

May 21, 2014

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 MARCH 26-27, 2014,  
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 March 26-27, 2014, 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 March 2014 onsite observation visit were technical discussions on: (1) closing of FTF Tanks 5/6 and grouting, (2) implementation of radiation protection program and environmental monitoring program, (3) site stability, (4) NRC Technical Review Reports, and (5) status of high-level waste tank residual solids sample leaching experiments. Those activities were consistent with those described in NRC Observation Guidance Memorandum for the SRS FTF (dated February 27, 2014,) [available via the NRC's Agencywide Documents Access and Management System (ADAMS) at Accession No. ML14045A215]. 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) five Technical Review Reports (TRRs) [ADAMS Accession Nos. ML13080A401, ML13100A230, ML12272A082, ML13273A299, and ML13269A365]. 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 five 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 fifth 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 or change the NRC staff Technical Evaluation Report overall conclusions as a result of this onsite observation visit. There were no FTF Open Issues before the March 2014 onsite observation visit and there were none opened during the onsite observation visit. Thus, there are currently no FTF Open Issues.

J. Ridley

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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 actions to be performed by the 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), the 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](mailto: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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WIR Service List  
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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](mailto:Harry.Felsher@nrc.gov), or at (301) 415-6559.

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<b>OFC</b>	DWMEP:PM	DWMEP	DWMEP:LA	DWMEP:BC	DWMEP:BC	DWMEP:DD
<b>NAME</b>	HFelsher	CBarr	TMoon	CMcKenney	GSuber	AMohseni
<b>DATE</b>	04/17/14	04/21/14 (by e-mail)	04/29/14	05/01/14	05/21/14	05/21/14

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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

Ruth Thomas  
354 Woodland Drive  
Columbus, SC 28722

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. NUCLEAR REGULATORY COMMISSION  
MARCH 26-27, 2014, 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 fifth onsite observation visit, Observation 2014-01, to the F-Tank Farm (FTF) Facility at the Savannah River Site (SRS) on March 26-27, 2014. This is the first FTF onsite observation visit in Calendar Year 2014. 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 2014-01 NRC focused on the monitoring areas and monitoring factors in the FTF Monitoring Plan, Rev. 0 (NRC, 2013b), as supplemented by NRC issued Technical Review Reports (TRRs) [(NRC, 2013e), (NRC, 2013f), (NRC, 2013h), (NRC, 2013m), and (NRC, 2013n)] since DOE issued the FTF final Waste Determination. Beginning with FTF Observation 2013-01, the NRC has included 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 2014-01. EPA Region 4 staff also participated in FTF Observation 2014-01.

As described in the Observation Guidance Memorandum for FTF Observation 2014-01 (NRC, 2014), the NRC staff and DOE (i.e., includes DOE contractors throughout this report) discussed the following technical topics: (1) Closing FTF Tanks 5/6; (2) Implementation of radiation protection program, including as low as reasonably achievable (ALARA), air monitoring, and final radiological data for Tanks 5/6 grouting; (3) Status of the high-level waste tank residual solids sample leaching experiments, including NRC's comments on the DOE experimental plan; (4) Tanks 5/6 Special Analysis Technical Review Report, Features, Events, and Processes Analysis Technical Review Report, and review of environmental monitoring data; and (5) Earthquakes and other impacts on site stability. Also, there were other items discussed, such as the review of follow-up action items. This report provides a description of NRC activities during FTF Observation 2014-01, including observations made by NRC.

NRC does not expect to close any of the 26 FTF monitoring factors or change the NRC staff Technical Evaluation Report overall conclusions as a result of this onsite observation visit. There were no FTF Open Issues before the March 2014 onsite observation visit and there were none opened during the onsite observation visit. Thus, there are currently no FTF Open Issues.

The NRC staff received documentation and a DOE presentation (SRR-CWDA-2014-00029, Rev. 1) that pertained to the activities observed during FTF Observation 2014-02. The presentation that DOE provided to the NRC staff is accessible via the NRC's document repository, the Agencywide Documents Access and Management System (ADAMS), via

ENCLOSURE

Accession No. ML14101A108. A technical presentation on “Radionuclide Release from Tank Waste Residual Solids” was provided, which is available in ADAMS via Accession No. ML14101A111.

