



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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February 6, 2019

Mr. Daniel Ferguson
Waste Disposition Programs Division
U.S. Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION AUGUST 13 – 14, 2018,
ONSITE OBSERVATION VISIT REPORT FOR THE SAVANNAH RIVER SITE
TANK FARMS

Dear Mr. Ferguson:

The enclosed Onsite Observation Visit (OOV) Report describes the OOV that the U.S. Nuclear Regulatory Commission (NRC) conducted on August 13 – 14, 2018, at the Savannah River Site (SRS) Tank Farms (TFs). The SRS TFs consists of the F-Tank Farm (FTF) and the H-Tank Farm (HTF). The August 2018 TFs OOV was conducted in accordance with Section 3116(b) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA), which requires the NRC, in coordination with the NDAA-Covered State, to monitor certain disposal actions taken by the U.S. Department of Energy (DOE) for the purpose of assessing compliance with the five performance objectives set out in Title 10 of the *Code of Federal Regulations* (CFR) Part 61, Subpart C. The five 10 CFR Part 61 Subpart C performance objectives are: (1) §61.40 (General Requirements); (2) §61.41 (Protection of the General Population from Releases of Radioactivity); (3) §61.42 (Protection of Individuals from Inadvertent Intrusion); (4) §61.43 (Protection of Individuals during Operations); and (5) §61.44 (Stability of the Disposal Site after Closure). The August 2018 TFs OOV was the eighth TFs OOV conducted since the NRC began monitoring the DOE TFs disposal actions under NDAA Section 3116(b) in June 2012.

The main activities conducted during the August 2018 TFs OOV were: (1) discuss tank closure status; (2) tour the General Separations Area (GSA) streams; (3) discuss the Tank 12 and Tank 18 waste release testing; (4) discuss the GSA PORFLOW Model; (5) discuss the *Tank 12 and Tank 16 Grouting Technical Review Report* (TRR); (6) discuss the *Tank 12 Inventory and Special Analysis Document* TRR; (7) discuss the *TFs Environmental Monitoring* TRR; and (8) discuss the DOE and NRC contractor research.

Those OOV activities were consistent with the activities described in the NRC Guidance Memorandum for the August 2018 TFs OOV dated July 12, 2018 [available via the NRC Agencywide Documents Access and Management System (ADAMS) at Accession No. ML18192A328]. That Guidance Memorandum was developed using the TFs Monitoring Plan, Rev. 0, dated October 2015 [ADAMS Accession No. ML15238A761]. The NRC 2015 TFs Monitoring Plan contains the monitoring areas and monitoring factors that describe how the NRC will monitor the DOE TFs disposal actions to assess compliance with the performance

D. Ferguson

- 2 -

objectives, which will be performed through a risk-informed, performance-based process using technical reviews, data reviews, and OOVs.

There were no TFs Open Issues before the August 2018 TFs OOV and there were no TFs Open Issues identified during the August 2018 TFs OOV. Further, based on the August 2018 TFs OOV, the NRC did not: (1) close any of the TFs monitoring areas; (2) close any of the TFs monitoring factors; or (3) change the overall conclusions from either the NRC Technical Evaluation Report (TER) for the FTF dated October 2011 [ADAMS Accession No. ML112371751] or the NRC TER for the HTF dated June 2014 [ADAMS Accession No. ML14094A496], which both were that “[the] NRC did not make a conclusion on the ability of the DOE to meet the requirements of the [performance objectives] in 10 CFR Part 61, Subpart C due to uncertainty in the final inventories for the remaining tanks” as well as other factors related to uncertainty in disposal facility performance. In accordance with the requirements of NDAA Section 3116(b), the NRC, in coordination with the NDAA-Covered State of South Carolina, will continue to monitor the DOE disposal actions at the SRS TFs.

