

November 12, 2013

Ms. Jean Ridley, Director
Waste Disposition Programs Division
U.S. Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

SUBJECT: THE U.S. NUCLEAR REGULATORY COMMISSION AUGUST 27-28, 2013,
ONSITE OBSERVATION VISIT REPORT FOR THE SAVANNAH RIVER SITE
F-TANK FARM FACILITY (DOCKET NO. PROJ0734)

Dear Ms. Ridley:

The enclosed report describes the U.S. Nuclear Regulatory Commission (NRC) onsite observation visit on August 27-28, 2013, at the Savannah River Site (SRS) F-Tank Farm (FTF) Facility. That onsite observation visit was conducted in accordance with Section 3116(b) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA), which requires NRC to monitor certain disposal actions taken by the U.S. Department of Energy (DOE) for the purpose of assessing compliance with the performance objectives set out in Title 10 of the Code of Federal Regulations (CFR) Part 61, Subpart C.

The main activities conducted during the August 2013 onsite observation visit were:
(1) technical discussion on the technical reviews related to FTF Tanks 5/6 closure; and
(2) observation of grouting of FTF Tanks 5/6 with technical discussion on grout formula, development, and testing documentation. Those activities were consistent with those described in the NRC Observation Guidance Memorandum for the SRS FTF (dated July 29, 2013,) [available via the NRC's Agencywide Documents Access and Management System (ADAMS) at Accession No. ML13196A134]. That Guidance Memorandum was developed using the following NRC documents: (1) FTF Monitoring Plan, Rev. 0 (dated January 2013) [ADAMS Accession No. ML12212A192]; and (2) three Technical Review Reports (TRRs) [ADAMS Accession Nos. ML13080A401, ML13100A230, and ML12272A082]. The FTF Monitoring Plan contains the monitoring areas and monitoring factors, which describe how NRC will monitor DOE FTF disposal actions to assess compliance with the performance objectives. The three TRRs contain follow-up action items that will be used in future monitoring activities and will be incorporated into future revisions to the FTF Monitoring Plan.

This is the fourth FTF onsite observation visit since NRC began monitoring DOE FTF disposal actions under NDAA Section 3116(b) in March 2012. NRC does not expect to close any of the 26 FTF monitoring factors, close any of the 8 FTF monitoring areas, or change the NRC staff Technical Evaluation Report overall conclusions in the early stages of the monitoring process. There were no FTF Open Issues before the August 2013 onsite observation visit and there were none opened during the onsite observation visit. Thus, there are currently no FTF Open Issues.

NRC does expect to open and close follow-up action items during onsite observation visits and clarification teleconference calls. Most of those follow-up action items are specific short-term

J. Ridley

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actions to be performed by NRC or DOE. Usually, most of those follow-up action items are closed before the next onsite observation visit or clarification teleconference call. Therefore, in accordance with the requirements of NDAA Section 3116(b), NRC will continue to monitor DOE disposal actions at SRS.

If you have any questions or need additional information regarding this report, please contact Harry Felsher of my staff at Harry.Felsher@nrc.gov, or at (301) 415-6559.

Sincerely,

/RA/

Aby Mohseni, Deputy Director
Environmental Protection and Performance
Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: PROJ0734

Enclosure:
NRC Onsite Observation Visit Report

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If you have any questions or need additional information regarding this report, please contact Harry Felsher of my staff at Harry.Felsher@nrc.gov, or at (301) 415-6559.

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Aby Mohseni, Deputy Director
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NRC Onsite Observation Visit Report

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WIR Service List

Glenn Carroll, Coordinator
Nuclear Watch South
P.O. Box 8574
Atlanta, GA 31106

Tom Clements, Member
Friends of the Earth
1112 Florence Street
Columbia, SC 29201

Jim Hardeman, Manager
Environmental Radiation Program
Environmental Protection Division
Georgia Department of Natural Resources
4220 International Parkway, Suite 100
Atlanta, GA 30354

Karen Patterson, Environmental
Appointment
Governors' Nuclear Advisory Council
and Tetra Tech NUS
900 Trail Road
Aiken, SC 29803-5297

Bobbie Paul, Executive Director
Georgia Womens Action for New Directions
250 Georgia Ave., SE
Suite 202
Atlanta, GA 30312

Robert H. Pope
Senior Remedial Project Manager
U.S. Environmental Protection Agency
Region 4, Superfund Division
Federal Facilities Branch, Waste Division
61 Forsyth Street
Atlanta, GA 30303

Jon Richards, Remedial Project Manager
U.S. Environmental Protection Agency
Region 4, Superfund Division
Federal Facilities Branch, Waste Division
61 Forsyth Street
Atlanta, GA 30303

Thomas Saporito, Executive Director
P.O. Box 8413
Jupiter, FL 33468

John J. Schnabel
Saltstone Project Inspector,
Professional Engineer
Division of Mining and Solid Waste
Management
Bureau of Land and Waste Management
South Carolina Department of Health
and Environmental Control
2600 Bull Street
Columbia, SC 29201-1208

