

December 5, 2012

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SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION SEPTEMBER 26-27, 2012,  
ONSITE OBSERVATION REPORT FOR THE SAVANNAH RIVER SITE F-TANK  
FARM CLOSURE

Dear Mr. Folk:

The enclosed report describes the U.S. Nuclear Regulatory Commission's (NRC's) onsite observation activities on September 26-27, 2012, at the Savannah River Site (SRS) F-Tank Farm performed in coordination with the South Carolina Department of Health and Environmental Control. This onsite observation was conducted in accordance with Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (Section 3116), which requires NRC to monitor disposal actions taken by the U.S. Department of Energy (DOE) for the purpose of assessing compliance with the performance objectives set out in 10 CFR Part 61, Subpart C. The activities conducted during the site visit were consistent with those described in the NRC's observation guidance at SRS F-Tank Farm, dated August 23, 2012, (Agencywide Documents Access and Management System Accession No. ML12228A631) and NRC's staff guidance for activities related to waste determinations (NUREG-1854, dated August 2007).

This onsite observation at SRS was focused on assessing compliance with three of the four performance objectives contained in 10CFR Part 61: (i) protection of the general population from releases of radioactivity (§61.41); (ii) protection of individuals from inadvertent intrusion (§61.42); and (iii) protection of individuals during operations (§61.43). Meeting these performance objectives is predicated on the performance of the tanks and ancillary facilities as closed by DOE.

J. Folk

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If you have any questions or need additional information regarding this report, please contact James Shaffner of my staff at [James.Shaffner@nrc.gov](mailto:James.Shaffner@nrc.gov), or at (301) 415-5496.

Sincerely,

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Enclosures:

1. NRC Observation Report
2. DOE Pre-briefing

cc w /enclosures:

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# **U.S. NUCLEAR REGULATORY COMMISSION SEPTEMBER 26-27, 2012, ONSITE OBSERVATION REPORT FOR THE SAVANNAH RIVER SITE F-TANK FARM CLOSURE**

## **EXECUTIVE SUMMARY:**

The U.S. Nuclear Regulatory Commission (NRC) staff conducted, its second onsite observation visit to the F-Tank Farm (FTF) at the Savannah River Site (SRS) on September 26-27, 2012. The purpose of this visit was to follow-up on items related to Tank 18 and 19 grouting that arose from the first monitoring site visit conducted on June 12, 2012, (Agencywide Documents Access and Management System [ADAMS] Accession No. ML12191A210). Further, the staff was interested in aspects of preparation of Tanks 5 and 6 for closure and grouting, as well as discussing NRC reviews of several U.S. Department of Energy (DOE) technical reports. All issues are related to compliance with three of the four performance objectives in 10 CFR Part 61, Subpart C: (i) protection of the general population from releases of radioactivity (§61.41); (ii) protection of individuals from inadvertent intrusion (§61.42), and (iii) protection of individuals during operations (§61.43). During the on-site observation DOE staff conducted in-briefing presentations (Enclosure 2) related to both closure completion of Tanks 18 and 19, as well as sampling and analysis of Tanks 5 and 6. DOE also provided a discussion of groundwater monitoring in the vicinity of F-Tank Farm. NRC staff took a walking tour of closed Tanks 18 and 19, as well as in preparation Tanks 5 and 6. NRC staff was also given tours of the Savannah River National Laboratory (SRNL) which characterizes residual tank waste. Staff also visited a field lysimeter test which may yield information related to radionuclide movement in the natural environment.

Prior to the visit, the NRC and contractor staff reviewed a number of reports prepared by the DOE and its contractors related to various aspects of anticipated F-Tank Farm future performance. These reports are evaluated in separate technical review memoranda along with other technical reports previously provided to the NRC staff by DOE.

In accordance with the onsite observation guidance (ML12228A631), NRC staff had planned reviews and follow-up in the following areas: Tank and Vault Grouting; Radiation Protection Program; Waste Retrieval and Closure; Waste Release/Solubility; and Environmental Monitoring of Groundwater.