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

Sincerely,

/RA/

Bo Pham, Acting Director
Division of Decommissioning, Uranium Recovery,
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket No. PROJ0734

Enclosure:
NRC Onsite Observation Visit Report

cc: w/ Enclosure:
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D. Ferguson

- 3 -

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION AUGUST 13 – 14, 2018,
ONSITE OBSERVATION VISIT REPORT FOR THE SAVANNAH RIVER SITE
TANK FARMS **DATE February 6, 2019**

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**U.S. NUCLEAR REGULATORY COMMISSION
AUGUST 13 – 14, 2018, ONSITE OBSERVATION VISIT REPORT FOR
THE SAVANNAH RIVER SITE TANK FARMS**

EXECUTIVE SUMMARY:

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its eighth Onsite Observation Visit (OOV) to the Tank Farms (TFs) at the Savannah River Site (SRS) on August 13 – 14, 2018 (TFs Observation 2018-01). This was the only TFs OOV in Calendar Year (CY) 2018. The SRS TFs consists of the F-Tank Farm (FTF) and the H-Tank Farm (HTF). On every OOV to SRS under Section 3116(b) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA), the NRC is focused on assessing the U.S. Department of Energy (DOE) compliance with the following performance objectives in Title 10 of the *Code of Federal Regulations* (CFR) Part 61, Subpart C: (1) §61.41 (Protection of the General Population from Releases of Radioactivity), (2) §61.42 (Protection of Individuals from Inadvertent Intrusion), (3) §61.43, (Protection of Individuals during Operations), and (4) §61.44, (Stability of the Disposal Site after Closure). Also, if the NRC concludes with reasonable assurance that the DOE complies with the §61.41, §61.42, §61.43, and §61.44 performance objectives, then the NRC will also conclude with reasonable assurance that the DOE complies with the §61.40 “General Requirement” performance objective.

For the detailed technical information from this OOV, please see the Memorandum in the NRC Agencywide Documents Access and Management System (ADAMS) at Accession No. ML19025A069. For this OOV, the NRC focused on the monitoring areas and monitoring factors in the NRC TFs Monitoring Plan, Rev. 0 dated October 2015 [available via ADAMS at Accession No. ML15238A761]. All NRC concerns prior to the 2015 TFs Monitoring Plan were rolled into the monitoring factors in the 2015 TFs Monitoring Plan. The NRC performs monitoring activities in coordination with the NDAA-Covered State of South Carolina. Therefore, the South Carolina Department of Health and Environmental Control (SCDHEC) staff also participated in this OOV.

Consistent with the NRC Guidance Memorandum for this OOV dated July 12, 2018, [ADAMS Accession No. ML18192A328], the main activities conducted during this OOV were: (1) discuss tank closure status; (2) tour the General Separations Area (GSA) streams; (3) discuss the Tank 12 and Tank 18 waste release testing; (4) discuss the GSA PORFLOW Model; (5) discuss the *Tank 12 and Tank 16 Grouting* Technical Review Report (TRR); (6) discuss the *Tank 12 Inventory and Special Analysis Document* TRR; (7) discuss the *TFs Environmental Monitoring* TRR; and (8) discuss both the DOE and NRC contractor research.

The NRC does not expect to close any of the TFs monitoring factors or change the overall conclusions from either the NRC Technical Evaluation Report (TER) for the FTF dated October 2011 [ADAMS Accession No. ML112371751] or the NRC TER for the HTF dated June 2014 [ADAMS Accession No. ML14094A496] as a result of this OOV. There were no TFs Open Issues before this OOV and there were no TFs Open Issues identified during this OOV.

During the NDAA monitoring process, the NRC does expect to open and close Follow-Up Action Items (FUAIs) during OOVs, meetings, clarification teleconference calls, or technical teleconference calls. Most of those FUAIs are specific short-term actions to be performed by

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the NRC or the DOE. Usually, most of those FUAIs are closed before the next OOV, meeting, clarification teleconference call, or technical teleconference call. During this OOV, there were seven FUAIs opened.

After the OOV, the NRC received the updated DOE OOV presentation (SRR-CWDA-2018-00047, Rev. 1) [ADAMS Accession No. ML18247A080] pertaining to the activities during this OOV.

1.0 BACKGROUND:

Section 3116(a) of the NDAA authorizes the 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 the NRC to monitor the DOE disposal actions to assess compliance with the performance objectives in 10 CFR Part 61, Subpart C.