Shelly Wilson
Federal Facilities Liaison
Environmental Quality Control
Administration
South Carolina Department of Health
and Environmental Control
2600 Bull Street
Columbia, SC 29201-1708

U.S. NRC AUGUST 27-28, 2013, ONSITE OBSERVATION VISIT REPORT FOR THE SAVANNAH RIVER SITE F-TANK FARM FACILITY

EXECUTIVE SUMMARY:

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its fourth onsite observation visit, Observation 2013-02, to the F-Tank Farm (FTF) Facility at the Savannah River Site (SRS) on August 27-28, 2013. This is the second FTF onsite observation visit in Calendar Year 2013. On every onsite observation visit to SRS, NRC is focused on assessing compliance with four performance objectives in Title 10 of the Code of Federal Regulations (CFR) Part 61, Subpart C: (1) protection of the general population from releases of radioactivity (§61.41), (2) protection of individuals from inadvertent intrusion (§61.42), (3) protection of individuals during operations (§61.43), and (4) stability of the disposal site after closure (§61.44).

For FTF Observation 2013-02 NRC focused on the monitoring areas and monitoring factors in the FTF Monitoring Plan, Rev. 0 (NRC, 2013b), as supplemented by the NRC issued Technical Review Reports (TRRs) [(NRC, 2013e), (NRC, 2013f), and (NRC, 2013h)] since DOE issued the FTF final waste determination. Starting with FTF Observation 2013-01, NRC involves U.S. Environmental Protection Agency (EPA) Region 4 in the monitoring activities at FTF because, for closed FTF tanks, South Carolina Department of Health and Environmental Control (SCDHEC) will have lead regulatory authority and EPA will also have regulatory authority. After the entire FTF Facility is closed, EPA and SCDHEC will share regulatory authority through the SRS Federal Facility Agreement (FFA). NRC performs monitoring activities in coordination with the State, so SCDHEC staff also participated in FTF Observation 2013-02. EPA Region 4 staff was invited to participate in FTF Observation 2013-02.

As described in the Observation Guidance Memorandum for FTF Observation 2013-02 (NRC, 2013i), NRC staff and DOE (i.e., includes DOE contractors throughout this report) discussed the following topics: (1) technical reviews for FTF related to FTF Tanks 5/6 closure, including the review of Tanks 5/6 Special Analysis and final inventory development; and (2) grout formula, development, and testing documentation for Tanks 5/6. In addition, NRC staff and DOE observed grouting of Tanks 5/6. Also, there were other items discussed, such as the status of other NRC TRRs and a review of follow-up action items. This report provides a description of the NRC activities during FTF Observation 2013-02, including observations made by NRC.

NRC does not expect to close any of the 26 FTF monitoring factors, close any of the 8 FTF monitoring areas, or change the NRC staff Technical Evaluation Report overall conclusions in the early stages of the monitoring process. There were no FTF Open Issues before the August 2013 onsite observation visit and there were none opened during the onsite observation visit. Thus, there are currently no FTF Open Issues.

NRC staff received documentation and a DOE presentation (SRR-CWDA-2013-00116, Rev. 1) that pertained to the activities observed during FTF Observation 2013-02. The presentation that DOE provided to NRC staff is accessible via the NRC's document repository, the Agencywide Documents Access and Management System (ADAMS), via Accession No. ML13253A270.

Enclosure

1.0 **BACKGROUND:**

Section 3116(a) of the National Defense Authorization Act for Fiscal Year 2005 (NDAA) authorizes DOE, in consultation with NRC, to determine that certain radioactive waste related to the reprocessing of spent nuclear fuel is not high-level waste, provided certain criteria are met. NDAA Section 3116(b) requires NRC to monitor DOE disposal actions to assess compliance with the performance objectives in 10 CFR Part 61, Subpart C.

On September 30, 2010, DOE issued the draft FTF Waste Determination (DOE/SRS-WD-2010-001, Rev. 0), which was provided to NRC for consultation under NDAA Section 3116(a). The purpose of the draft Waste Determination was to demonstrate DOE compliance with the criteria in NDAA Section 3116(a), including compliance with the performance objectives in 10 CFR Part 61, Subpart C. In its consultation role, the NRC reviewed the draft Waste Determination and highlighted a number of technical concerns during a series of public meetings and requests for additional information. In October 2011, NRC documented the results of its review in the FTF TER (NRC, 2011). In the TER, NRC made a number of recommendations that NRC believes, if implemented by DOE, will enhance the DOE demonstration that FTF disposal actions would meet the performance objectives in 10 CFR Part 61, Subpart C during the FTF closure process. Taking into consideration the information and recommendations in the NRC TER, DOE completed a number of studies that were referenced in the final FTF Waste Determination that DOE issued in March 2012 (DOE/SRS-WD-2012-001, Rev.0). DOE indicated that it predicated the final Waste Determination on extensive analyses and scientific rationale, including the final FTF Performance Assessment (SRS-REG-2007-00002, Rev. 1), as supplemented by the FTF Tanks 18/19 Special Analysis (SRR-CWDA-2010-00124, Rev. 0). Taking into consideration the information in the NRC TER and the final FTF Waste Determination, NRC finalized and issued the FTF Monitoring Plan, Rev. 0 (NRC, 2013c), which was transmitted to DOE by letter dated January 23, 2013 (NRC, 2013b) and issued in a *Federal Register Notice* on February 21, 2013, (NRC, 2013c).