Prior to the on-site observation, DOE informed NRC that several of the observation objectives would not be ready for review by September 26-27, 2012. Consequently, the scope of the on-site observation was limited as discussed herein.

It should be noted that this onsite observation was completed prior to the preparation of a formal monitoring plan. The monitoring plan is being prepared and will be used to inform onsite observations beginning in Fiscal Year 2013.

NRC staff identified no open issues associated with this onsite observation. However, NRC staff provided several follow-up actions requesting information from DOE.

A summary of the staff's observations and conclusions is provided below.

## **1.0 BACKGROUND:**

Section 3116 of the National Defense Authorization Act for Fiscal Year 2005 (Section 3116) 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. Section 3116 also 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 submitted a "Draft Basis for Section 3116 Determination Closure of FTF Savannah River Site" to demonstrate compliance with the Section 3116 criteria including demonstration of compliance with the performance objectives in 10 CFR Part 61, Subpart C (DOE, 2010). In its consultation role, the NRC staff reviewed the draft waste determination and provided a number of recommendations that staff believed would be beneficial regarding DOE's demonstration of compliance with long-term performance objectives. The NRC documented the results of its review in a Technical Evaluation Report issued in October 2011 (NRC, 2011). DOE issued a final waste determination in March 2012 taking into consideration the assumptions, conclusions, and recommendations in NRC's Technical Evaluation Report (DOE, 2012). DOE began grouting operations in April 2012.

To carry out its monitoring responsibility under Section 3116, NRC performs technical reviews and onsite observations related to DOE disposal activities, in coordination with the State of South Carolina site regulator, South Carolina Department of Health and Environmental Control (SC DHEC). Technical reviews generally focus on evaluation of information and data collected to provide support for key assumptions made in DOE's FTF Performance Assessment (PA) that are considered important to the compliance demonstration. Onsite observations generally are performed to: (i) observe the collection of information and data that are the subject of the technical reviews (e.g., observation of waste sampling used to generate radionuclide inventory data); or to (ii) observe key disposal (or closure) activities related to technical review areas or that are otherwise important to the compliance demonstration (e.g., slag and other material storage, grout formulation and preparation, and grout placement).

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

### **2.1 Technical Focus:**

Staff focused on long-term concerns related to grout performance and its impact on the ability to meet 10 CFR 61.41 and 61.42. Staff also began review of aspects of closure of Tanks 5 and 6 and the impact of tank closure on the ability to meet 10 CFR 61.41 and 61.42. Staff also obtained information related to planned, current and historic groundwater monitoring activities in the vicinity of F-Tank Farm and the relationship of such monitoring on the ability to meet 10 CFR 61.41 and 61.42.

## 2.2 **Observation Scope:**

### A. **Tank and Vault Grouting**

1. Supplemental Review video of Tanks 18 and 19 grouting - *follow up from June 12 visit.*
2. Review of “as built” documentation of grouted tanks including estimates of void volume in equipment and in tank tops.
3. Continue discussion regarding development and testing of shrinkage compensating additives and testing of the potential for grout shrinkage - *follow up from June 12 visits.*
4. Discuss thermal calculations conducted to support tank grouting, testing, and evaluation of the potential for thermal cracking.
5. Discuss tank vault component grouting (e.g., leak detection channels) - *follow up from June 12 visits.*
6. Discuss results of follow-up testing of grout (e.g. compressive strength).

### B. **Radiation Protection Program**

1. Review activity-specific radiation protection program and final collective dose calculations.
2. Waste Retrieval and Closure.
3. Discuss schedule for Tanks 5 and 6 closure.
4. Review final inventories developed for Tanks 5 and 6.
5. Review cost benefit analysis for Tanks 5 and 6, if available.
6. Review special analysis for Tanks 5 and 6, if available.
7. Discuss anticipated changes in grouting operations given “lessons learned” from Tanks 18 and 19 grouting.
8. Discuss progress on cleaning of other FTF tanks.

