

July 2, 2013

Ms. Jean Ridley, Director  
Waste Disposition Programs Division  
U.S. Department of Energy  
Savannah River Operations Office  
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SUBJECT: THE U.S. NUCLEAR REGULATORY COMMISSION MARCH 27-28, 2013, ONSITE  
OBSERVATION VISIT REPORT FOR THE SAVANNAH RIVER SITE F-AREA  
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 27-28, 2013, at the Savannah River Site (SRS) F-Area 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 activities conducted during the March 2013 onsite observation visit were consistent with those described in the NRC observation guidance memorandum for the SRS FTF (dated February 25, 2013) [available via the NRC's Agencywide Documents Access and Management System (ADAMS) at Accession No. ML13046A374], which was developed using both the NRC monitoring plan for the SRS FTF (dated January 2013) [ADAMS Accession No. ML12212A192] and the NRC staff guidance for activities related to waste determinations (NUREG-1854, dated August 2007) [ADAMS Accession No. ML072360184].

On every onsite observation visit to SRS, NRC is focused on assessing compliance with four performance objectives in 10 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).

On September 30, 2010, DOE submitted to NRC the SRS FTF draft waste determination (DOE/SRS-WD-2010-001, Rev. 0), whose purpose was to demonstrate compliance with the criteria in Section 3116(a) of the NDAA, including compliance with the performance objectives in 10 CFR Part 61, Subpart C. In its consultation role, NRC staff reviewed the document and highlighted a number of technical concerns during a series of public meetings. In October 2011, NRC staff documented the results of its review in a Technical Evaluation Report (TER) [ADAMS Accession No. ML112371715]. In the TER, NRC staff made a number of recommendations that NRC believes that, if implemented by DOE, will enhance DOE's demonstration of meeting the performance objectives of 10 CFR Part 61, Subpart C during the FTF closure process. Using the information in the NRC TER, DOE issued the SRS FTF final waste determination

J. Ridley

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(DOE/SRS-WD-2012-001, Rev.0) in March 2012 [ADAMS Accession No. ML121140051]. NRC used the information in the TER and final waste determination in developing the SRS FTF Monitoring Plan, Rev. 0.

The March 2013 onsite observation visit focused on the technical concerns in the TER, as monitored by NRC using the SRS FTF Monitoring Plan, Rev. 0. There were no Open Issues previously and there are no new Open Issues resulting from that onsite observation visit.

During the March 2013 onsite observation visit, NRC technical staff and DOE technical staff, including contractors, discussed many of the technical concerns that NRC raised in the TER and DOE provided information to NRC. 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](mailto:Harry.Felsher@nrc.gov), or at (301) 415-6559.

Sincerely,

*/RA/*

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Division of Waste Management  
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Office of Federal and State Materials  
and Environmental Management Programs

Docket No.: PROJ0734

Enclosure:  
NRC Onsite Observation Visit Report

cc w /enclosure:  
WIR Service List and  
SRS E-mail Contact 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.

Sincerely,

Aby Mohseni, Deputy Director  
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Office of Federal and State Materials  
and Environmental Management Programs

Docket No.: PROJ0734

Enclosure:  
NRC Onsite Observation Visit Report

cc w /enclosure:  
WIR Service List and  
SRS E-mail Contact List

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## **U.S. NUCLEAR REGULATORY COMMISSION March 27-28, 2013, ONSITE OBSERVATION VISIT REPORT FOR THE SAVANNAH RIVER SITE F-AREA TANK FARM FACILITY**

### **EXECUTIVE SUMMARY:**

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its third onsite observation visit, Observation 2013-01, to the F-Area Tank Farm (FTF) Facility at the Savannah River Site (SRS) on March 27-28, 2013. This is the first one 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 Observation 2013-01, NRC focused on information regarding the technical concerns in the October 11, 2011, NRC Technical Evaluation Report (TER) (NRC, 2011), as monitored by NRC using the SRS FTF Monitoring Plan, Rev. 0. NRC performs monitoring activities in coordination with the State, so staff from the South Carolina Department of Health and Environmental Control (SCDHEC) also participated in that onsite observation visit. Starting with this onsite observation visit, NRC will involve U.S. Environmental Protection Agency (EPA) Region 4 in the monitoring activities at FTF because, for closed FTF tanks, 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). EPA Region 4 staff was invited to participate in that onsite observation visit.

To accomplish those goals during Observation 2013-01, NRC staff and DOE (i.e., includes DOE contractors throughout this report) discussed the following topics: Environmental Monitoring Program, Radiation Protection Program, FTF Tanks 18/19 Final Closure Documentation, DOE Order 435.1 Performance Assessment Maintenance Plan, and FTF Tanks 5/6 Final Inventory Reports. In addition, NRC staff and DOE toured the FTF. This report provides a description of the NRC activities during that onsite observation visit, including observations made by NRC.

Previously, there were no Open Issues for FTF monitoring. There are no new Open Issues resulting from Observation 2013-01. NRC staff received documentation and a DOE presentation (SRR-CWDA-2013-00051, Rev. 1) that pertained to the activities observed during that onsite observation visit. 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. ML13093A159.