To carry out its monitoring responsibility under NDAA Section 3116(b), NRC, in coordination with the State site regulator – SCDHEC, performs three types of activities: (1) technical reviews, (2) onsite observation visits, and (3) data reviews. Those activities focus on both key modeling assumptions identified in the NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b), as supplemented by the NRC TRRs [(NRC, 2013e), (NRC, 2013f), and (NRC, 2013h)]; and the DOE disposal actions. Technical reviews generally focus on review of information generated to provide support for key assumptions that DOE made in the FTF Performance Assessment. Onsite observation visits generally are performed to either observe the collection of data and review the data to assess consistency with assumptions made in the FTF final Waste Determination; or observe key disposal or closure activities related to technical review areas. Data reviews supplement technical reviews by focusing on monitoring data that may indicate future system performance or reviewing records or reports that can be used to directly assess compliance with the performance objectives.

2.0 NRC ONSITE OBSERVATION VISIT ACTIVITIES:

On July 29, 2013, NRC issued the Observation Guidance for the August 27-28, 2013, onsite observation visit, FTF Observation 2013-02 (NRC, 2013I). An Observation Guidance is a plan for what NRC expects to cover during an onsite observation visit, which may not be followed based on what happens during the onsite observation visit. The following two topics in the Observation Guidance for FTF Observation 2013-02 were not covered during FTF Observation 2013-02 and will be covered in future onsite observation visits: (1) Technical Review of 10 CFR Part 61 As Low As Is Reasonably Achievable (ALARA) and (2) NRC Observation of DOE Implementation of the Radiation Protection Program, including ALARA.

FTF Observation 2013-02 began with a short briefing on the agenda and site safety procedures presented by DOE contractor, Savannah River Remediation (SRR) that was attended by representatives from DOE, NRC, and SCDHEC. Afterwards, there were welcoming remarks and introductions. The following topics were technical discussions between NRC and DOE during FTF Observation 2013-02: (1) Technical Reviews for FTF related to Tanks 5/6 Closure, including the review of Tanks 5/6 special analysis and final inventory development; and (2) grout formula, development, and testing documentation for Tanks 5/6. In addition, NRC staff and DOE observed grouting of Tanks 5/6. Also, there were other items discussed, such as the status of other NRC TRRs and a review of follow-up action items.

2.1 Technical Discussion – Technical Reviews for FTF related to FTF Tanks 5/6 Closure:

2.1.1 Observation Scope:

Using the NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b), NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41 and 10 CFR 61.42 performance objectives for tank closure activities through Monitoring Area 1 (Inventory) under: Monitoring Factor 1.1 (Final Inventory and Risk Estimates) for §61.41 and Monitoring Factor 1.1 (Final Inventory and Risk Estimates-Additional Considerations) for §61.42; Monitoring Factor 1.2 (Residual Waste Sampling) for §61.41 and Monitoring Factor 1.2 (Residual Waste Sampling-Additional Considerations) for §61.42; and Monitoring Factor 1.3 (Residual Waste Volume) for §61.41.

2.1.2 Observation Results:

NRC discussed with DOE the current development of the NRC technical reviews for FTF related to Tanks 5/6 closure in the following areas: special analysis and final inventory development. Highlights of that Technical Discussion are the following:

Regarding the FTF Tanks 5/6 Special Analysis TRR:

- NRC staff inquired about the development of site-specific Niobium distribution coefficients (K_d s) that appear to be risk-significant.
- DOE indicated that the site-specific analysis for Niobium K_d s is in-progress and the results are expected in the near-term.
- NRC staff indicated that the TRR was expected to be issued shortly.

Regarding the FTF Tanks 5/6 Final Inventory Development TRR:

- NRC staff indicated that, in general, the sampling and analysis program and volume estimation program are technically sound and defensible.
- NRC staff discussed the issues related to identification and quantification of tank waste variability and management of volume uncertainty, which NRC staff expects will be considered in future DOE analyses.

In addition, NRC staff discussed with DOE the current development of the Grouting of FTF Tanks 18/19 TRR. Highlights of that discussion are the following:

- NRC staff emphasized that the TRR conclusion will be that performance requirements for grout formulations recommended and tested for Tanks 18/19 closure are generally consistent with bulk initial properties assumed in the DOE FTF Performance Assessment. However, of primary importance, NRC expects that DOE would provide sufficient information, and testing to exclude alternative conceptual models reflecting preferential flow through the tank grout monolith from the DOE base case.
- NRC staff indicated that DOE appears to not have plans for shrinkage testing of the grout formulations regarding preferential pathways. DOE responded that there are currently no plans for additional shrinkage testing.
- NRC staff indicated that the TRR will include both observations of potential segregation of grout during tank grouting and the remaining questions on segregation that were sent to DOE for the May 1, 2013, NRC/DOE clarifying teleconference on grouting.
- NRC staff indicated items of secondary importance, including the expectation that DOE would provide additional information on: (1) thermal cracking evaluations, (2) estimation of emplaced void volumes, (3) consideration of degradation from alkali-silica reactivity, and (4) impact on pH buffering from limestone substitutions in the grout formulation.
- NRC staff indicated that it will continue to evaluate the potential for preferential flow through the tank grout due to shrinkage and cracking under Monitoring Factor 3.3 (Shrinkage and Cracking).