## **1.0 BACKGROUND:**

Section 3116(a) of the National Defense Authorization Act for Fiscal Year 2005 (NDAA) authorizes DOE, in consultation with the 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: (1) key modeling assumptions identified in the NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b), as supplemented by the NRC TRRs [(NRC, 2013e), (NRC, 2013f), (NRC, 2013h), (NRC, 2013m), and (NRC, 2013n)]; and (2) 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: (1) observe the collection of data and review the data to assess consistency with assumptions made in the FTF final Waste Determination; or (2) 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 February 27, 2014, NRC issued the Observation Guidance for the March 26-27, 2014, onsite observation visit, FTF Observation 2014-01 (NRC, 2014). 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.

FTF Observation 2014-01 began with a short briefing on the agenda presented by DOE contractor, Savannah River Remediation (SRR) that was attended by representatives from DOE, NRC, SCDHEC, and EPA Region 4. Afterwards, there were welcoming remarks and introductions. The following topics were technical discussions between NRC and DOE during FTF Observation 2014-01: (1) Closing FTF Tanks 5/6; (2) Implementation of radiation protection program; including ALARA, air monitoring, and final radiological data for Tanks 5/6 grouting; (3) Status of the high-level waste tank residual solids sample leaching experiments, including NRC's comments on the DOE experimental plan; (4) Tanks 5/6 Special Analysis Technical Review Report, Features, Events, and Processes Analysis Technical Review Report, and review of environmental monitoring data; and (5) Earthquakes and other impacts on site stability. Also, there were other items discussed, such as the review of follow-up action items.

### **2.1 Technical Discussion – Closing of FTF Tanks 5/6:**

#### **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 3 (Cementitious Material Performance) under: Monitoring Factor 3.2 (Groundwater Conditioning), Monitoring Factor 3.3 (Shrinkage and Cracking), Monitoring Factor 3.4 (Grout Performance), and Monitoring Factor 3.6 (Use of Stabilizing Grout (As It Pertains to ALARA)).

#### **2.1.2 Observation Results:**

NRC discussed with DOE information about “tank closure” terms, closure of FTF Tanks 5/6, and other related items. Highlights of that Technical Discussion are the following:

##### **Regarding “tank closure terms”:**

- DOE provided context regarding the various “closure” terms, including:
  - in the Federal Facilities Agreement, a tank that is “removed from service” is the same as “operational closure,” which means that the tank is no longer used as a high-level waste tank;
  - after SCDHEC and EPA final approval of closure documentation and SCDHEC inspection, DOE sends a letter to SCDHEC requesting “removal of a tank from the South Carolina Industrial Wastewater (SCIW) Permit,” which is a partial closure of the SCIW permit and means that the tank cannot be used again in the future. Prior to removal from the permit, an Interim Record of Decision is completed by DOE, SCDHEC and EPA which SCDHEC incorporates into the Resource Conservation and Recovery Act (RCRA) permit; and

- using the term “closed” in plain language documents and presentations to members of the general public, which indicates that DOE does not plan to use the tank again.
- EPA indicated that “closure” is used to describe a tank that has been grouted.

Regarding closure of FTF Tanks 5/6:

- Prior to the onsite observation visit, NRC requested that DOE provide Tanks 5/6 grouting video, five accepted and five rejected Tanks 5/6 batch tickets (if available), Tanks 5/6 grouting schedule, and Tanks 5/6 Final Configuration Report, or inputs, if Report was not available yet.
- DOE provided inputs to the FTF Tanks 5/6 Final Configuration Report because the Report was not yet complete, the Report will be a follow-up action item, and the other items were provided by DOE prior to the onsite observation visit.
- NRC staff questions and DOE responses related to (1) grout formulation and testing, (2) calculation of void volumes; (3) strategy for tank and annulus grouting, (4) strategy for cooling coil grouting and (5) grouting video are discussed below:

Grout Formulation and Testing

- NRC staff inquired about correlation between water-to-cement ratios and slump because review of data for Tanks 18/19 revealed no strong correlation.
- DOE indicated viscosity modifying admixtures were used to control slump that would decrease the correlation between water-to-cement ratio and slump.
  - Same maximum water-to-cement ratio of 0.57 was used for grouting of Tanks 18/19 and grouting of Tanks 5/6.
  - Higher slump was needed for Tanks 5/6 to increase flowability of grout in tanks with cooling coils.
  - Acceptable slump was obtained at the batch plant and 20.3 litres (8.0 gallons) of water was withheld to allow DOE to adjust slump with water additions after grout was delivered to the site, if needed.
    - Only water could be used to adjust slump at the site.
- NRC staff inquired about records of any non-conformances identified during testing of the grout and an assessment of the extent to which any non-conformances may have impacted the integrity of the production grout.
- DOE identified the following grout testing anomalies: (1) test cylinder curing room temperature and humidity instrumentation was not functioning for a period of time; (2) timing of test cylinder compressive strength testing for 17 cylinders was not within specification due to the partial stop-work during lapse in appropriations; and (3) grout placed in Tank 6 on September 19, 2013, had excess water content (i.e., <3% excess).
  - Excess water was a result of grout supplier setting the mix with a positive hold on water, which resulted in a one gallon per cubic yard increase over what was requested by the procurement specification.



- Even though that grout was outside the procurement specification, it was still within the American Society for Testing and Materials specification.
- NRC staff inquired about the maximum water-to-cement ratio observed for the September 19, 2013, placements.

#### Calculation of Void Volumes

- DOE indicated that estimates of volume of grout delivered to the tanks and ancillary equipment were based on 8 cubic yards of grout per truck.
- DOE indicated that one grout truck could grout three to four risers.
  - Riser volume estimates were based on grouting time by knowing the total time it took to completely discharge the contents of one grout truck and the time it took to fill a riser.
  - Therefore, riser volume estimates should not be considered very accurate.

#### Strategy for Tank and Annulus Grouting

- NRC staff inquired about: (1) which risers corresponded to which cameras in the video; and (2) whether grout was poured through multiple risers throughout grouting process.
- In the onsite observation visit presentation, DOE provided a diagram identifying the video channels to each riser for both Tanks 5/6.
  - Preferred riser locations were used for each lift to facilitate even grout placement.
  - Additional risers (other than the preferred risers) could have been used if needed, but those risers were not needed during Tanks 5/6 grouting.
- NRC staff inquired about water added to the tremmie at the beginning or end of the day.
- DOE clarified that no water was used.
  - Slickwillie tremmie lubricant was used at the beginning of the day and, at the end of the day, a “pig” was used to clean the line by air injection.
- NRC staff inquired about DOE concerns or lessons learned from grouting Tanks 5/6.

#### Strategy for Cooling Coil Grouting

- NRC staff inquired about: (1) strategy for grouting both intact and failed cooling coils and how the strategy followed the recommendations in WSRC-STI-2008-00298; and (2) strategy for reducing air entrainment during grout pumping operations for Tank 5/6 cooling coils.
- DOE indicated the ability to use a manually operated pump to control the pressure and flow in order to reduce air entrainment, if needed.
- DOE indicated that the grout was introduced in a vertical orientation whenever possible and that the liquid-to-liquid interface with the grout and the water used to flush the coils prior to grouting was maintained in order to follow the recommendations in WSRC-STI-2008-00298 as closely as possible.

- DOE discussed the results of cooling coil grouting and indicated:
  - Tank 5 had seven failed cooling coils and Tank 6 had nine failed coils.
  - All failed cooling coils for Tanks 5/6 from inlet and outlet were successfully grouted.
  - Out of 56 intact coils for Tanks 5/6:
    - 51 were successfully grouted.
    - 2 were only partially filled and DOE suspected that it was due to not adequately cleaning the grout line prior to the fill, which allowed grout residue to plug the line.
    - 2 had known holes and DOE believed that they were plugged during bulk fill grouting activities.
    - 1 had a stoppage of grouting due to high radiation rates and when grouting resumed, the already poured grout had set, which prevented further grouting.
- NRC staff inquired about: (1) controlling temperature of the grout in the cooling coils; and (2) whether temperature caused any abnormalities in cooling coil grouting.
- DOE indicated that temperature was not a contributing factor related to grouting any of the five partially filled intact cooling coils.
  - Grout was delivered more slowly in the experiments described in WSRC-STI-2008-00298 versus the speed of actual grouting, such that temperature rise was less of a concern in actual grouting.
- NRC staff inquired about the measured flow and pressure during cooling coils grouting.
- DOE indicated that flow was measured, but pressure was not measured because the pump would automatically shut down when it reached a maximum pressure.