There were no NRC staff conclusions resulting from Observation 2013-01 and a summary of NRC staff observations from that onsite observation visit is provided below:

### **Tour of the FTF:**

NRC staff and DOE toured the FTF, specifically, Tanks 18, 19, 5, and 6: NRC asked DOE questions, including about the following topics: grouting formulation, waste removal, and well sampling.

Technical Discussion – Environmental Monitoring Program:

NRC was interested in the historical releases from FTF Tank 8 and H-Area Tank Farm (HTF) Tank 16 that might provide insights on potential vulnerabilities in the tank systems and information about contaminant flow and transport at FTF that might help validate DOE models. NRC asked DOE questions, including about the following topics: choosing locations of wells, frequency of sampling wells, purpose of monitoring wells, and preferential pathways.

Technical Discussion – Radiation Protection Program:

NRC asked DOE questions, including about the following topics: DOE radiation protection challenges and overall doses, air exposure, and ventilation monitoring during grouting.

Technical Discussion – FTF Tanks 18/19 Final Closure Documentation:

NRC asked DOE questions, including about the following topics: grouting video and final configuration report. DOE indicated that it has no intent to grout the transfer line piping, including the transfer piping within the tank system.

Technical Discussion – DOE Order 435.1 Performance Assessment Maintenance Plan:

NRC asked DOE questions, including about the following topics: Annual Update to the Performance Assessment Maintenance Plan and the DOE  $K_d$  averaging approach used to model Plutonium.

Technical Discussion – FTF Tanks 5/6 Final Inventory Reports:

NRC asked DOE questions that had previously been provided to DOE following NRC review of previously provided DOE documents.

**1.0 BACKGROUND:**

Section 3116 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 also requires NRC to monitor DOE disposal actions related to those determinations to assess compliance with the performance objectives in 10 CFR Part 61, Subpart C.

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 key assumptions identified in the NRC monitoring plan. Technical reviews generally focus on reviewing additional model support for assumptions that DOE made in its performance assessment, which are considered important to the DOE compliance demonstration. Onsite observation visits generally are performed to: (1) observe the collection of data (e.g., observation of waste sampling used to generate radionuclide inventory data) and review the data to assess consistency with assumptions made in the waste determination; and (2) observe key disposal or closure activities related to technical review areas (e.g., slag/other

material storage, grout formulation, preparation, or placements). Data reviews supplement technical reviews by focusing on monitoring data that may indicate future system performance or by reviewing records or reports that can be used to directly assess compliance with the performance objectives.

On September 30, 2010, DOE issued a draft waste determination (DOE/SRS-WD-2010-001, Rev. 0), which was provided to NRC for consultation under NDAA Section 3116(a). The purpose of that draft waste determination was to demonstrate 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 staff 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 staff documented the results of its review in a TER (NRC, 2011) [ADAMS Accession No. ML112371715]. In the TER, NRC staff made a number of recommendations that NRC believes that, if implemented by DOE, will enhance DOE's demonstration of meeting the performance objectives of 10 CFR Part 61, Subpart C during the FTF closure process. Taking into consideration the information and recommendations in the NRC TER, DOE issued the final waste determination in March 2012 (DOE/SRS-WD-2012-001, Rev.0). In the final waste determination, DOE indicated that it predicated the final waste determination on extensive analyses and scientific rationale, including the FTF performance assessment (PA) (SRS-REG-2007-00002, Rev. 0), as supplemented by the special analysis for FTF Tanks 18/19 (SRR-CWDA-2010-00124, Rev. 0). By letter dated January 23, 2013, (NRC, 2013a), NRC transmitted the FTF Monitoring Plan, Rev. 0 (NRC, 2013b) to DOE and it was issued in a Federal Register Notice on February 21, 2013 (NRC, 2013c).

## **2.0 NRC ONSITE OBSERVATION VISIT ACTIVITIES:**

On February 25, 2013, NRC issued the Observation Guidance for this onsite observation visit, Observation 2013-01 (NRC, 2013d). That onsite observation visit 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.

After welcoming remarks and introductions, NRC inquired about the recent question raised at Waste Management 13 Symposium regarding SCDHEC and EPA Region 4 shared responsibilities during and after tank closure. DOE provided an overview of how EPA Region 4 and SCDHEC have certain joint regulatory responsibilities during the time of NRC's monitoring role under NDAA Section 3116(b) for the SRS tank farms (i.e., FTF and HTF). There was general discussion about upcoming plans, where DOE indicated that grouting Tanks 5/6 was expected to occur sometime in 2013. Thus, DOE's expected schedule is to update the Citizen's Advisory Board (CAB) at the June 25, 2013, CAB Meeting, with NRC potentially participating. DOE also mentioned that, in the future, DOE might want NRC to perform joint FTF and HTF monitoring activities. DOE suggested that that could mean replacing the individual FTF and HTF waste determinations with a joint FTF/HTF waste determination or adding HTF information to the FTF monitoring plan and then issuing it as the FTF/HTF monitoring plan. Regarding the monitoring plan, that was the intent of NRC, as stated many times, as recently as at the Waste Management 2013 Symposium.

The following topics were technical discussions between NRC and DOE during Observation 2013-01: Environmental Monitoring Program, Radiation Protection Program, FTF Tanks 18/19 Final Closure Documentation, DOE Order 435.1 Performance Assessment Maintenance Plan, and FTF Tanks 5/6 Final Inventory Reports. In addition, during that onsite observation visit, NRC staff and DOE toured the FTF, specifically around Tanks 18, 19, 5, and 6. The sections below contain more detailed accounts of those technical discussions and tour.