The other three topics covered during this Technical Discussion were: (1) NRC staff questions sent on August 21, 2013, about two DOE documents; (2) review of follow-up action items since FTF Observation 2013-01, including the DOE methodology for doing inventory adjustments, and (3) NRC staff discussion of the major findings and conclusions in both the NRC issued Tanks 18/19 Special Analysis TRR and Waste Release TRR. Below are some highlights of those topics:

On August 21, 2013, NRC staff provided DOE with follow-up questions on both the *Liquid Waste Tank Residuals Sampling and Analysis Program Plan (SRR-CWDA-2011-00050, Rev. 1) [SAPP]* and the *Liquid Waste Tank Residuals Sampling-Quality Assurance Program Plan, (SRR-CWDA-2011-00117, Rev. 0) [QAPP]*. DOE provided responses to those questions during Observation 2013-02. NRC staff questioned the DOE decision criteria for the collection and analysis of additional samples based on heterogeneity. DOE indicated that it will use expert judgment and knowledge of tank cleaning history to determine if additional samples should be

taken or if discrete samples should be analyzed. That decision will be informed, in part, by DOE historical knowledge of mound formation and movement during the cleaning process, as well as by the practicality of sampling access to certain tank locations. NRC staff questioned DOE about the frequency of validation (i.e., every tenth waste tank for a limited suite of radionuclides and chemicals). DOE indicated that the frequency was decided between DOE and SCDHEC with SCDHEC's approval. Regarding the inconsistent uncertainty terminology between the SAPP and QAPP, DOE will attempt to address those inconsistencies in future revisions to both the SAPP and QAPP. DOE is not planning on revising those two documents in the near future to address the terminology issue.

During FTF Observation 2013-02, DOE provided information in *Followup In Support of U.S. Nuclear Regulatory Commission Monitoring Activities for F-Tank Farm, (SRR-CWDA-20130-00103, Rev 0)*, in response to all but one follow-up action item from the three clarifying teleconference calls that NRC held with DOE on May 1, 8, and 15, 2013. DOE led the discussion about the DOE methodology for doing inventory adjustments and examples of using that methodology, such as for I-129 and for Tc-99. NRC staff questioned DOE regarding details of the methodology and examples. NRC staff questioned the basis for assuming a volume of 1,700 gallons (6,435 liters) of residual waste for Type I Tanks that have not been cleaned when Tanks 5/6 had higher final residual volumes. DOE indicated that the basis for that volume was a factor of 10 times higher than the 0.0625 inches (0.15875 cm) height assumed in the FTF Performance Assessment.

Regarding the FTF Tanks 18/19 Special Analysis TRR and the Waste Release TRR, NRC staff reiterated its expectation that DOE would perform waste release experiments to better understand plutonium solubility. That is particularly important given the NRC staff observations of risk-significant plutonium solubility observed in Tank 18 following Tank 18 cleaning. NRC staff discussed its expectations that DOE would perform additional analyses to address the performance impact of higher mobility forms of plutonium that may exist in SRS subsurface environments, which were based on site-specific research and data.

2.1.3 Conclusions and Follow-up Actions:

NRC staff will continue to perform technical reviews on topics related to monitoring FTF activities. The following five follow-up actions resulted from that technical discussion:

- DOE to provide NRC with *Followup In Support of U.S. Nuclear Regulatory Commission Monitoring Activities for F-Tank Farm, (SRR-CWDA-20130-00103, Rev. 0)*.
- NRC to provide DOE with an external computer hard drive for the FTF Tanks 5/6 Special Analysis PORFLOW files.
- DOE to provide NRC with the FTF Tanks 5/6 Special Analysis PORFLOW files on the NRC previously provided external computer hard drive.
- DOE to provide NRC with both *Liquid Waste Tank Residuals Sampling and Analysis Program Plan (SRR-CWDA-2011-00050, Rev. 2)* and *Liquid Waste Tank Residuals Sampling-Quality Assurance Program Plan, (SRR-CWDA-2011-00117, Rev. 1)*.

- DOE to provide NRC with *Task Technical and Quality Assurance Plan for Determining the Radionuclide Release from Tank Waste Residual Solids (SRNL-STI-2013-00203, Rev. 0)*.

2.2 Observation of Grouting of Tanks 5/6 and Technical Discussion – Grout Formula, Development, and Testing Documentation:

2.2.1 Observation Scope:

Using the NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b), NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41 and 10 CFR 61.42 for grout performance through Monitoring Area 3 (Cementitious Material Performance) under Monitoring Factor 3.4 (Grout Performance) for §61.41 and Monitoring Factor 3.4 (Grout Performance-Additional Considerations) for §61.42.