#### Grout Video

- DOE discussed: (1) improvements of video quality from Tank 18/19 grouting to Tanks 5/6 grouting; and (2) how helpful it was to have multiple cameras.
- NRC staff inquired about potential mislabeling of a portion of video from the morning of August 22, 2013, for the DVD labeled "Tank 5 Lift 3," which contained some video labeled "Tank 6" on the actual video.
- DOE clarified that all video labeling is correct for the morning of August 22, 2013, (i.e., a portion of the video from the morning of August 22, 2013, is Tank 6 video).
- NRC staff inquired about the volume of Slickwillie (i.e., lubricant that is a pumping aid for grout) that was added to Tanks 5/6.
- DOE provided an estimate of the amount of Slickwillie that was added for each day of grouting of Tanks 5/6.
- NRC staff and DOE reviewed portions of the video where NRC staff identified a concern about shrinkage of dried grout away from the tank walls or cooling coils.

- DOE indicated that it believed that it was too soon after grout pouring for shrinkage to occur and that the dark line at the edge of the tank was Slickwillie.
- NRC staff and DOE reviewed portions of the video where NRC staff identified a concern about non-self-leveling of grout and segregation of grout components as the grout flowed toward the periphery of the tanks (i.e., areas where Slickwillie appeared to form puddles on top of grout).
- DOE indicated that the work order was modified to allow pumping off the Slickwillie lubricant when the grouting reached the top of the tanks, but that was not needed because it was believed that the lubricant had been absorbed or evaporated by the time the top of the tanks were grouted.
- NRC staff and DOE reviewed portions of the annulus video during Lift 3, where grout was poured into the interior of the duct.
- NRC staff observed that video showed grout backing up and spilling out of the register openings in certain locations and then overtopping the duct and pouring in through the registers at 'downstream' locations.
- DOE indicated that the backup may have been due to the smaller diameter of the duct in certain locations.
  - DOE reiterated confidence that all areas of the duct had been filled with grout and referred to the video showing grout flowing both inside and outside the duct.
- NRC staff and DOE reviewed portions of the annulus video during Lift 5, where the Slickwillie enters through the duct vent registers.
- NRC staff inquired about the potential impact on the quality of the grout that filled the top portion of the interior of the duct.
- DOE indicated the strategy was to fill the smaller diameter portion of the ventilation duct, so that Slickwillie would be pushed back toward the larger diameter portion of the duct, and then the Slickwillie would eventually be pushed out by grout filling the larger diameter portion of the ventilation that took longer to fill.

Regarding FTF and HTF tank leak site information:

- Prior to the onsite observation visit, DOE provided information on tank leak sites (*SRS High Level Waste Tank Crack and Leak Information*, C-ESR-G-00003, Rev. 10).
- DOE indicated that Tank 4 had a total of four leak sites, which are located near the top of the tank.
- DOE clarified that the logic used to determine that tanks were initially failed in the HTF Performance Assessment was not used for the FTF Performance Assessment.

Regarding status of lysimeter testing:

- Prior to the onsite observation visit, DOE provided information on lysimeter testing (*Determination of Constituent Concentration in Field Lysimeter Effluents, FY13 Final Report, Task 2: Lysimeter Leachate Chemistry, SRR-CWDA-2013-00121, Rev. 0*).
- DOE indicated that the lysimeter testing report will be updated annually.
- NRC staff inquired about characterization of the lysimeters following the experiments to complement the information obtained from analysis of the lysimeter effluent.
- DOE indicated planned staggered dissections of some of the lysimeters at 2-, 5-, and 10- years after start of the experiments.
- NRC staff indicated that predictive modeling of the lysimeters could provide important insights into the release and modeling of contaminants from the cementitious materials and soils.