## 2.1 Tour of the FTF:

### 2.1.1 Observation Scope:

In the NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b), there are 26 Monitoring Factors that provide details of the basis for NRC staff review areas for monitoring, including the overall FTF.

### 2.1.2 Observation Results:

During the tour, DOE provided an overview of the activities that took place at FTF, especially at Tanks 18, 19, 5, and 6.

NRC inquired about grout formulation changes and testing since grouting of Tanks 18/19. DOE clarified that a more flowable grout would be used in Tanks 5/6, as compared to Tanks 18/19, due to the presence of cooling coils that were not present in Tanks 18/19. NRC inquired if the grout formulation would use a higher water to cement ratio or make use of either viscosity modifying admixtures or high range water reducers to achieve the desired slump. DOE indicated that the water to cement ratios would be the same and that admixtures would be used to increase slump. NRC inquired if testing for shrinkage had been conducted for the intended grout formulation. DOE indicated that Tanks 18/19 grout cylinders had been tested and met all DOE requirements.

NRC inquired about the effectiveness and efficiency of submersible mixer pumps for all stages of waste retrieval, including heel removal. DOE indicated that, in an ideal world it would be beneficial to use different pumps for different stages of waste removal; but, that it was not practical to do so.

NRC inquired whether any of the wells in the vicinity of Tank 8, which were sampled following the release of high-level waste from Tank 8 due to a historical overfull event, were still operable. DOE indicated that they would provide a map of the wells that were in use at FTF.

### 2.1.3 Conclusions and Follow-up Actions:

NRC staff will continue to monitor FTF activities and tour FTF when needed. There are no follow-up actions that resulted from that tour.

## 2.2 Technical Discussion – Environmental Monitoring Program:

### 2.2.1 Observation Scope:

In the NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b), NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41 for DOE's environmental monitoring program through

Monitoring Area 4 (Natural System Performance) under Monitoring Factor 4.3 (Environmental Monitoring). Section 3.4.3 of that monitoring plan provides details of the basis for NRC staff reviews for monitoring the DOE environmental monitoring program.

### 2.2.2 Observation Results:

Through discussion, NRC asked a wide-range of general and specific questions and DOE provided both overall and specific answers to those questions. NRC plans to issue a Technical Review Report via a memorandum on this topic at a later date, which will be publicly available.

NRC was interested in the historical releases from Tanks 8/16 that might provide insights on potential vulnerabilities in the tank systems and information about contaminant flow and transport at FTF that might help validate DOE models.

- NRC was interested in the elevated concentrations of Technetium (Tc)-99 observed at FTF Well 28 screened in the lower zone of the Upper Three Runs Aquifer (UTRA). Contamination observed in that well had been historically linked to a release from Tank 8 after an overflow event in the early 1960's. More recently, DOE linked the contamination in that well to the F-Area Inactive Process Sewer Line, which transferred waste between the separations area and seepage basins. NRC inquired about the presence of Tc-99 several decades after the release and vertical extent of the plume that lies directly underneath the process sewer lines. This is important because it was not clear to NRC staff that Tc-99 could be present in the lower zone of the UTRA from a source located directly above it. DOE explained that a large source of waste water could possibly explain the vertical extent. DOE provided corroborating evidence of a residual hydrogen ion footprint located along the sewer lines that is similarly, vertically extensive in the UTRA. NRC asked for clarification regarding the continued presence of Tc-99 in that well several decades after the event. NRC provided DOE with three possible hypotheses for that: (1) continuing source of Tc-99; (2) previously released Tc-99 was generally hydraulically inactive and has been periodically released; or (3) Tc-99 was relatively immobile in the acid plume associated with the release, compared to its typical mobility in unimpacted SRS groundwater and Tc-99 continues to be released from impacted soils, as groundwater continues to flush soils of acid and contaminants.
- NRC was interested in the large range of potential Cesium (Cs)-137 to Strontium (Sr)-90 ratios reported in a Tank 8 release report. NRC was interested in Sr-90 activity due to the relatively higher mobility of Sr-90 in the subsurface compared to Cs-137. If present in a risk-significant quantity in the waste released from Tank 8, then a Sr-90 plume might provide insights on flow directions and contaminant mobility at FTF. DOE indicated that Sr-90 settled as sludge in the tank after a certain period of time and that waste was introduced at the bottom of the tank.

NRC inquired about sampling. DOE indicated that sampling is done once/year for the Eastern Groundwater Operable Unit area and twice/year for the Western Groundwater Operable Unit area.

NRC inquired about the criteria for placing a well and the purpose of monitoring it. DOE described the characterization process for choosing wells and indicated that the purpose of monitoring the wells is to meet EPA regulations for groundwater monitoring. Also, the purpose

of monitoring at FTF is to detect any releases from the tanks. In addition, wells are screened in locations generally consistent with the PORLFOW modeling, such that modeled releases from the tanks would generally intersect well screens.