2.2.2 Observation Results:

NRC staff and DOE observed grouting of Tanks 5/6 and participated in related technical discussions. NRC staff asked DOE questions and DOE provided both overall and specific answers to those questions related to the following topics: grout formulations, grout testing, grout acceptance, and grout placement. Highlights of that Observation and Technical Discussion are the following:

Before observing the grouting of Tanks 5/6, DOE provided information regarding: FTF Tanks 5/6 Grouting Strategy, Status of Tanks 5/6 Grouting (through August 22, 2013), Tanks 5/6 Grouting Equipment, Tanks 5/6 Bulk Fill Grout Pumps, Tanks 5/6 Cooling Coil Fill Grout Skid, Tanks 5/6 Bulk Grout Fill, Grout Testing Protocol, Tanks 5/6 Bulk Grout Fill, Cooling Coil Grout Fill, Tanks 5/6 Field Observation, Tanks 5/6 Grouting Schedule, Equipment Fill, Equipment Fill Grout, Coiling Coil Fill, Coiling Coil Fill Grout, Annulus Grouting, and Riser Grouting, and Status of Tank Closure Progression.

After observing the grouting of Tanks 5/6, NRC staff and DOE watched video of specific Tanks 5/6 grouting activities: Primary Tank Grout (Lift 1), Annulus Grout Fill (Lifts 2 and 3), and Cooling Coil Grout Fill (Broken Coils).

- NRC staff inquired about the change in grout formulation from Tanks 18/19, which would allow the grout to flow more easily around cooling coils in Type I Tanks, such as Tanks 5/6. NRC staff inquired about the maximum water-to-cement ratio and if a higher water-to-cement ratio was used in Tanks 5/6 versus Tanks 18/19 to achieve greater flowability.
- DOE indicated that the maximum water-to-cement ratio of 0.58 for Tanks 5/6 was calculated based on the values in the table in Attachment 5.5 to C-SPP-F-00055. That value is similar to the water-to-cement ratio for Tanks 18/19.
 - The amount of high range water reducer was increased to achieve greater flowability, as reflected in the slump. The targeted slump range is 26 – 30 inches [66 - 76 cm] for Type I Tanks 5/6 and 24 – 28 inches [61 – 71 cm] for Type IV Tanks 18/19.

- DOE also has some control of slump in the field. A quantity of water is reserved until the grout is delivered to the work site. That additional water can then be added to achieve the desired slump, if needed.
- NRC staff inquired as to whether DOE planned to formally document the lessons-learned from grouting Tanks 18/19.
- DOE indicated that it did not have plans to develop such lessons-learned documentation at this point in time, but that there is potential for formally documenting lessons-learned after Tanks 5/6 are grouted. One of the DOE lessons-learned from Tanks 18/19 grouting was that 90-day compressive strength measurements were not needed because the 28-day tests showed sufficient strength. Another one was the need for more flowable grout to avoid mounding of tank grout underneath risers used as access points for grouting.
- NRC staff inquired as to whether DOE plans to do testing on shrinkage compensating grout formulas, as recommended by Savannah River National Laboratory (SRNL).
- DOE indicated that no additional testing beyond that documented in "*Tanks 18 and 19-F Structural Flowable Grout Fill Material Evaluation and Recommendations*" (SRNL-STI-2011-00551, Rev. 1) was planned.
- DOE highlighted that, for tanks with cooling coils, when compared to tanks without cooling coils, shrinkage around the cooling coils could potentially aid in the reducing capability of the grout mixture because the water pathways would likely be throughout the interior of the tank, as opposed to along the tank walls. NRC staff acknowledged the potential for that phenomenon.
- NRC staff indicated that the primary concern related to tank grouting is shrinkage of grout away from the tank wall, which will accentuate the potential for by-pass flow of infiltrating water around reducing tank grout.
- NRC staff indicated that more contact of infiltrating groundwater with reducing grout is expected for tanks with cooling coils (i.e., shrinkage concentrated at the tank wall in Type IV Tanks may be more risk-significant), but the main concern is that the DOE reference case does not account for by-pass flow for any tank.
- NRC staff and DOE agreed that a preferential pathway case may represent a bounding scenario and discussed different methods of adding realism to the performance assessment calculations.
- NRC staff indicated that segregation of grout could lead to higher porosity, higher permeability, and less reductive grout at the periphery of the Type IV Tanks. Higher water-to-cement ratios at the periphery of Type IV Tanks, due to the delivery of grout in the center riser, could also lead to greater shrinkage along the tank walls. With regard to shrinkage in Type I Tanks, such as Tanks 5/6, shrinkage away from cooling coils and the tank wall could lead to by-pass flow.