On September 30, 2010, the DOE submitted to the NRC the *Draft Basis for 3116 Determination for Closure of F Tank Farm at the Savannah River Site* (DOE/SRS-WD-2010-001, Rev. 0) [ADAMS Accession No. ML102790078] to demonstrate compliance with the NDAA criteria, including demonstration of compliance with the performance objectives in 10 CFR Part 61, Subpart C at the FTF. In its consultation role, the NRC staff reviewed the FTF draft Waste Determination and associated documents, including the performance assessment. In the NRC FTF TER issued in October 2011 [ADAMS Accession No. ML112371751], the NRC documented the results of its review and did not make a conclusion on the ability of the DOE to meet the requirements of the performance objectives in 10 CFR Part 61, Subpart C due to uncertainty in the final inventories for the remaining tanks in the FTF; but, did make observations and recommendations. Taking into consideration the observations and recommendations in the NRC 2011 FTF TER, in March 2012, the DOE issued both the Final Waste Determination for the FTF (DOE-WD-2012-001, Rev. 0) [ADAMS Accession No. ML121140043] and the Final Basis Document (DOE/SRS-WD-2012-001, Rev. 0) [ADAMS Accession No. ML121140051] for the FTF. After the DOE issued the Final Basis Document for the FTF, the NRC began monitoring at the FTF. In January 2013, the NRC issued the NRC Monitoring Plan for the FTF, Rev. 0 [ADAMS Accession No. ML12212A192] and began using it to monitor the DOE disposal actions at the FTF.

On February 6, 2013, the DOE submitted to the NRC the *Draft Basis for 3116 Determination for Closure of H-Tank Farm at the Savannah River Site* (DOE/SRS-WD-2013-001, Rev. 0) [ADAMS Accession No. ML13045A504] to demonstrate compliance with the NDAA criteria, including demonstration of compliance with the performance objectives in 10 CFR Part 61, Subpart C at the HTF. In its consultation role, the NRC staff reviewed the HTF draft Waste Determination and associated documents, including the performance assessment. In the NRC HTF TER issued in June 2013 [ADAMS Accession No. ML14094A496], the NRC documented the results of its review and did not make a conclusion on the ability of the DOE to meet the requirements of the performance objectives in 10 CFR Part 61, Subpart C due to uncertainty in the final inventories for the remaining tanks in the HTF; but did make observations and recommendations. Taking into consideration the observations and recommendations in the NRC 2013 HTF TER, in December 2014, the DOE issued both the Final Waste Determination

(DOE-WD-2014-001, Rev. 0) [ADAMS Accession No. ML15051A352] for the HTF and the Final Basis Document (DOE/SRS-WD-2014-001, Rev. 0) [ADAMS Accession No. ML15051A353] for the HTF. After the DOE issued the Final Basis Document for the HTF, the NRC began monitoring at the TFs (i.e., both FTF and HTF). In October 2015, the NRC issued the NRC Monitoring Plan for the TFs, Rev. 0 [ADAMS Accession No. ML15238A761] and began using it to monitor the DOE disposal actions at the TFs.

As described in the NRC Monitoring Plan for the TFs, Rev. 0, to carry out its monitoring responsibility under NDAA Section 3116(b), the NRC, in coordination with the NDAA-Covered State of South Carolina (by SCDHEC), performs three NDAA monitoring activities: (1) technical reviews; (2) data reviews; and (3) OOVs. Specifically, technical reviews generally focus on reviewing information generated to provide support for key assumptions that the DOE made in the TFs performance assessment or supplements, such as special analysis documents. Data reviews generally focus on supplementing 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. OOVs generally focus on either: (1) observing the collection of data and reviewing the data to assess consistency with assumptions made in the DOE Final Waste Determination; or (2) observing key disposal or closure activities related to technical review areas. In between revisions of a monitoring plan, the NRC may issue one or more letters to the DOE that supplement a monitoring plan.

The information in an OOV Report is relevant to all aspects of the NDAA monitoring activities. The NRC will use the information in an OOV Report to evaluate whether or not DOE disposal actions comply with the performance objectives, whether to open new or close current monitoring areas, and whether to open new or close current monitoring factors. During an OOV, the DOE may present preliminary data and commit to provide final data in a publicly available document or documents at a later time to the NRC. That DOE commitment to provide that future document or documents to the NRC would be a FUAL in an OOV Report. The future NRC decisions on performance objectives, monitoring areas, and monitoring factors will be based on evaluating the final data in that future DOE document or documents and will not be based on the preliminary data discussed at an OOV and summarized in an OOV Report. The NRC review of the final DOE data may be documented in a TRR or a TER, both of which would be publicly available. The issues evaluated in a TRR or a TER will be related to routine NRC monitoring activities that are described in monitoring plan, as supplemented by any NRC letters to the DOE.