NRC staff discussed with DOE other related items, including the following:

- A previous follow-up action item was: *DOE to provide NRC with Idaho grout drop report, "Grout/CLSM Testing and Selection for the INTEC Tank Farm Closure, EDF-6715."*
- DOE provided that Idaho drop report to NRC and it is in ADAMS as ML060810244.
- A previous follow-up action item was: *DOE to provide NRC with basis for the 10-foot grout drop height used in FTF Tanks 18/19 grouting.*
- DOE indicated that the 10-foot drop height was based on an industry standard, not the American Concrete Institute standard.
  - During grouting of Tanks 18/19, DOE performed visual observation to ensure that the 10-foot drop height did not lead to segregation.
  - DOE indicated that the Savannah River National Laboratory (SRNL) grout expert (i.e., C. Langton) recommended visual observation of drop heights greater than 5-foot to evaluate the potential for segregation, given the higher slump grout used for grouting of Tanks 5/6.
  - DOE stated that, "Tanks 5/6 grouting was all performed at <5-foot drop and so the 10-foot drop height was not utilized."
  - DOE indicated future plans for testing higher drop heights, up to 40 feet high, because higher drop heights would lead to a reduction in both worker radiation exposure and worker risk associated with cutting and replacing tremmies.
- NRC staff followed up on questions and findings in the NRC Technical Review of Tanks 18/19 Grouting (ML13269A365), including DOE documentation of: (1) trial batching, (2) adiabatic temperature rise calculations, (3) moisture retention measurements over the range of 15 to 45 bars (see recommendation in SRNL-STI-2011-00551), and (4) grout density (see differences in values in Table 3-4 and Table 3-5 in SRNL-STI-2011-00551).

- DOE indicated that the Fiscal Year 2014 Performance Assessment Maintenance Plan (*Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program – FY2014 Implementation Plan*, SRR-CWDA-2013-00133) was recently transmitted to NRC with the reference DVD provided with the submittal of the *Crosswalk of Select Documents Related to the Monitoring Programs for the Saltstone Disposal Facility*, SRR-CWDA-2014-00002.
- NRC staff reiterated that the primary concerns with grouting are the potential for shrinkage and development of preferential pathways through the tank grout.
- NRC confirmed that DOE added shrinkage and shrinkage compensating formulation testing to the most recent Performance Assessment Maintenance Plan.

### 2.1.3 Conclusions and Follow-up Actions:

NRC will continue to monitor DOE FTF activities. The following follow-up actions resulted from that technical discussion:

- DOE to provide NRC with *Tanks 5/6 Final Configuration Report*.
- DOE to provide NRC with documentation relative to nonconformance reports for Tanks 5/6 grouting (i.e., excess water and grout curing conditions).
- DOE to provide NRC with available information regarding adiabatic temperature rise in tank fill grout.
- DOE to provide NRC with documentation relative to completion of full-scale batching (i.e., qualification testing), as recommended on page 24 in SRNL-STI-2011-00551.
- DOE to provide NRC with information relative to differences in grout density values listed in Tables 3-4 and 3-5 of SRNL-STI-2011-00551.
- DOE to provide NRC with information regarding DOE decision to not utilize shrinkage compensating admixtures in tank grout formulation.
- DOE to provide NRC with documentation of Work Order modification, which added the steps for potentially removing excess liquid during riser fill activities.
- DOE to provide NRC with the total volume of tremmie lubricant (i.e., Slickwillie) added to Tanks 5/6 during grouting activities.
- DOE to provide NRC with the water-to-cement ratios for all batch tickets from grouting activities on September 19 and 23, 2013.
- DOE to provide NRC with documentation on Tanks 5/6 grouting lessons-learned.

## 2.2 Technical Discussion – Implementation of Radiation Protection Program:

### 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 61.43 performance objective for tank closure activities through Monitoring Area 7 (Protection of Individuals During Operations) under Monitoring Factor 7.1 (Protection of Workers During Operations), Monitoring Factor 7.2 (Air Monitoring), and Monitoring Factor 7.3 (As Low As Is Reasonably Achievable).

### 2.2.2 Observation Results:

NRC discussed with DOE about implementation of the radiation protection program and other related items. Highlights of that Technical Discussion are the following:

- NRC staff requested the post-ALARA job report for Tanks 5/6 grouting.
- NRC staff requested the criteria for DOE to determine whether a post-ALARA review is needed.
- NRC staff requested the location of alpha and beta/gamma surveys reported on post-ALARA job reports.
- NRC staff requested to walk-down the FTF radiation detection and sampling instrumentation with DOE during a future onsite observation visit.
- DOE indicated that instrument locations do not change significantly over time and that activity could be performed during a future onsite observation visit.
- NRC staff indicated that a comprehensive review of the DOE radiation protection program is planned for a future onsite observation visit.
  - After that comprehensive review, NRC would use a graded approach in subsequent reviews (e.g., review a limited number of documents related to higher radiologically-risk activities).