- NRC staff indicated that shrinkage compensating formulations may be more successful in tanks with internal restraints (e.g., coiling coils), such as Type I Tanks.
- NRC staff agreed with DOE that in the case of shrinkage away from walls and internal restraints, infiltrating groundwater may contact more of the tank grout in Type I Tanks compared to Type IV Tanks. That is because shrinkage in Type I Tanks would be more widely distributed. Shrinkage in Type I Tanks would occur along the interface of the tank grout and either the surface of the tank wall or the surfaces of internal structures, such as cooling coils. Shrinkage in Type IV Tanks may be concentrated along the tank wall.
- NRC staff inquired about the basis for the 10 feet (3.048 meters) drop height of grout into the tanks.
- DOE indicated that the drop height is actually 5 feet (1.524 meters) and believed that the basis for the allowable drop height is found in an American Concrete Institute standard, which allows a drop height of up to 10 feet (3.048 meters) without additional evaluation. DOE added that the drop height was evaluated by SRNL. However, it was not clear to NRC staff that SRNL evaluated the acceptability of the drop height for Tanks 5/6.
- NRC staff inquired about the grout testing protocol, including which tests and how the results of the tests are used to make acceptance decisions for the grout.
- DOE indicated that only the time, drum rotations, and slump test results are used for grout acceptance decisions.
 - Grout mixes may be rejected if they do not meet the specified slump flow. The grout must also be discharged within 90 minutes and 300 drum revolutions.
 - The results of the bleed water test would not impact grout acceptability. However, failing a bleed water test would cause DOE to investigate the reasons and make any necessary adjustments with the grout supplier. Similarly, results of the temperature test would not impact grout acceptability, but will be used in recommending adjustments to the supplier.
 - At the time of the observation, all results for time, drum rotations, and slump tests had been documented and all grout had been accepted. The tests are carried out in compliance with American Society for Testing and Materials Standards.
- NRC staff questioned the representativeness of test samples for emplaced grout for the 7-day and 28-day compressive strength tests.
- NRC staff observed that the tapping and molding actions performed by the testing staff may not mimic what occurs within a tank. However, generally, the grout significantly exceeded the required strength by the 28-day test and compressive strength may not be as risk-significant as other concerns.
- NRC staff inquired about which risers DOE has access to for grouting Tanks 5/6.

- DOE clarified that there are preferred access points (i.e., Risers 1, 3, 5, 8) and only one of those risers will be used at any given time. Any of the other risers could be used with approval from the Engineering Team and after retrofitting that riser to accept the grout.
- NRC staff watched video of grouting Tanks 5/6 to observe flowability of grout, potential for mounding/lumping, and coverage capability of the video.
 - Some color differentiation (i.e., marbling) of grout introduced to the Tank 5 annulus was observed, which indicated a potential lack of mixing in some places.
 - The video of grouting of failed cooling coils clearly showed the residual water and water/grout mixture exiting the broken end of the coil, followed by the grout until it reached a constant consistency/color.
 - The video showed the injection of the 'pig' (i.e., foam ball used to clean the grout delivery hose) at the completion of a grout pour.
- NRC staff inquired about the annulus risers that would be used for grouting.
- DOE clarified that the annuli have four risers (i.e., North, South, East, West) and both an intake and outtake for the ventilation duct system. The North and South annulus Risers will be used to place grout and all four annulus risers will be used to support videotaping.
- NRC staff inquired as to how DOE ensures that the inside of the ventilation duct is grouted.
- DOE explained how the interior structure of the ventilation duct at the connection with the top of the tank is similar to pants legs, where the grout will be introduced to one side of the leg and flow around the circular duct to the other side. DOE confirmed that the grout has flowed to the opposite side through video showing the grout flowing within the duct beneath the open register. NRC staff observed video of flow within a duct.

2.2.3 Conclusions and Follow-up Actions:

The NRC staff will continue to monitor FTF activities related to observing grout-filling tanks. There are no follow-up actions that resulted from that observation. The NRC staff will continue to monitor FTF activities related to the grout formula, development, and testing documentation. The following two follow-up actions resulted from that technical discussion:

- DOE to provide NRC with Idaho grout drop report, *Grout/CLSM Testing and Selection for the INTEC Tank Farm Closure (EDF-6715, Rev. 0)*.
- DOE to provide NRC with basis for the 10-foot grout drop height.

3.0 OVERALL CONCLUSIONS, STATUS OF MONITORING AREAS, MONITORING FACTORS, OPEN ISSUES, AND OPEN FOLLOW-UP ACTION ITEMS; AND ISSUANCE OF NRC TECHNICAL REVIEW REPORTS:

3.1 Overall Conclusions:

The information gathered during FTF Observation 2013-02 will be used for multiple NRC Technical Review Reports via memoranda and future onsite observation visits, based on the topics discussed. There is no change to the NRC staff overall conclusions from the FTF TER regarding compliance of DOE disposal actions with the 10 CFR Part 61 performance objectives

3.2 Status of Monitoring Areas in FTF Monitoring Plan, Rev. 0:

FTF Observation 2013-02 is the second onsite observation visit under the FTF Monitoring Plan (NRC, 2013b). NRC staff did not close any monitoring areas during FTF Observation 2013-02. Therefore, all eight monitoring areas (i.e., 1-Inventory, 2-Waste Release, 3-Cementitious Material Performance, 4-Natural System Performance, 5-Closure Cap Performance, 6-Performance Assessment Maintenance, 7-Protection of Individuals During Operations, and 8-Site Stability) in the FTF Monitoring Plan, Rev. 0 remain open.