2.0 ONSITE OBSERVATION VISIT ACTIVITIES:

On July 12, 2018, the NRC issued the OOV Guidance Memorandum [Accession No. ML18192A328] for the August 2018 TFs OOV, TFs Observation 2018-01. An OOV Guidance Memorandum is a plan for what the NRC expects to cover during an OOV, which may be changed based on what happens during the OOV. The detailed technical information collected during this OOV can be found in the Memorandum in ADAMS at Accession No. ML19025A069.

The OOV began with a short briefing on the agenda that was attended by representatives from the DOE (including the DOE contractors), the NRC, and the SCDHEC. Afterwards, there were

welcoming remarks and introductions. The rest of the OOV consisted of a tour and technical discussions. The tour was focused on the General Separations Area (GSA) streams. The technical discussions were focused on the: (1) tank closure status; (2) Tank 12 and Tank 18 waste release testing; (3) GSA PORFLOW Model; (4) *Tank 12 and Tank 16 Grouting* TRR; (5) *Tank 12 Inventory and Special Analysis Document* TRR; (6) *TFs Environmental Monitoring* TRR; and (7) DOE and NRC contractor research.

2.1 Technical Discussion – Tank Closure Status:

2.1.1 Observation Scope:

The technical discussion supported the NRC monitoring of the DOE disposal actions to assess compliance with all of the 10 CFR Part 61 performance objectives. The technical discussion was relevant to most of the monitoring areas and monitoring factors in the TFs Monitoring Plan, Rev. 0.

2.1.2 Observation Results:

The DOE presented an overview of the recent TFs tank closure activities and monitoring activities as well as an overview of the DOE Tank Closure Cesium Removal (TCCR) (SRR-CWDA-2018-00047, Rev. 1) [ADAMS Accession No. ML18247A080]. This included a discussion of the routine documents developed by the DOE, such as environmental monitoring reports and groundwater monitoring reports, which can be useful during NDAA-monitoring activities at the TFs; and how the DOE addressed FUAIs from the 2016 TFs OOV. The key points from the technical discussion were:

- The DOE discussed Tank 12 closure activities since the 2016 TFs OOV and since the NRC issued the *Tank 12 and Tank 16 Grouting* TRR, including that the DOE switched to Grade 120 slag
- The DOE discussed cleaning of Tank 15, which contains almost all H-Canyon Modified (HM) PUREX processed waste, including that the waste in Tank 15 has high aluminum content, is very viscous, and is difficult to remove
- The DOE discussed that the Tank 15 waste was being transferred to Tank 13, where it is slurried and sent to Tank 51 for sludge batch preparation and in addition, that Tank 13 contains four submersible mixing pumps (SMPs); but, one SMP has failed and it is being replaced with a Commercial SMP (CSMP)
- The DOE discussed the modular TCCR technology currently being deployed to treat Tank 10 waste, including that it is designed to remove Cesium (Cs) from the waste stream before transfer to the Saltstone Disposal Facility

2.1.3 Conclusions and Follow-Up Action Items:

The NRC staff will continue to monitor the DOE TFs closure activities. The following FUAIs resulted from the technical discussion:

- The DOE to provide the NRC with the *Annual Radioactive Waste Tank Inspection Program Report* [SRR-STI-2018-00146]
- The DOE to provide the NRC with the *Tank 12 Final Configuration Report* [SRR-CWDA-2016-00068]

2.2 Tour – GSA Streams

2.2.1 Observation Scope:

The tour supported the NRC monitoring of the DOE disposal actions to assess compliance with §61.41 and §61.42. The tour was most relevant to the following monitoring areas and monitoring factors in the TFs Monitoring Plan, Rev. 0:

- Monitoring Area (MA) 4 (Natural System Performance):
 - Monitoring Factor (MF) 4.3 (Environmental Monitoring)
- MA 6 (Performance Assessment Maintenance):
 - MF 6.3 (Tank Farms Performance Assessment Revisions)

2.2.2 Observation Results:

The tour consisted of observing, partly on foot and partly from a vehicle, the GSA streams, including several tributaries and outfalls near the TFs or associated with TF plumes. The key points from the tour were:

- The first stop was a drive-by observation of Four Mile Branch (FMB) from the bridge on the way from C-Area to HTF
- The second stop was a tributary of FMB near HTF, where downcutting was significant (several feet) and a road over the tributary had been washed out with a resultant culvert deposited in the tributary
- The third stop was near piezometer FGW023 to the west of the biomass facility in the Western Groundwater Operable Unit:
 - there was a rock apron thought to be erosion control for surface water runoff from the biomass facility
 - groundwater seeps were observed further down on the drainage to Upper Three Runs (UTR), which was indicative of baseflow rather than surface water runoff
- The tour also included the Crouch Branch tributary to UTR, where the water was very clear, the stream bed was very sandy, and the stream flow was low, but, more substantial than in tributaries to FMB

2.2.3 Conclusions and Follow-Up Action Items:

The NRC staff will continue to monitor the DOE TFs closure activities. The DOE and the NRC staff may do another tour of the GSA streams in a future TFs OOV in order to support the future NRC review of the new DOE updated GSA PORFLOW model. There were no FUAIs that resulted from the tour.

2.3 Technical Discussion – Tank 12 and Tank 18 Waste Release Testing

2.3.1 Observation Scope:

The technical discussion supported the NRC monitoring of the DOE disposal actions to assess compliance with §61.41 and §61.42. The technical discussion was most relevant to the following monitoring area and monitoring factor in the TFs Monitoring Plan, Rev. 0:

- MA 2 (Waste Release):
 - MF 2.1 (Solubility-Limiting Phases/Limits and Validation)

2.3.2 Observation Results:

The DOE briefed the NRC staff on activities related to Tank 12 and Tank 18 waste release testing. The key points from the technical discussion were:

- The DOE indicated that new waste release testing was being conducted on Tank 12 investigating Iodine (I), in addition to the radionuclides studied during Tank 18 waste release testing: Neptunium (Np), Technetium (Tc), Uranium (U), and Plutonium (Pu)
- The NRC staff indicated that the Tank 18 waste release testing results showed that, although the DOE was using the best thermodynamic database available, the geochemical modeling was, in many cases, unable to accurately predict the solubility limiting phases and solubilities of those unique tank wastes
- The DOE responded that it was not currently looking to revise its geochemical models
- In response to the NRC staff comments, the DOE contractor (Savannah River National Laboratory (SRNL)) clarified that it thought that the oxidation-reduction potential (E_h) endpoints could not be achieved using reasonable oxidants and reductants and, therefore, the E_h endpoints would not likely be achieved in the field
- The NRC staff indicated that it was not clear that the experiments had reached a steady-state condition because several constituent concentrations were still trending up at the conclusion of the waste release experiment
- The NRC staff indicated that the DOE technical analyses (SRR-CWDA-2016-00086) did not consider uncertainty in barriers that delay the timing of release and, therefore, conclusions regarding the impact of the waste release testing results on the performance assessment were not fully supported

2.3.3 Conclusions and Follow-Up Action Items:

The NRC staff will continue to monitor the DOE TFs closure activities. The following FUAJ resulted from the technical discussion:

- The DOE to provide the NRC with the briefing material: *SRS Tank 12H Residual Radionuclide Release Testing Status [SRNL-MS-2018-00142]*

2.4 Technical Discussion – GSA PORFLOW Model

2.4.1 Observation Scope:

The technical discussion supported the NRC monitoring of the DOE disposal actions to assess compliance with §61.41 and §61.42. The technical discussion was most relevant to the following monitoring areas and monitoring factors in the TFs Monitoring Plan, Rev. 0:

- MA 4 (Natural System Performance):
 - MF 4.3 (Environmental Monitoring)
- MA 6 (Performance Assessment Maintenance):
 - MF 6.3 (Tank Farms Performance Assessment Revisions)

2.4.2 Observation Results:

The DOE briefed the NRC staff on activities related to the GSA PORFLOW model. The key points from the technical discussion were:

- The DOE provided the NRC staff with an update on the evolution of the GSA regional groundwater model:
 - the initial GSA model was created using the subsurface Flow and Contaminant Transport (FACT) code in the 1990s
 - the initial GSA model was translated to the PORFLOW code in 2004
 - the DOE collected additional groundwater characterization data and developed new calibration targets using data collected from 2004 to 2014
- The GSA PORFLOW groundwater model was updated from 2016 to 2017 using newly available groundwater characterization data, calibration targets and hydrostratigraphic unit picks:
 - the GSA PORFLOW groundwater model was calibrated using the Parameter Estimation (PEST) code
 - the DOE is in the process of updating the model to incorporate data from Z-Area, Mixed Waste Management Facility (MWMF), Low Level Radioactive Waste