### 2.2.3 Conclusions and Follow-up Actions:

NRC staff will continue to monitor DOE FTF activities. The following follow-up actions resulted from that technical discussion:

- DOE to provide NRC with *Tanks 5/6 Grouting Post Job ALARA Reviews*.
- DOE to provide NRC with an example survey log sheet (e.g., survey log associated with Tank 5 crawler sampling reported in Post-Job ALARA Review [11-FTF-147]).
- DOE to provide NRC the SRS site procedure governing Post-Job ALARA Reviews.

- DOE to provide NRC with *2013 Facility Annual Review of Monitoring Systems (FARMS) F-Tank Farm Facility*, SRR-FSH-2013-00024.

## 2.3 Technical Discussion – Status of Tank Residual Solids Sample Leaching Experiments:

### 2.3.1 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 2 (Waste Release) under Monitoring Factor 2.1 (Solubility Limiting Phases/Limits and Validation) and Monitoring Factor 2.2 (Chemical Transition Times and Validation).

### 2.3.2 Observation Results:

DOE provided an overview presentation of the status of tank residual solids sample leaching experiments (“Radionuclide Release from Tank Waste Residual Solids,” SRNL-STI-2014-00117, Rev. 0). NRC and DOE discussed the information in the presentation and the NRC November 18, 2013, comments on the DOE experimental plan (“Task Technical and Quality Assurance Plan for Determining the Radionuclide Releases from Tank Waste Residual Solids,” SRNL-RP-2013-00203, Rev. 0). Highlights of that Technical Discussion are the following:

- DOE identified two possible testing methodologies: (1) controlled atmosphere vessel and (2) zero head space.
  - Zero-head space method was used with sealed glass vials.
  - Although there was no vapor space, the liquid was equilibrated prior to sealing the vials with an atmosphere consistent with the specific conditions that were being investigated.
- DOE indicated that Tank 18 surrogate samples included the following radionuclides: Uranium (U), Neptunium (Np), Plutonium (Pu), and Technetium (Tc).
  - Solids were prepared mimicking chemical conditions of the PUREX processing and precipitated from an acidified solution.
  - Tc in the samples did not co-precipitate.
  - DOE did not characterize the Pu in the samples for co-precipitation because of its low concentration.
  - Minimum ratio of iron to constituent is needed to co-precipitate Tc and Pu.
- DOE indicated that the following  $E_h$ -pH pore-water conditions were targeted:

Condition	$E_h$ (mV)	pH
Reduced Region II (RR2)	-470	11.1
Oxidized Region II (OR2)	+560	11.1
Oxidized Region III (OR3)	+680	9.2

- NRC staff discussed that the targeted  $E_h$ -pH pore-water conditions are a good starting point to provide more bounding  $E_h$ -pH conditions.

- If the solubility is relatively high under the bounding conditions, then the conditions could be constrained to find the critical  $E_h$ -pH envelope.
- DOE indicated that the pore-water  $E_h$  values were not as reducing or as oxidizing as the targeted reducing and oxidizing conditions.
  - Tank 18 surrogate solids may have contributed to the lower-than-targeted  $E_h$  for the oxidizing conditions, potentially due to the presence of a reduced manganese phase.
  - Closed experimental system may have depleted the oxygen to concentrations lower than expected for field conditions.
- DOE indicated that the addition of Tank 18 surrogate solids generally resulted in an increase in the pH, due to the basicity of the surrogate solids.
- DOE indicated that samples did not appear to have reached equilibrium with the cement/fly ash/blast furnace slag (CFS).
  - Experiments were carried out both with and without the CFS solids present after the initial equilibration period.
  - Samples that included the CFS solids after equilibration were generally more conditioned as the experiments progressed (i.e., lower  $E_h$  and higher pH).
- DOE indicated that leach tests provided the following information on Pu and U release from the surrogate solids:
  - Pu concentrations were at or slightly above the lower limit of detection;
  - Pu and U release were similar for RR2 and OR2;
    - RR2 and OR2 in those experiments had similar  $E_h$  and pH values
  - Pu and U release increased under OR3, which had both a higher  $E_h$  and a lower pH; and
  - presence of CFS solids generally reduced Pu and U release.
- DOE indicated that testing activities planned for Fiscal Year 2014 include:
  - reducing lower limit of detection for Pu in leachates;
  - extending equilibration period to reach equilibrium or steady-state conditions with the CFS solids;
  - studying effect of filter pore size on Pu and U release to evaluate potential presence of colloids; and
  - producing pore water conditions that are closer to the targeted values for RR2, OR2, and OR3, which may require additional reagents such as ferrous iron and peroxide.
    - includes performing OR2 and OR3 leaching tests in open containers to maintain dissolved oxygen concentrations for the duration of the test.