3.3 Status of Monitoring Factors in FTF Monitoring Plan, Rev. 0:

FTF Observation 2013-02 is the second onsite observation visit under the FTF Monitoring Plan (NRC, 2013b). NRC staff did not close any monitoring factors during FTF Observation 2013-02. Therefore, all 26 Monitoring Factors (i.e., 1.1 – 1.5, 2.1 – 2.2, 3.1 – 3.6, 4.1 – 4.3, 5.1 – 5.3, 6.1 – 6.3, 7.1 – 7.3, 8.1), including similar ones for different performance objectives, in the FTF Monitoring Plan, Rev. 0 remain open.

3.4 Status of Open Issues for FTF Monitoring:

Previously, there were no FTF Open Issues. NRC staff did not open any new Open Issues during FTF Observation 2013-02. Therefore, there are currently no FTF Open Issues.

3.5 Status of Open Follow-up Action Items from Previous FTF Onsite Observation Visit Reports:

There were three previous NRC FTF onsite observation visits. The status of open follow-up action items from the publicly available reports for those onsite observation visits is listed below:

- Report for FTF Observation 2012-01 (June 12, 2012) (NRC, 2012b) with Guidance issued on June 4, 2012, (NRC, 2012a): **All Action Items completed.**
- Report for FTF Observation 2012-02 (September 26-27, 2012) (NRC, 2012d) with Guidance issued on August 23, 2012, (NRC, 2012c): **All Action Items completed.**
- Report for FTF Observation 2013-01 (March 27-28, 2013) (NRC, 2013h) with Guidance issued on February 25, 2013, (NRC, 2013d): **All Action Items completed.**

3.6 Status of Open Follow-up Action Items from Clarifying Teleconference Calls:

Between FTF Observation 2013-01 and FTF Observation 2013-02, NRC held three clarification teleconference calls with DOE. The status of open follow-up actions items from those publicly available teleconference call summaries is listed below:

- Summary of May 1, 2013, Clarifying Teleconference Call – Tank 18 Grouting Operation Videos from FTF, May 24, 2013, (NRC, 2013g). **One Action Item not yet completed:** *DOE to provide in writing or in another NRC telecon a response to the NRC main points about water segregation and the NRC observations of Tank 18 grouting videos.*
- Summary of May 8, 2013, Clarifying Teleconference Call – FTF Tanks 5/6 Special Analysis, June 3, 2013, (NRC, 2013i). **All Action Items completed.**
- Summary of the May 15, 2013, Clarifying Teleconference Call – FTF Volume Mapping and Inventory, June 18, 2013, (NRC, 2013j). **All Action Items completed.**

3.7 Issuance of NRC Technical Review Reports:

Between FTF Observation 2013-01 and FTF Observation 2013-02, NRC issued the following FTF Technical Review Reports via memorandum, which are publicly available:

- Technical Review – “Tanks 18 and 19 Special Analysis for the Performance Assessment for the F-Tank Farm at the Savannah River Site,” (SRR-CWDA-2010-00124, Rev. 0), April 10, 2013, (NRC, 2013f)
- Technical Review – Waste Release and Solubility Related Documents Prepared by United States Department of Energy to Support Final Basis for Section 3116 Determination for the F-Area Tank Farm Facility Savannah River Site, May 31, 2013, (NRC, 2013h)

4.0 PARTICIPANTS:

<u>U. S. NRC</u>	<u>SCDHEC</u>	<u>U.S. DOE</u>	<u>SRR</u>
Cynthia Barr	Byron Amick	Dan Ferguson	Greg Arthur
Harry Felsher	Leigh Beatty	Sherri Ross	Ben Dean
Christopher Grossman	Barry Mullinax	Linda Suttora	Mark Layton
Christopher McKenney	Scott Simons	Amada Watson	Mark Mahoney
Leah Parks			Bruce Martin
			Rana O’Bryant
			Joe Pavletich
			Larry Romanowski
			Kent Rosenberger
			James Rush
			Steve Thomas
			Skip Wiggins

5.0 REFERENCES:

10 CFR Part 61, *Federal Register*, "Licensing Requirements for Land Disposal of Radioactive Waste," Code of Federal Regulations, Office of the Federal Register, January 2001.

U.S. Congress, "Public Law 108-375, Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Section 3116, Defense Site Acceleration Completion," October 2004.

U.S. Department of Energy (DOE), DOE Manual 435.1-1, "Radioactive Waste Management Manual, Change 1," June 2001, ML110800193.

_____, DOE Order 435.1, "Radioactive Waste Management," August 2001, ML101590125.

_____, SRS-REG-2007-00002, Rev. 1, "Performance Assessment for the F-Tank Farm at the Savannah River Site," March 31, 2010, ML102850339.