NRC inquired about a reference to dissolution zones discussed in a comment/response to a Georgia Department of Natural Resource comment on the environmental impact statement (EIS) for high-level waste tank closure. The commenter was concerned about preferential pathways from tank farms to Four Mile Creek. In the EIS response, DOE indicated that in the vicinity of F- and H- Area seepage basins, very acidic water released to the sediments dissolved some of the soil constituent; but, that such dissolution channels do not occur in the area around the FTF and HTF. During the onsite observation visit, DOE indicated that it knows that preferential pathways occur naturally due to deposition characteristics; but, it does not think that dissolution of calcareous zone materials currently leads to facilitated transport in the subsurface.

### 2.2.3 Conclusions and Follow-up Actions:

The NRC staff will continue to monitor FTF activities related to the DOE environmental monitoring program. The following three follow-up actions resulted from that technical discussion:

- DOE to provide NRC the *2012 Annual Groundwater Monitoring Report for the F- and H- Area Radioactive Liquid Waste Tank Farms (SRNS-RP-2013-00118)*, when available, which is expected to be sent in April 2013.
- DOE to provide NRC the GSA Eastern and Western groundwater reports, which are expected to be sent in April 2013.
- NRC to arrange a clarification phone call on the Tank 8 release, including the following topics: expected Cesium-137/Strontium-90 ratios in release, ability to detect Strontium-90 in the subsurface (e.g., analytical techniques and calibration), Strontium-90 mobility and any inferences that could be made from event and plume data related to the hydrogeological system at FTF (e.g., flow directions inferred from data and particle tracking from various sources to wells).

## 2.3 Technical Discussion – Radiation Protection Program:

### 2.3.1 Observation Scope:

In the NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b), NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.43 for the DOE radiation protection program through Monitoring Area 7 (Protection of Individuals During Operations) under Monitoring Factors 7.1 (Protection of Workers During Operations), 7.2 (Air Monitoring), and 7.3 (As Low As is Reasonably Achievable). Sections 5.1 through 5.3 of that monitoring plan provide details of the basis for NRC staff reviews for DOE's radiation protection program, under monitoring. NRC staff monitors both the inventory of tanks in FTF and the DOE methodology to quantify that inventory.

### 2.3.2 Observation Results:

Through discussion, NRC asked a wide-range of general and specific questions and DOE provided both overall and specific answers to those questions. NRC plans to issue a Technical Review Report via a memorandum on this topic at a later date, which will be publicly available.

NRC inquired about the DOE radiation protection challenges and overall doses. DOE responded with: (1) overview of radiation protection program; (2) challenges: grouting with tremmies, contamination, minimizing exposure, interference from risers, location of cameras, and location of lights; and (3) doses were at Radiation Work Permit levels: total Tank 18 dose of 202 millirem (mrem) (with maximum individual dose of 18 mrem) and total Tank 19 dose of 146 mrem (with maximum individual dose of 25 mrem). DOE indicated that the major activities that would incur a dose include: removal of riser port plugs to obtain access to tank, installation of tremmies, cameras, lighting, early stages of grouting (i.e., dose falls off as tank grout reaches a certain level), and waste sampling.

NRC inquired about air exposure. DOE indicated that the information is in databases (i.e., not in reports) and is available as part of the annual environmental report at the boundary of each facility (i.e., FTF, HTF, and Saltstone Disposal Facility (SDF)). Local FTF air data is also available.

NRC inquired about ventilation monitoring during grouting. DOE indicated that there is some information about that in the Industrial Hygiene Plan and the Radiation Action Plan.

### 2.3.3 Conclusions and Follow-up Actions:

The NRC staff will continue to monitor FTF activities related to the DOE radiation protection program. The following four follow-up actions resulted from that technical discussion:

- DOE to provide NRC the radiological dose reports for FTF Tanks 5/6 Final Sampling, and Characterization, which is expected to be sent in April 2013.
- DOE to provide NRC the information on air doses (i.e., radiological) within FTF and the annual environmental monitoring report, which is expected to be sent in April 2013.
- DOE to provide NRC the FTF Tanks 18/19 Pre-Job ALARA Reviews, which is expected to be sent in April 2013.
- DOE to provide NRC the Industrial Hygiene Monitoring Plan for FTF Tanks 18/19, as well as associated results of monitoring, which is expected to be sent in April 2013.

## 2.4 Technical Discussion – FTF Tanks 18/19 Final Closure Documentation:

### 2.4.1 Observation Scope:

In the NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b), NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41 related to FTF Tanks 18/19 Final Closure Documentation through Monitoring Area 3 (Cementitious Material Performance) under Monitoring Factor 3.4

(Grout Performance). Section 3.3.4 of that monitoring plan provides details of the basis for NRC staff reviews for monitoring for the grout performance.

#### 2.4.2 Observation Results:

Through discussion, NRC asked a wide-range of general and specific questions and DOE provided both overall and specific answers to those questions. NRC plans to issue a Technical Review Report via a memorandum on this topic at a later date, which will be publicly available.

NRC and DOE discussed the grouting video and the upcoming DOE Tanks 18/19 Final Configuration Report. NRC's indicated opinion was there was a significant amount of segregation or bleed water that might lead to higher hydraulic conductivity grout at the edge of a tank. Higher water to cement ratios of grout at the tank periphery may also enhance shrinkage and formation of preferential pathways at the tank edge. Regarding the process in the SRS FFA between DOE, EPA, and South Carolina, DOE indicated that a tank specific Final Configuration Report goes along with an Explanation of Significant Difference to EPA and SCDHEC for approval of both of the agencies. DOE also indicated that it has no intent to grout the transfer line piping, including the transfer piping within the tank system.