### 2.3.3 Conclusions and Follow-up Actions:

NRC will continue to monitor DOE FTF activities. The following follow-up actions resulted from that technical discussion:

- NRC to arrange a follow-on telecon with DOE regarding on-going residual waste testing.
- DOE to provide NRC with *Task Technical and Quality Assurance Plan for Determining the Radionuclide Release from Tank Waste Residual Solids* (SRNL-RP-2013-00203, Rev. 1).

### 2.4 Technical Discussion – Tanks 5/6 Special Analysis Technical Review Report, Features, Events, and Processes Analysis Technical Review Report, and Review of Environmental Monitoring Data:

#### 2.4.1 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 Assessments), Monitoring Area 4 (Natural System Performance) under Monitoring Factor 4.2 (Calcareous Zone Characterization) and Monitoring Factor 4.3 (Environmental Monitoring), and Monitoring Area 6 (Performance Assessment Maintenance) under Monitoring Factor 6.1 (Scenario Analysis).

#### 2.4.2 Observation Results:

NRC discussed with DOE about the NRC Tanks 5/6 Special Analysis Technical Review Report (TRR). Highlights of that Technical Discussion are the following:

- DOE Tanks 5/6 Special Analysis was well documented, which enabled NRC staff to understand the influence of successive parameter changes on the results of the Analysis.
- Given the importance of the Niobium (Nb)-93 distribution coefficient (Kd) to the results of the DOE Tanks 5/6 Special Analysis, Nb site-specific Kds are needed for NRC staff to have reasonable assurance that 10 CFR Part 61 Performance Objectives could be met.
- Technical concerns identified in NRC Tanks 18/19 Special Analysis TRR (ML13100A230) are also applicable to NRC Tanks 5/6 Special Analysis TRR, so are not repeated.
  - As detailed in NRC Tanks 18/19 Special Analysis TRR, the NRC FTF Monitoring Plan (ML12212A192) provides a path forward for DOE to address all of the technical concerns discussed in that TRR.
- Prior to the onsite observation visit, DOE provided the report “Impact of Cementitious Leachate on Se, Nb, and Ra Partitioning” (SREL Document No. R-13-0005), which was performed primarily for the saltstone disposal facility (SDF).

- NRC staff provided general and more specific preliminary comments about the Report.
  - Additional data from the experiments (e.g., results from the control samples) would be helpful to verify that precipitation did not occur in the experiments.
  - Additional information to verify that the use of 2% H<sub>2</sub> (g) did not contribute to reduction of redox-sensitive radionuclides reducing conditions would be helpful.
  - Limited information is available in the literature on Nb solubility, but what is there shows the solubility of Nb may be slightly higher than the experiments.
  - Nonetheless, given the potential risk-significance of Nb, DOE should provide additional information to demonstrate that Nb was not saturated in the experiments, which would potentially invalidate the site specific K<sub>d</sub>s.
  - Soils used in the experiments may not be representative of subsurface soils at the FTF (i.e., SDF soils used may have had a higher clay content than the clay content of the FTF sandy soils that comprise the Upper Three Runs Aquifer).

NRC discussed with DOE about the NRC Features, Events, and Processes (FEPs) Analysis Technical Review Report, which will soon be issued. Highlights of that Technical Discussion are the following:

- DOE identification of FEPs was generally adequate.
- FEPs Screening Team Membership was heavily weighted towards the performance assessment area and did not contain subject matter experts in other key areas.
- Due to issues with transparency and documentation traceability, NRC staff does not have confidence that all relevant FEPs were adequately considered in the FTF Performance Assessment.
- NRC staff expects that the DOE FEPs Analysis issues will be addressed under the DOE performance assessment maintenance program, as a longer-term activity.

NRC discussed with DOE about implementation of the environmental monitoring program and other related items. Highlights of that Technical Discussion are the following:

- NRC requested various environmental monitoring documents on a yearly basis.
- NRC staff indicated that a review of the DOE environmental monitoring program is planned for a future onsite observation visit.