_____, DOE/SRS-WD-2010-001, Rev. 0, "Draft Basis for Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site," September 30, 2010, ML102790078.

_____, SRR-CWDA-2010-00124, Rev. 0, "Tank 18/Tank 19 Special Analysis for the Performance Assessment for the F-Tank Farm at the Savannah River Site," February 2012.

_____, DOE/SRS-WD-2012-001, Rev.0, "Basis for Section 3116 Determination Closure of F-Tank Farm at Savannah River Site," March 2012, ML121140051.

_____, SRR-CWDA-2013-00051, Rev. 1, "Presentation for Savannah River Site F-Tank Farm NRC Onsite Observation Visit on March 27-28, 2013," March 28, 2013, ML13093A159.

U.S. Nuclear Regulatory Commission, NUREG-1854, "NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations – Draft Final Report for Interim Use," August 2007, ML072360184. (NRC, 2007)

_____, "Technical Evaluation Report for F-Area Tank Farm Facility, Savannah River Site, South Carolina, Final Report," October 2011, ML112371715. (NRC, 2011)

_____, "Onsite Observation Guidance for June 11-12, 2012, Waste Monitoring Visit to the Savannah River Site, F-Area Tank Farm," June 4, 2012, ML12135A666. (NRC, 2012a)

_____, "U.S. Nuclear Regulatory Commission June 12, 2012, Onsite Observation Report for the Savannah River Site F-Tank Farm Closure," September 5, 2012, ML12191A210. (NRC, 2012b)

_____, "Observation Guidance for September 26-27, 2012, Waste Monitoring Visit to the Savannah River Site, F-Area Tank Farm," August 23, 2012, ML12228A631. (NRC, 2012c)

_____, "U.S. Nuclear Regulatory Commission September 26-27, 2012, Onsite Observation Report for the Savannah River Site F-Tank Farm Closure," December 5, 2012, ML12299A190. (NRC, 2012d)

_____, Letter from L. Camper to M. Gilbertson transmitting the NRC's F-Area Tank Farm Monitoring Plan, Rev. 0, to DOE, "The U.S. Nuclear Regulatory Commission Planned Monitoring Activities for F-Area Tank Farm at the Savannah River Site," January 23, 2013, ML12345A318. (NRC, 2013a)

_____, "U.S. Nuclear Regulatory Commission Plan for Monitoring Disposal Actions Taken by the U.S. Department of Energy at the Savannah River Site F-Area Tank Farm Facility in Accordance With the National Defense Authorization Act for Fiscal Year 2005," January 2013, ML12212A192. (NRC, 2013b)

_____, Federal Register Notice (FRN) – Notice of Issuance for NRC Plan for Monitoring Disposal Actions taken by DOE at the Savannah River Site F-Area Tank Farm," February 21, 2013, ML13046A192. (NRC, 2013c)

_____, "Onsite Observation Guidance for March 27-28, 2013, Monitoring Visit to the Savannah River Site, F-Area Tank Farm," February 25, 2013, ML13046A374. (NRC, 2013d)

_____, "Technical Review – Updated Cost-Benefit Analysis for Removal of Additional Highly Radioactive Radionuclides from Tank 18," March 21, 2013, ML13080A401. (NRC, 2013e)

_____, "Technical Review – 'Tanks 18 and 19 Special Analysis for the Performance Assessment for the F-Tank Farm at the Savannah River Site,' (SRR-CWDA-2010-00124, Rev. 0)," April 10, 2013, ML13100A230. (NRC, 2013f)

_____, "Summary of May 1, 2013, Clarifying Teleconference Call between the U.S. Nuclear Regulatory Commission and the U.S. Department of Energy Regarding Tank 18 Grouting Operation Videos from F-Area Tank Farm at the Savannah River Site," May 24, 2013, ML13127A291. (NRC, 2013g)

_____, "Technical Review – Waste Release and Solubility Related Documents Prepared by United States Department of Energy to Support Final Basis for Section 3116 Determination for the F-Area Tank Farm Facility Savannah River Site, May 31, 2013," ML12272A082. (NRC, 2013h)

_____, "Summary of May 8, 2013, Clarifying Teleconference Call between the U.S. Nuclear Regulatory Commission and the U.S. Department of Energy Regarding F-Area Tank Farm Tanks 5/6 Special Analysis for the Savannah River Site," June 3, 2013, ML13133A125. (NRC, 2013i)

_____, "Summary of the May 15, 2013, Clarifying Teleconference Call between the U.S. Nuclear Regulatory Commission and the U.S. Department of Energy Regarding F-Area Tank Farm Volume Mapping and Inventory for the Savannah River Site," June 18, 2013, ML13150A219. (NRC, 2013j)

_____, "U.S. Nuclear Regulatory Commission March 27-28, 2013, Onsite Observation Report for the Savannah River Site F-Tank Farm Facility," July 2, 2013, ML13113A322. (NRC, 2013k)

_____, "Onsite Observation Guidance for August 27-28, 2013, Monitoring Visit to the Savannah River Site, F-Area Tank Farm," July 29, 2013, ML13196A134. (NRC, 2013l)