### C. **Waste Release/Solubility**

1. Discuss plans for experiments to study key radionuclide solubility for key risk drivers at FTF.
2. Discuss plans for experiments to study grout conditioning of infiltrating groundwater.

#### **D. Environmental Data**

1. Discuss monitoring plan for FTF groundwater.
2. Discuss monitoring results for FTF wells.
3. Review historical information regarding initiating event and releases from FTF and HTF tanks.

Prior to the on-site observation, DOE informed NRC that several of the observation objectives would not be ready for review by September 26-27, 2012. Consequently, the scope of the on-site observation was limited to items A.1 and 6; C. 1 and 6; and D. 1, 2 and 3. DOE provided a status of other items that were part of the original scope and suggested when they would be ready for review

#### **2.3 On-Site Observation**

##### **2.3.1 Recently Completed DOE Grouting Activities for Tanks 18 and 19 (A. 1,4,6)**

DOE provided a status of the recently grouted Tanks 18 and 19. This included discussions of verification of void filling in tanks and internal equipment, riser completion and details regarding testing mechanical characteristics. DOE provided a schedule for completion of activities including the following:

1. Final Configuration Report (March 31, 2013)
  - Summary of internal components grouted
  - Will address grouting of leak detection sump
2. Liquid Waste Maintenance Plan (March 31, 2013)
  - Evaluation of shrinkage testing
  - Evaluation of thermal cracking
  - Key radionuclide solubility
  - Grout conditioning of infiltrating water

##### **2.3.2 Waste Retrieval and Closure (C.1 and 6)**

DOE provided a status update and schedule for closure of Tanks 5 and 6. These are type I tanks and presented unique challenges vis-a-vis cleaning and sampling of residual waste. In particular the tanks each contained over 21,000 lineal feet of 2" ID cooling coil which presented significant obstacles to both cleaning and sampling equipment.

As part of the in-brief on September 27, 2012, DOE provided a detailed presentation related to its sampling strategy and implementation challenges for both tanks. Because infrastructure was different for both tanks, different approaches were needed.

DOE also provided a general overview of the schedule for overall closure of FTF. The timeline extended at least 10 years into the future.

NRC staff was also able to observe surface features associated with Tanks 5 and 6 including access risers. DOE also discussed limitations regarding the use of some risers for access for waste removal and sampling of residual waste.

### 2.3.3 **Environmental Data (D.1, 2, 3)**

DOE presented information related to groundwater monitoring in the vicinity of FTF. DOE discussed the introduction and evolution of both up gradient and down gradient wells. DOE discussed external features (in particular, a leaking process sewer line near FTF) that likely will impact groundwater monitoring results. In conjunction with the discussion, DOE agreed to consider NRC's request for specific information from its Geographic Information System (GIS) and Environmental Restoration Data Management System (specifically well construction and water elevation data from 1990 to the present) from the General Separations Area that may help with the interpretation of groundwater monitoring data. NRC staff also requested additional information regarding characterization of over-fill events that occurred at Tank 8 in FTF and Tank 16 in HTF that may provide information regarding engineered and natural system performance.

### 2.3.4 **Supplemental Observation Activities**

NRC staff was also afforded the opportunity to tour the Savannah River National Laboratory (SRNL) facility that processes, characterizes and analyzes samples of residual tank waste. Although this tour was outside the scope of the formal monitoring site visit, it provided NRC staff with a perspective of the challenges inherent in these activities and therefore some of the limitations.

NRC staff was afforded the opportunity to tour a long-term field lysimeter experiment in which DOE has placed a number of test samples to try to determine long-term performance in natural conditions. Again, this was outside the scope of the monitoring site visit, but future results may provide insight regarding expectations of both residual tank waste performance as well as performance of saltstone.