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

The NRC staff will continue to monitor FTF activities related to FTF Tanks 18/19 Final Closure Documentation. The following two follow-up actions resulted from that technical discussion:

- DOE to provide NRC the *Tanks 18 and 19 Final Configuration Report for F-Tank Farm at the Savannah River Site*, when available. DOE will notify NRC if anticipated issuance date becomes after May 2013.
- NRC/DOE to arrange a clarification phone call on the FTF Tank 18 Grouting Video that DOE provided to NRC as follow-up action to the June 2012 onsite observation visit.

### 2.5 Technical Discussion – DOE Order 435.1 Performance Assessment Maintenance Plan:

#### 2.5.1 Observation Scope:

In the NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b), NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41 related to DOE Order 435.1 performance assessment maintenance plan through Monitoring Area 6 (Performance Assessment Maintenance). Section 3.6 of that monitoring plan provides details of the basis for NRC staff reviews for monitoring for performance assessment maintenance.

#### 2.5.2 Observation Results:

DOE Manual 435.1-1 requires DOE to implement a performance assessment maintenance program to evaluate changes that could affect the performance, design, and operating bases for FTF. DOE Order 435.1 includes that the performance assessment maintenance must include the conduct of research, field studies, and monitoring needed to address uncertainties or gaps in existing data. In addition to fulfilling those internal DOE requirements, DOE uses

performance assessment maintenance activities to address technical topics in the NRC monitoring plan.

Through discussion, NRC asked a wide-range of general and specific questions and DOE provided both overall and specific answers to those questions.

NRC inquired about the Annual Update to the Performance Assessment Maintenance Plan. DOE indicated that the Plan is actually an update covering all three DOE facilities that NRC consults with or monitors under NDAA (i.e., FTF, HTF, SDF). For FTF and HTF, the two important items are: (1) computational methods/method development for impact on higher pH leachates on soils and testing  $K_d$ s; and (2) waste release/solubility assumptions.

NRC indicated a concern about the DOE  $K_d$  averaging approach used to model Plutonium (Pu) at FTF. This is important because higher mobility forms of Pu are thought to exist based on DOE lysimeter experiments. Model fits to data suggest that  $K_d$ s for the more mobile fraction are as low as around 3 litres per kilogram. Therefore, given the relatively rapid potential rates of transport of more mobile forms of Pu, it will be important for DOE to demonstrate that an insignificant fraction of higher mobility Pu exists along flow paths from the FTF/HTF tanks or that Pu is immobilized along the flow path.

### 2.5.3 Conclusions and Follow-up Actions:

The NRC staff will continue to monitor FTF activities related to DOE Order 435.1 Performance Assessment Maintenance Plan. The following follow-up action resulted from that technical discussion:

- DOE to provide NRC the *Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program – FY 2013 Implementation Plan*, when available, which is expected to be sent in May 2013.

## 2.6 Technical Discussion – FTF Tanks 5/6 Final Inventory Reports:

### 2.6.1 Observation Scope:

In the NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b), NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41 related to FTF Tanks 5/6 Final Inventory Reports through Monitoring Area 1 (Inventory) under Monitoring Factors 1.2 (Residual Waste Sampling) and 1.3 (Residual Waste Volume). Sections 3.1.2 and 3.1.3 of that monitoring plan provide details of the basis for NRC staff reviews for monitoring for FTF tanks residual waste sampling and residual waste volume.

### 2.6.2 Observation Results:

Through discussion, NRC asked a wide-range of general and specific questions and DOE provided both overall and specific answers to those questions. NRC plans to issue a Technical Review Report via a memorandum on this topic at a later date, which will be publicly available.

This technical discussion is based on questions in areas of concern that NRC had provided to DOE after NRC reviewed documents previously provided by DOE, including:

- Areas from SRR-CWDA-2011-00050, Rev. 1, “Liquid Waste Tank Residuals Sampling and Analysis”:
  - Differences in sampling and analysis of Tanks 18/19 vs. Tanks 5/6 and differences in sampling and analysis of Tanks 5/6 vs. program plan to be used for tanks other than Tanks 5, 6, 18, and 19:
    - DOE indicated that the only difference was composite sampling.
  - Basis for sufficiency of number of samples in the sampling and analysis program plan and basis for sufficiency of composite samples:
    - DOE indicated that three samples are typically needed to perform statistical analysis and that, due to the expected mixing of the waste, 15 sample locations are sufficient.
  - Use of historical characterization in sampling methodology:
    - DOE indicated that they do not use historical characterization for that.
  - Plans/methodology to sample FTF ancillary equipment:
    - DOE indicated that they will do that and the plan will be developed closer to the time of waste removal activities for each of the structures.
- Areas from SRR-CWDA-2012-00027, Rev. 1, “Tank 5 Inventory Determination”:
  - Timing of volume estimates, density, and solids contents measurements for adjustments in inventory:
    - DOE indicated that volume and sampling estimates are performed concurrently and that large changes in the volume over time are not observed. DOE also indicated that drier samples are easier to take.
  - Density measurement and solids percentage:
    - DOE indicated that it was wet density and solids weight percentage.
  - Differences in density measurements of waste in Tank 5 and Tank 18:
    - DOE indicated that they could not clarify the differences.
  - Basis for samples of cooling coils:
    - DOE indicated that they were able to visually examine the exterior surfaces of the cooling coils for material build-up with significant improvement in photographic and video capabilities. There is also difficulty and high worker dose associated with taking cooling coil samples.

