was grouted with 8 gallons of grout.
  The two pipes identified in the Tank 18 Center Riser reached from above the tank top to near the tank floor, approximately 44 feet below the tank top. The pipes were mining/spray lines constructed of stainless steel. Based on an assumed length of 50 feet, the internal volume of the pipes is 8.7 gallons. Minimal contamination may have potentially migrated into the pipes via the spray heads; however, based on the volume of grout placed in these pipes, the amount of potential residual waste in the pipes is negligible. Also, based on the volume of grout placed in these pipes, this entombed equipment does not provide a vertical void space of significant length to provide a fast flow path from the top of the tank to the residual material at the floor and, therefore, does not impact the FTF Special Analysis. [SRR-CWDA-2012-00051]
- Table 7.2-2 of the Tanks 18 and 19 CM lists a thermowell in the Tank 19 Northeast Riser as equipment to remain in Tank 19. This thermowell was removed from the waste tank prior to grouting.

- Bubbler tubes and a pipe containing a conductivity probe were identified in the Tank 19 Northwest Riser. These pipes did not extend into the waste tank and were identified as the riser was being prepared for grouting. They were not listed in Table 7.2-2 of the Tanks 18 and 19 CM as equipment to remain in Tank 19. The bubbler tubes and pipe were grouted when the riser was filled with grout.
- Two 1.5-inch diameter pipes were identified in the Tank 19 Northeast Riser as the riser was being prepared for grouting. They were not listed in Table 7.2-2 of the Tanks 18 and 19 CM as equipment to remain in Tank 19. One pipe was grouted with 4 gallons of grout, and the other pipe was grouted with one-third gallon of grout. These two pipes were associated with spray wash equipment in the riser and were constructed of stainless steel. The lengths of these pipes are approximately five feet with minimal (if any) extension below the five-foot long riser into the waste tank. These pipes would not have been contacted by waste because of their position in the riser at the roof of the tank above the historical highest elevation of waste in this tank. The amount of potential residual waste in the pipes is negligible and does not impact the FTF Special Analysis. [SRR-CWDA-2012-00051]

3.2.3 Riser Filling and Capping

For both Tanks 18 and 19, waste tank top modifications were made to accommodate waste tank riser grouting. Examples of pre-grout modifications included removal of equipment components from risers, core drilling openings in Tank 18 pill boxes, and disconnecting and lowering miscellaneous hoses and cables into the waste tank. All waste tank risers were filled and capped with the same type of reducing grout that was used for bulk fill. Typically, a form was built around the top of the risers to facilitate capping the riser with grout to sufficiently cover the riser and any equipment entombed in the riser. Figure 3.2-2 shows a typical riser before and after riser filling and capping.

Figure 3.2-2: Typical Riser - Before and After Filling and Capping (Tank 19 Northeast Riser)

The primary work packages that implemented grouting of Tanks 18 and 19 may be retrieved from SRS Records Management, if needed. These are work packages 1087939 and 1087938.

Work packages addressed grout preparations, bulk fill, riser fill, equipment fill preparation, equipment fill, and riser capping. Since Tanks 18 and 19 had been isolated from the operating facility, configuration control of waste tank grouting activities was maintained by work packages, consistent with the isolation strategy of each waste tank. [SRR-LWE-2010-00062, SRR-LWE-2010-00107]

4.0 MONITORING

As required by the Tanks 18 and 19 CM, DOE will perform annual inspection and maintenance activities for Tanks 18 and 19 during the interim period between operational closure of Tanks 18 and 19 and the final closure of the FTF. Ancillary structures (e.g., the Concentrate Transfer System, 241-F Evaporator, structural steel) associated with Tanks 18 and 19 will be removed from service when determined that it is practical. The leak detection systems for Tanks 18 and 19 will be grouted in conjunction with the closure of other ancillary systems in the vicinity. The closure of ancillary systems, including Tanks 18 and 19 leak detection systems will be tracked in Appendix A of each future waste tank closure module.

As described in Section 8 of the Tanks 18 and 19 CM, the annual visual inspections of the area surrounding Tanks 18 and 19 will be conducted and documented by procedure/work control processes. Maintenance actions will be performed, as appropriate, to ensure long-term structural integrity of the grouted tanks is maintained and adequately documented. The stormwater system will be maintained to ensure any possible water infiltration through grout is minimized.

After all waste tanks and ancillary structures in the FTF have been removed from service, decisions on removal of external structures such as remaining structural steel trusses, mechanical and electrical piping/conduit, instrumentation and power cables/wiring, raceways, motors, and any other remaining equipment from the tank top footprint will be addressed in conjunction with the final Resource Conservation and Recovery Act/Comprehensive Environmental Response, Compensation, and Liability Act closure of the FTF Operable Unit. [WSRC-OS-94-42]

5.0 CONCLUSION

This FCR is submitted to meet the requirements of the FTF GCP, the Tanks 18 and 19 CM and to satisfy requirements of Section IX of the Savannah River Site Federal Facility Agreement. [LWO-RIP-2009-00009, SRR-CWDA-2010-00003, WSRC-OS-94-42] This report documents the final configuration of the closed Tanks 18 and 19 in F-Area at the Savannah River Site and describes field conditions that differ from those described in the Tanks 18 and 19 CM. [SRR-CWDA-2010-00003]

Upon approval of this report and final inspection/walkdown of closure activities by SCDHEC, DOE will request approval to remove these waste tanks from Construction Permit #17,424-IW. An approval letter of the closure activities from SCDHEC will represent partial operational closure of Construction Permit #17,424-IW. [DHEC_01-25-1993]

6.0 PROFESSIONAL ENGINEER CERTIFICATION

The information in this report was developed from reviews and inspections under my direction or supervision, which included drawings, plans, specifications, and other documents. I certify that to the best of my knowledge, information, and belief, the information represents the current conditions of Tanks 18 and 19 and that each of these waste tanks retains sufficient structural integrity through annual visual inspection of the area around Tanks 17 through 20. The stormwater system will be maintained to ensure any possible water infiltration through grout is minimized.

Stamp

6/17/13

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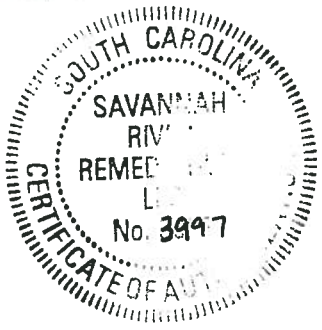

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