#### 2.4.3 Conclusions and Follow-up Actions:

NRC staff will continue to monitor DOE FTF activities. The following follow-up actions resulted from that technical discussion:

- DOE to provide NRC with *2013 Annual Groundwater Monitoring Report for the F- and H-Area Radioactive Liquid Waste Tank Farms*.
- DOE to provide NRC with the 2013 groundwater reports for GSA Eastern and Western Operable Units.

## 2.5 Technical Discussion – Earthquakes and Other Impacts on Site Stability:

### 2.5.1 Observation Scope:

Using the NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b), NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.44 performance objective for tank closure activities through Monitoring Area 8 (Site Stability) under Monitoring Factor 8.1 (Settlement).

### 2.5.2 Observation Results:

NRC discussed with DOE about earthquakes and other impacts on site stability. Highlights of that Technical Discussion are the following:

- NRC staff inquired about the recent 4.1 magnitude earthquake that occurred on February 14, 2014, in South Carolina.
- DOE indicated that a walkdown of SRS had been conducted after the earthquake.
  - No observed effects at SRS due to the earthquake.
  - Magnitude of the earthquake at SRS was less than the design basis event.
- NRC staff discussed on-going NRC contractor waste tank structural analysis calculations to evaluate the static and dynamic site stability aspects related to FTF tanks (e.g., Type IV tank basemats).

### 2.5.3 Conclusions and Follow-up Actions:

NRC staff will continue to monitor DOE FTF activities. The following follow-up actions resulted from that technical discussion:

- DOE to provide NRC with documentation available regarding DOE response to recent 4.1 magnitude earthquake that occurred on February 14, 2014, in South Carolina.
- NRC to arrange a follow-on telecon with DOE regarding on-going NRC waste tank structural analysis calculations.
- DOE to provide NRC with any additional documentation available regarding tank farm structural analysis.

## 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 2014-01 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 Factors in FTF Monitoring Plan, Rev. 0:

FTF Observation 2014-01 is the fourth onsite observation visit under the FTF Monitoring Plan (NRC, 2013b). NRC staff did not close any monitoring factors during FTF Observation 2014-01. 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.

### 3.3 Status of Open Issues for FTF Monitoring:

Previously, there were no FTF Open Issues. The NRC staff did not open any new Open Issues during FTF Observation 2014-01. Therefore, there are currently no FTF Open Issues.

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

There were four 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.**
- Report for FTF Observation 2013-02 (August 27-28, 2013) (NRC, 2013o) with Guidance issued on July 29, 2013, (NRC, 2013l): **All Action Items completed.**

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

Between FTF Observation 2013-02 and FTF Observation 2014-01, NRC did not hold any clarification teleconference calls with DOE. The status of one open follow-up action item from a previous publicly available teleconference call summary 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.*

### 3.6 Issuance of NRC Technical Review Reports:

Between FTF Observation 2013-02 and FTF Observation 2014-01, NRC issued two FTF Technical Review Reports via memorandum:

- “Technical Review of Tanks 5 And 6 Special Analysis at F-Tank Farm Facility, Savannah River Site,” October 4, 2013, ML13273A299. (NRC, 2013m)
- “Technical Review: U.S. Department of Energy Documentation Related to Tanks 18F and 19F Final Configurations with an Emphasis on Grouting from Recommendations and Testing to Final Specifications and Procedures,” October 30, 2013, ML13269A365. (NRC, 2013n)

**4.0 PARTICIPANTS:**

<u>U. S. NRC</u>	<u>SCDHEC</u>	<u>U.S. EPA Region 4</u>	<u>U.S. DOE</u>	<u>SRR</u>	<u>SRNL</u>
George Alexander	Byron Amick	Martha Berry	Dan Ferguson	Greg Arthur	David Hobbs
Cynthia Barr	Leigh Beatty		Sherri Ross	Joel Cantrell	
Harry Felsher	Barry Mullinax			Mark Layton	
Leah Parks	Scott Simons			Mark Mahoney	
Greg Suber				Bruce Martin	
				John Occhipinti	
				Larry Romanowski	
				Kent Rosenberger	
				James Rush	
				Steve Thomas	
				Cliff Winkler	

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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)

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