- Thorium-230 change in distribution from Normal to Gamma:
  - DOE indicated that it was done to give more conservative results because the long tails of the normal distribution led to many values near zero.
- Basis for detection limits of radionuclides:
  - DOE indicated that the detection limits were based on assumed inventory in the PA and were provided to ensure that values used in the PA are not zero. NRC questioned that response and inquired whether values less than Maximum Detectable Concentration (MDC) could be risk-significant. DOE clarified that values were selected so that more risk-significant radionuclides had an assumed inventory (i.e., and associated detection limit) of 0.001 curies, while less risk-significant radionuclides had an assumed inventory of 1.0 curie.
- Choice of MDC for a particular radionuclide:
  - DOE indicated the following: (1) for radionuclides that were not detected, the best estimate inventory, lowest detectable limit was used; (2) for bounding inventory, highest detectable limit was used; and (3) for mixed inventory, the details vary from radionuclide to radionuclide and that information is provided in the statistical reports for each tank.
- Areas from U-ESR-F-00048, Rev. 0, "Tank 5 Volume Determination and Uncertainty Estimate Report":
  - Tank Mapping Methodology for Tanks 18/19 volume estimates vs. Tanks 5/6:
    - DOE indicated that same Tank Mapping Methodology was used.
  - Changes to Tank Mapping Methodology since Tanks 18/19:
    - DOE indicated that they have a qualification program and train staff, so that there is consistency in how Tank Mapping Methodology is done in the future:
  - Tank types with greatest challenges in determining volume estimates:
    - DOE indicated that it was Tank IV types because there are no landmarks and limited access points for photographic equipment.
  - Assigned heights of flaked samples:
    - DOE indicated that thickness estimate was based on staff following the process to jointly determine the heights, rather the table in the document that indicates that characteristics of the flakes are used to determine thickness less than 1/8 inch. NRC indicated that the next highest landmark reported was the bottom of the cooling coils at 13/16 inch. DOE

indicated that lifting plates were also used to assign thicknesses, although lifting plates in Type I tanks inventory documentation were not discussed (e.g., lifting plates were used and provided as examples of landmarks for Type IV tanks). DOE will provide video of tank and annulus inspection and the spreadsheets used to document thicknesses of the bottom of the tank on a 1 foot by 1 foot grid. NRC and DOE will conduct a follow-up call to discuss this information after the information is received and reviewed.

- Use of damaged cooling coils for determining heights:
  - DOE indicated that they do not use the distance from the floor to the bottom of damaged coils as a landmark. However, it is possible that the coil diameter, a known dimension, may still be utilized as a reference dimension to support estimation for depths of residuals.
- Low or high bias in inventory or uncertainty range:
  - DOE indicated that the high end volume is biased high (i.e., 40 percent (%) higher vs. 30% lower), not because of the discrete nature in which the thicknesses are assigned; but, because DOE errs on the side of conservatism and defensible by design.
- Hand-drawn maps of heights:
  - DOE agreed to discuss this topic during a follow-up clarification phone call. DOE will provide details on the process of drawing hand contoured maps. DOE will clarify what was meant when it indicated that it had a separate map for areas of similar heights.
- Area from SRNL-LWE-2010-00285, Rev. 1, and SRR-LWE-2010-00340, Rev.0:
  - Impact of water additions:
    - DOE indicated that they provided a contingency in the event that additional washing needed to occur; but, water additions were small quantities with no significant expected impact.
- Area from SRNL-STI-2012-00034, Rev. 1, "Analysis of the Tank 5F Final Characterization Samples – 2011":
  - Possible sample mixup:
    - DOE clarified that more than one sample is typically placed in the same bag. When some of the sample was displaced from the sample container to the bag, DOE justified why re-sampling was not needed.

- Area from SRR-CWDA-2012-00075, Rev. 0, “Tank 6 Inventory Determination”:
  - DOE assumption of volume of annulus waste:
    - Contrary to documentation that suggested minimal visual inspection of the tank annulus due to riser/access limitations, DOE indicated that they inspected 100% of the Tanks 5/6 annulus via a crawler. NRC inquired about use of the crawler on the annulus floor and ability to inspect 100% of the annulus, given the presence of the ventilation duct. DOE agreed to provide NRC (after reviewing for applicability) either the entire or parts of the crawler video. DOE agreed to discuss this topic during a follow-up clarification phone call. Also, DOE indicated that the Mantis in Tank 18 lost traction when the waste became dried. NRC agreed that if 50 gallons was a good estimate, then the risk-significance of 50 gallons of waste could be more easily supported. However, annulus contamination volume is not directly comparable to tank waste volume because the constituents are different and the waste is located outside of containment.
  