## 2.4 **Observation Results:**

### 2.4.1 **Recently Completed DOE Grouting Activities for Tanks 18 and 19 (A. 1 and 6)**

NRC staff identified no new issues associated with Tanks 18 and 19 tank grouting. NRC staff will continue to monitor DOE activities related to the potential for shrinkage and cracking of FTF tank grout. NRC is concerned with tank grout shrinkage and cracking as it could lead to preferential or by-passing pathways through the tank grout and earlier, risk-significant release of key radionuclides from the grouted tanks. NRC agreed to provide DOE and SC DHEC with a copy of a recently completed Center for Nuclear Waste Regulatory Analysis (CNWRA) report documenting the results of meso- and intermediate-scale grout monolith experiments using tank grouts (ML12251A305). This report provides estimates of bulk permeability and information about the potential for shrinkage and cracking of tank grouts proposed for use in National Defense Authorization Act (NDAA) tanks. DOE plans for shrinkage testing and thermal cracking evaluations will become clearer when the FTF Liquid Waste Maintenance Plan is issued (currently planned for March 2013).

With regard to the video footage of tank grouting operations provided by DOE following the June 12, 2012, onsite observation, NRC indicated that the video provided was consistent with NRC staff's request. DOE clarified that it provided video up to the last day of tank grouting at the point at which the camera was removed from the Tank 18 tank riser to complete grouting.

NRC will review the final configuration report for Tanks 18 and 19 grouting (expected to be completed in March 2013), including information regarding final tank and equipment void volume estimates. NRC evaluation of the information provided in the report will be documented in a technical review memorandum. With regard to the test results of grout samples that were taken during grouting of Tanks 18 and 19, NRC reviewed several grout test reports and confirmed the measured compressive strength of the samples meet the DOE specifications. DOE indicated that the compressive strength of all samples taken through May 25, 2012, grouting operations are within specifications. The remainder of the 91-day results are still pending.

NRC requested an equipment fill mock up test report cited in SRNL-STI-2011-0056. DOE indicated the report was available on-line through the Office of Scientific Technical Information bridge. NRC staff will review the equipment fill mock up test report (SRNL-STI-2011-00564) and document the results of its review in a technical review memorandum

During the onsite observation, DOE discussed a grout formulation that was not required for use in grouting Tanks 18 and 19. The grout formulation will be used for grouting cooling coils present in Tanks 5 and 6, which are Type I tanks. DOE indicated information on the cooling coil grout is provided in two references that supported the final Basis document (WSRC-STI-2008-00172 and WSRC-STI-2008-00298). NRC staff will review these reports and document the results of its review in a technical review memorandum.

#### **2.4.2 Waste Retrieval and Closure (C. 1 and 6)**

NRC identified no issues associated with Tank 5 and 6 sampling and analysis during the onsite observation. DOE provided a CD that included electronic copies of a number of reports related to Tank 5 and 6 final inventory developments including the following:

1. SRR-CWDA-2012-00027 Revision 1, Tank 5 Inventory Determination.
2. SRR-CWDA-2012-00075, Tank 6 Inventory Determination.
3. SRR-LWE-2010-00300, Tank 6 Sampling and Analysis Plan.
4. SRR-LWE-2010-00285, Tank 5 Sampling and Analysis Plan.
5. SRR-LWE-2011-00235, Tank 6 Sampling and Analysis Plan Addendum 2.
6. SRR-CWDA-2011-00050 Revision 1, Liquid Waste Tank Residuals Sampling and Analysis Program Plan.
7. SRR-LWE-2010-00340, Addendum to Tank 5 Sampling and Analysis Plan.

8. SRR-LWE-2011-00209, Tank 6 Sampling and Analysis Plan Addendum.

DOE also provided a hard copy of the following reference that contains information on analytical methods for analysis of the high-level waste tanks samples:

9. SRNL-STI-2012-00365, Rev. 0, "Analysis of the Tank 6F Final Characterization Samples-2012 (U).

NRC staff will review the references listed above related to development of the final inventory for Tanks 5 and 6 and document the results of its review in a technical review memorandum.