Disposal Facility (LLRWDF), and E-Area with an updated report that is expected to be issued in September 2018

- The NRC staff asked the DOE whether the NRC should wait to review the 2018 GSA PORFLOW model or begin by reviewing the 2016 GSA model while waiting for the 2018 report to be issued and the DOE indicated that:
 - the FTF and HTF modeling results should not be a significant step-change between the 2016 and 2018 GSA PORFLOW models
 - the NRC could start reviewing the 2016 report now to focus mainly on methodology and then review the 2018 report when it is issued to focus mainly on model results
 - it would be useful for the NRC to start reviewing the 2016 GSA PORFLOW model because there will only be a supplement provided in the 2018 model update, which will primarily be focused on flow and transport in Z-Area, MWMF, LLRWDF, and E-Area

2.4.3 Conclusions and Follow-Up Action Items:

The NRC staff will continue to monitor the DOE TFs closure activities. The following FUAIs resulted from the technical discussion:

- The DOE to provide the NRC with the *Annual 2017 TFs Groundwater Monitoring Report* [SRR-RP-2018-00226]
- The DOE to provide the NRC with a listing of documents with information about GSA electromagnetic borehole flowmeter-derived hydraulic conductivity data

2.5 Technical Discussion – Tank 12 and Tank 16 Grouting TRR

2.5.1 Observation Scope:

The technical discussion supported the NRC monitoring of the DOE disposal actions to assess compliance with §61.41 and §61.42. The technical discussion was most relevant to the following monitoring area and monitoring factors in the TFs Monitoring Plan, Rev. 0:

- MA 3 (Cementitious Material Performance):
 - MF 3.2 (Groundwater Conditioning via Reducing Grout)
 - MF 3.3 (Shrinkage and Cracking of Reducing Grout)
 - MF 3.4 (Grout Performance)

2.5.2 Observation Results:

The NRC staff and the DOE discussed the follow-up items from the May 17, 2016, teleconference about grouting Tank 12 and Tank 16 as well as the *Tank 12 and Tank 16*

Grouting TRR [ADAMS Accession No. ML16231A444] issued on September 6, 2016. In particular, the discussion was focused on the TRR Attachment 3, "List of Outstanding References." This included the clarifications, responses, and paths forward for each item or question in the following sections of the TRR Attachment 3: (1) Items from the May 17, 2016, Teleconference; (2) Follow-Up List of Questions from the May 17, 2016, Teleconference; and (3) Other Follow-Up List of References and Questions from the *Tank 12 and Tank 16 Grouting* TRR. The key points from the technical discussion were:

- Action Items from the May 17, 2016, Teleconference:
 - regarding Action Item #2: The DOE clarified that it performed two pumping campaigns of ~3,800 liters/campaign (1,000 gallons/campaign) due to in-leakage into the Tank 12 annulus from a clay ventilation pipe
 - regarding Action Item #4: with respect to the NRC staff inquiry regarding which of the three grout formulations provided within procurement specification C-SPP-Z-00012 (item referenced CSP-SPP-Z-00012; but, it was actually C-SPP-Z-00012) was used for clean cap grout in Tank 16, the DOE indicated that it utilized the "Vault 4 Clean Cap 1" formulation
- Follow-Up List of Questions from the May 17, 2016, Teleconference:
 - regarding Question #1: the DOE will gather information regarding the Tank 16 clean cap specification, explicitly whether Daratard or admixtures were used to increase flowability of the grout at a specified water-cement ratio
 - regarding Question #7: the DOE clarified that RECOVER is a hydration stabilizer added to the mix at the batch plant where the volume is determined by the batch plant as an amount needed to delay grout setting and that volume depends on the ambient temperature, humidity, travel time, operational conditions, and visual observation of previous batches
- Other Follow-Up List of References and Questions from the *Tank 12 and Tank 16 Grouting* TRR
 - regarding #1: the DOE indicated that shrinkage testing was inconclusive with respect to the observation of shrinkage or growth and there are now no plans to issue a related report, in contrast to what the DOE had previously indicated to the NRC staff during the 2016 TFs OOV