- Area from SRR-LWE-2010-00300, Rev. 1, SRR-LWE-2011-00209, and SRR-LWE-2011-00235, Rev. 0”:
  - Map of sample locations:
    - DOE indicated that they used volume proportions methods for the five samples. The map had old samples marked on it and will be revised. The lesson-learned by DOE that the locations of samples should be based on the volume proportions was applied to Tank 6 and will be applied to future tanks.
  
- Areas from SRR-LWE-2011-00245, Rev. 2, “Tank 6 Final Volume Determinations and Uncertainty Estimate”:
  - Reference for photographs used for Tank 6 volume estimates:
    - DOE will provide additional discussion as part of a follow-on clarification telephone call on mapping methodology.
  - Reason for difference in number of hand-drawn maps for Tank 5 vs. Tank 6:
    - DOE will provide additional discussion as part of a follow-on clarification telephone call on mapping methodology.
  
- Areas from SRNL-STI-2012-00365, Rev. 0, “Analysis of the Tank 6F Final Characterization Samples – 2012”:
  - Visual differences in samples from Tank 5 vs. Tank 6:
    - DOE indicated that it had to do with use of supernate during feed/bleed and salt/caustic differences and will be factored into Tank 12 wash.

- Wetter samples:
  - DOE indicated that there was very little difference in density between wetter and dryer samples.
- “Well-mixed” waste:
  - DOE indicated that its characterization that waste was “well mixed” was based on mapped waste distributions constructed during waste retrieval.
- Worker exposure and risk of contamination with various sampling options:
  - DOE will provide NRC with dose reports.

### 2.6.3 Conclusions and Follow-up Actions:

The NRC staff will continue to monitor FTF activities related to FTF Tanks 5/6 Final Inventory Reports. The following four follow-up actions resulted from that technical discussion:

- DOE to provide NRC the electronic copies of additional reference documents requested as part of NRC review of FTF Tanks 5/6 Final Inventory documentation, which is expected to be sent in April 2013:
  - SRNL-STI-2010-00386, Rev. 0, *Characterization of Additional Tank 18F Samples, Savannah River Site*, September 2, 2010
  - SRR-CWDA-2011-00117, Rev. 0, *Liquid Waste Tank Residuals Sampling-Quality Assurance Program Plan*, February 2012
  - SRR-CWDA-2011-00067, Rev. 1, *Tank 5 Composite Sample Volumetric Proportions*, April 2011
  - SRNL-L3100-2011-00066, Rev. 0, *Estimated Thicknesses of Tank 5 Floor Residue Scrape Samples*, April 14, 2011 (*Appendix H is stated to contain still photographs that provide example material heights*)
  - Calculation document, M-CLC-F-01256, which SRR-LWE-2010-00240, Rev. 0, *Tank Mapping Methodology* indicated that the Excel spreadsheet was based on
  - HLE-TTR-2010-004, Rev. 2, *Technical Task Request for FTF Tanks 5/6 Final Sample Analysis*, November 10, 2010
  - SRR-CWDA-2011-00172, Rev. 0, *Tank 6 Composite Samples Volumetric Proportions*, November 10, 2011
  - SRNL-RP-2010-01695, Rev. 1, *Task Technical and Quality Assurance Plan for Analysis of the Tank 5F and Tank 6F Final Characterization Samples – 2011*, November 30, 2011

- NRC to arrange a clarification phone call on mapping methodology, including the following topics: clarification of annulus volume determination (e.g., 100% inspection vs. four riser access), use of landmarks, mapping methodology and uncertainty (e.g., uncertainty in the areas of similar height).
- DOE to consider whether to provide NRC with all or some of the video of the FTF Tanks 5/6 Annulus Inspection (i.e., crawler video), which is expected to be sent in April 2013.
- NRC to arrange a clarification phone call on FTF Tanks 5/6 Special Analysis.

### **3.0 FOLLOW-UP ACTIONS AND OVERALL CONCLUSIONS:**

#### **3.1 Follow-up Actions from Tour of the FTF:**

- None.

#### **3.2 Follow-up Actions from the Technical Discussion – Environmental Monitoring Program:**

- DOE to provide NRC the *2012 Annual Groundwater Monitoring Report for the F- and H-Area Radioactive Liquid Waste Tank Farms (SRNS-RP-2013-00118)*, when available, which is expected to be sent in April 2013.
- DOE to provide NRC the GSA Eastern and Western groundwater reports, which are expected to be sent in April 2013.
- NRC to arrange a clarification phone call on the Tank 8 release, including the following topics: expected Cesium-137/Strontium-90 ratios in release, ability to detect Strontium-90 in the subsurface (e.g., analytical techniques and calibration), Strontium-90 mobility and any inferences that could be made from event and plume data related to the hydrogeological system at FTF (e.g., flow directions inferred from data and particle tracking from various sources to wells).

#### **3.3 Follow-up Actions from the Technical Discussion – Radiation Protection Program:**

- DOE to provide NRC the radiological dose reports for FTF Tanks 5/6 Final Sampling and Characterization, which is expected to be sent in April 2013.
- DOE to provide NRC the information on air doses (i.e., radiological) within FTF and the annual environmental monitoring report, which is expected to be sent in April 2013.
- DOE to provide NRC the FTF Tanks 18/19 Pre-Job ALARA Reviews, which is expected to be sent in April 2013.
- DOE to provide NRC the Industrial Hygiene Monitoring Plan for FTF Tanks 18/19, as well as associated results of monitoring, which is expected to be sent in April 2013.