### 2.4.3 **Environmental Data (D. 1, 2, 3)**

NRC staff identified no issues associated with environmental data collection during the onsite observation. With respect to the FTF groundwater monitoring plan, NRC staff noted that the trigger level of 50 pCi/L nonvolatile beta that would lead to radionuclide specific sampling of mobile beta emitters such as I-129 appears to be high given the relatively higher risk factors associated with I-129. However, NRC staff agreed that as long as Tc-99 continues to be sampled at appropriate wells, the Tc-99 measurements may provide good indicator information regarding I-129. NRC staff also inquired about the basis for the location of the FTF monitoring wells (e.g., recent PORFLOW particle tracking from FTF sources). NRC staff will review the monitoring well network against PORFLOW modeling results to evaluate the ability of the monitoring well network to detect FTF releases.

DOE also presented information related to the Tc-99 plume at the FTF that is now thought to be potentially sourced from the process sewer lines that feed the F-Area seepage basins. Previously, the Tc-99 plume was thought to be associated with a documented release from Tank 8 that occurred in 1961. While historical releases from the tank farm are not under the scope of NRC monitoring under the NDAA, NRC staff uses information gained from review of information from historical releases as a means of better understanding potential engineered and natural system performance. While NRC agrees that some of the contaminant transport data may not be applicable to releases from grouted tanks, information about expected flow directions and vertical gradients may also be gleaned from the data. For example, well FTF-28 is located in the lower zone of the Upper Three Runs Aquifer, while the well is located a short horizontal distance from the suspected source, the FTF process sewer lines. If the process sewer lines were the source, this would suggest a strong vertical gradient in the subsurface at FTF. Backwards particle tracking could be used to determine the source of the plume and provide validation information for the groundwater flow models used in FTF PA modeling.

During the onsite observation, DOE provided the FTF groundwater monitoring plan and the last three years of monitoring data for the FTF (SRNS-RP-2011-00995 (monitoring plan), SRNS-RP-2012-00022 (2011 data), SRNS-TR-2011-00038 (2010), and SRNS-TR-2010-00012 (2009)). NRC staff also requested information regarding the Tank 8 and Tank 16 historical releases to provide information regarding engineered and natural system performance. HTF Tank 16 release information will be provided with the HTF Basis document. NRC staff will review the groundwater monitoring data and event information and document the results of its review in a technical review memorandum.

NRC staff also requested GIS data for the General Separations Area (GSA) as well as water table data from 1990 to present and well construction data for applicable tank farm wells. The water table data will be used to determine the likelihood of water table rise above the bottom of FTF tanks, a potentially risk-significant alternative conceptual model for Type IV tanks at FTF. NRC staff requested the GSA GIS data to support tank farm and saltstone reviews and monitoring. The GIS data will be used to better understand and analyze groundwater data collected for the FTF and saltstone disposal facilities (e.g., will help NRC evaluate: (i) the PORFLOW groundwater models used in the PA analyses; and (ii) the efficacy of the groundwater monitoring networks).

### **3.0 FOLLOW-UP ACTIONS AND CONCLUSION:**

DOE will provide GSA GIS water table elevation, and well construction data to NRC.

NRC plans to review the ALARA and final collective dose calculations for Tank 18 and 19 grout operations that are estimated to be completed in January 2013. The results of the review will be documented in a technical review memorandum.

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### **5.0 REFERENCES:**

U. S. Nuclear Regulatory Commission, Onsite Observation Guidance for September 26-27, Waste Monitoring Visit to the Savannah River Site, F Area Tank Farm.

U.S. Department of Energy (DOE), DOE/SRS-WD-2012-001, Rev.) "Basis for Section 3116 Determination Closure of F-Tank Farm Savannah River Site," March 27, 2012.

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