2.5.3 Conclusions and Follow-Up Action Items:

The NRC staff will continue to monitor the DOE TFs closure activities. The following FUAIs resulted from the technical discussion:

- The DOE to provide the NRC with available documents from follow-up items from the *Tank 12 and Tank 16 Grouting* TRR (ML16231A444) (see description on pages 14 – 15)

- The NRC to hold teleconference with the DOE to follow-up on items from the *Tank 12 and Tank 16 Grouting* TRR (ML16231A444)

2.6 Technical Discussion – Tank 12 Inventory and Special Analysis Document TRR

2.6.1 Observation Scope:

The technical discussion supported the NRC monitoring of the DOE disposal actions to assess compliance with §61.41 and §61.42. The technical discussion was most relevant to the following monitoring area and monitoring factors in the TFs Monitoring Plan, Rev. 0:

- MA 1 (Inventory):
 - MF 1.1 (Final Inventory and Risk Estimates Grout)
 - MF 1.2 (Residual Waste Sampling)
 - MF 1.3 (Residual Waste Volume)

2.6.2 Observation Results:

The NRC staff and the DOE discussed the *Tank 12 Inventory and Special Analysis Document* TRR [ADAMS Accession No. ML17277B235] issued on January 8, 2018. The key point from the technical discussion was:

- The NRC staff indicated that the DOE did not appropriately consider uncertainty in calculating mass fractions from each of the segments (e.g., uncertainty in density measurements was not considered, although found to be variable between segments):
 - sampling of just three volumes from a triangular distribution representing volume uncertainty to determine mass fractions also appeared to be inappropriate
 - the NRC staff indicated that the DOE could consider volume and density uncertainty in a probabilistic analysis conducted to study inventory uncertainty in the Special Analyses Document in lieu of considering volume uncertainty alone in determining mass fractions in the volume proportional compositing scheme

2.6.3 Conclusions and Follow-Up Action Items:

The NRC staff will continue to monitor the DOE TFs closure activities. There were no FUAIs that resulted from the technical discussion.

2.7 Technical Discussion – TFs Environmental Monitoring TRR

2.7.1 Observation Scope:

The technical discussion supported the NRC monitoring of the DOE disposal actions to assess compliance with §61.41 and §61.42. The technical discussion was most relevant to the following monitoring area and monitoring factor in the TFs Monitoring Plan, Rev. 0:

- MA 4 (Natural System Performance):
 - MF 4.3 (Environmental Monitoring)

2.7.2 Observation Results:

The NRC staff and the DOE discussed the *TFs Environmental Monitoring* TRR [ADAMS Accession No. ML18051B009] issued on April 20, 2018. Note that the Enclosure is undated; but, Final [ADAMS Accession No. ML18051B153]. The key points from the technical discussion were:

- The NRC staff indicated that they performed independent PORFLOW transport modeling to evaluate the groundwater monitoring well network
- The NRC staff indicated that it was important to use PORFLOW modeling to evaluate vertical well placement in addition to plan view maps that present results of particle tracking, which are more useful to inform lateral placement of wells
- The NRC staff indicated that the DOE should consider using backwards particle tracking to support environmental monitoring report conclusions regarding the source of contaminant plumes

2.7.3 Conclusions and Follow-Up Action Items:

The NRC staff will continue to monitor the DOE TFs closure activities. There were no FUALs that resulted from the technical discussion.

2.8 Technical Discussion – *The DOE and NRC Contractor Research*

2.8.1 Observation Scope:

The technical discussion supported the NRC monitoring of the DOE disposal actions to assess compliance with all of the 10 CFR Part 61 performance objectives. The technical discussion was relevant to most of the monitoring areas and monitoring factors in the TFs Monitoring Plan, Rev. 0.