3.3.1 Follow-up Actions from the Technical Discussion – FTF Tanks 18/19 Final Closure Documentation:

- DOE to provide NRC the *Tanks 18 and 19 Final Configuration Report for F-Tank Farm at the Savannah River Site*, when available. DOE will notify NRC if anticipated issuance date becomes after May 2013.
- NRC to arrange a clarification phone call on the FTF Tank 18 Grouting Video that DOE provided to NRC as follow-up action to the June 2012 onsite observation visit.

3.3.2 Follow-up Actions from the Technical Discussion – DOE Order 435.1 Performance Assessment Maintenance Plan:

- DOE to provide NRC the *Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program – FY 2013 Implementation Plan*, when available, which is expected to be sent in May 2013.

3.3.3 Follow-up Actions from the Technical Discussion – FTF Tanks 5/6 Final Inventory Reports:

- DOE to provide NRC the electronic copies of additional reference documents requested as part of NRC review of FTF Tanks 5/6 Final Inventory Documentation, which is expected to be sent in April 2013:
  - SRNL-STI-2010-00386, Rev. 0, *Characterization of Additional Tank 18F Samples, Savannah River Site*, September 2, 2010
  - SRR-CWDA-2011-00117, Rev. 0, *Liquid Waste Tank Residuals Sampling-Quality Assurance Program Plan*, February 2012
  - SRR-CWDA-2011-00067, Rev. 1, *Tank 5 Composite Sample Volumetric Proportions*, April 2011
  - SRNL-L3100-2011-00066, Rev. 0, *Estimated Thicknesses of Tank 5 Floor Residue Scrape Samples*, April 14, 2011 (*Appendix H is stated to contain still photographs that provide example material heights*)
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  - SRR-CWDA-2011-00172, Rev. 0, *Tank 6 Composite Samples Volumetric Proportions*, November 10, 2011
  - SRNL-RP-2010-01695, Rev. 1, *Task Technical and Quality Assurance Plan for Analysis of the Tank 5F and Tank 6F Final Characterization Samples – 2011*, November 30, 2011

- NRC to arrange a clarification phone call on mapping methodology, including the following topics: clarification of annulus volume determination (e.g., 100% inspection vs. four riser access), use of landmarks, mapping methodology and uncertainty (e.g., uncertainty in the areas of similar height).
- DOE to consider whether to provide NRC with all or some of the video of the FTF Tanks 5/6 Annulus Inspection (i.e., crawler video), which is expected to be sent in April 2013.
- NRC to arrange a clarification phone call on FTF Tanks 5/6 Special Analysis.

### 3.4 Overall Conclusions:

The information gathered during Observation 2013-01 will be used for multiple NRC Technical Review Reports via memoranda, based on the topics discussed. There were no NRC staff conclusions resulting from that onsite observation visit.

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

Previously, there were no Open Issues for FTF Monitoring. There are no new Open Issues for FTF Monitoring resulting from Observation 2013-01. Therefore, there are no current Open Issues for FTF Monitoring.

### 3.6 Status of Monitoring Factors in FTF Monitoring Plan, Revision 0:

Observation 2013-01 is the first onsite observation visit under the NRC FTF Monitoring Plan (NRC, 2013b). There were no Monitoring Factors opened or closed during that onsite observation visit. 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) in the NRC FTF Monitoring Plan remain open.

### 3.7 Status of Open Action Items from Previous FTF Onsite Observation Visit Reports:

There were two previous NRC FTF onsite observation visits:

- Report for Observation 2012-01 (June 12, 2012) (NRC, 2012b) with Guidance issued on June 4, 2012, (NRC, 2012a): **All Action Items completed.**
- Report for Observation 2012-02 (September 26-27, 2012) (NRC, 2012d) with Guidance issued on August 23, 2012, (NRC, 2012c): **One Open Action Item:**
  - NRC plans to review the ALARA and final collective dose calculations for FTF Tanks 18/19 grout operations that are estimated to be completed in January 2013. The results of the review will be documented in a Technical Review Report.

Current Status: DOE provided the Tanks 18/19 grouting operations post-job ALARA reports before Observation 2013-01. DOE will provide the rest of the information to NRC as part of the Open Action Items from Observation 2013-01. **Therefore, All Action Items from Observation 2012-02 are considered by NRC to be completed.**

3.8 Status of NRC Technical Review Reports:

Between the issuance of NRC FTF Monitoring Plan, Rev. 0 (NRC, 2013b) and Observation 2013-01, NRC issued the following FTF Technical Review Report via memorandum, which is publicly available:

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

4.0 PARTICIPANTS:

<u>U. S. NRC</u>	<u>SCDHEC</u>	<u>U.S. DOE</u>	<u>SRR</u>	<u>SRNS</u>
Cynthia Barr	Leigh Beatty	Dan Ferguson	Ben Dean	Gerald Blount
Larry Camper	Barry Mullinax	Phillip Prater	Kim Hauer	Mike Griffith
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		Amanda Watson	John Occhipinti	
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			Kent Rosenberger	
			Owen Stevens	
			Steve Thomas	
			Andy Tisler	
			Skip Wiggins	

## 5.0 REFERENCES:

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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.

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\_\_\_\_\_, "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)

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