2.8.2 Observation Results:

The DOE and the NRC staff discussed the recent DOE research and the NRC contractor, Center for Nuclear Waste Regulatory Analyses (CNWRA), research that has been conducted or that is still ongoing. The key points from the technical discussion were:

- The DOE discussed research in the following documents:
 - *FY 2018 Performance Assessment Maintenance Plan* (SRR-CWDA-2017-00096), Rev. 0, [ADAMS Accession No. ML18067A594]

- *Lysimeter Testing* – both experimental work (SRRA021685-000008, Rev. 0) [ADAMS Accession No. ML18067A486] and analysis (SRRA021685-000009, Rev. 0) [ADAMS Accession No. ML18067A509]
- *Revised Geochemical Data Package* (SRNL-STI-2009-00473, Rev. 1) [ADAMS Accession No. ML17047A417]
- The NRC staff discussed research conducted by the CNWRA, including its survey of drilling companies and its Radon (Rn) basement model:
 - the CNWRA is conducting a survey of well drilling companies on technologies, behaviors, and practices to inform the inadvertent intruder calculations
 - the DOE inquired about their performance in addressing the monitoring factor priority table in the TFs Monitoring Plan, Rev. 0 and about where the DOE should focus its future research
 - the NRC staff discussed the monitoring factors in the priority table in the TFs Monitoring Plan, Rev. 0
 - the NRC staff responded that the *Tank 18 Special Analysis Document* TRR [ADAMS Accession No. ML12240A179] provided what the DOE needs to do with respect to Pu in Tank 18 because it has now been determined that the solubility of Pu is risk-significant
 - the DOE requested that any publicly available documents of CNWRA Tank Grout research be provided and the NRC staff indicated that they will consider distributing the CNWRA Reports through the WIR ListServ

2.8.3 Conclusions and Follow-Up Action Items:

The NRC staff will continue to monitor the DOE TFs closure activities. There were no FUAIs that resulted from the technical discussion.

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

3.1 Overall Conclusions:

The information gathered during TFs Observation 2018-01 will be used for multiple NRC TRRs and future OOVs, based on the topics discussed. There is no change to the overall conclusions from either the NRC 2011 FTF TER or the NRC 2014 HTF TER regarding compliance of DOE disposal actions with the 10 CFR Part 61 performance objectives.

During the OOV, the NRC staff appreciated the DOE technical discussions and tour, as well as its preparation for the OOV. The NRC expects that that the DOE will take into consideration the NRC staff information that was provided during the OOV.

3.2 Status of Monitoring Factors in TFs Monitoring Plan, Rev.0

TFs Observation 2018-01 is the eighth OOV for the TFs. The NRC staff did not close any monitoring factors based on this OOV. Therefore, all 26 TFs monitoring factors from the TFs Monitoring Plan, Rev. 0 are still open.

3.3 Status of Open Issues for TFs Monitoring:

All previous NRC concerns were rolled into the monitoring factors in the 2015 TFs Monitoring Plan, Rev. 0. There were no TFs Open Issues at the beginning of TFs Observation 2018-01. The NRC staff did not open any new Open Issues during this OOV.

3.4 Status of Open Follow-Up Action Items from Previous TFs OOV Reports:

There were seven previous NRC TFs OOVs. All of the FUAIs from those OOVs were closed prior to TFs Observation 2018-01.

3.5 Status of Open Follow-Up Action Items from Clarifying Teleconference Calls and Technical Teleconference Calls:

All but four FUAIs from previous clarification teleconference calls and technical teleconference calls were closed during TFs Observation 2018-01. The four FUAIs that are still open are from the May 17, 2016, teleconference call:

- #1: The DOE will gather information regarding the Tank 16 clean cap specification, explicitly whether Daratard or admixtures are used to increase flowability of the grout at a specified water:cement ratio.
- #2: The DOE will gather information to explain why compressive strength measurements are not required for the clean cap grout.
- #4: The DOE will provide attachments to work orders 01324150-64 and 01337683-33, as well as references related to the transition to use and testing of Grade 120 slag.
- #5: The DOE will gather information to clarify the testing of Grade 120 slag.

3.6 Summary of Follow-Up Action Items Opened During this Onsite Observation Visit:

The table below contains the seven FUAIs that were opened during TFs Observation 2018-01, including a unique NRC identifier for each FUAI:

Unique Identifier	FUAI
TFs-CY18-01-001	The DOE to provide the NRC with the <i>Annual Radioactive Waste Tank Inspection Program Report</i> [SRR-STI-2018-00146]
TFs-CY18-01-002	The DOE to provide the NRC with the <i>Tank 12 Final Configuration Report</i> [SRRCWDA-2016-00068]
TFs-CY18-01-003	The DOE to provide the NRC with the briefing material: <i>SRS Tank 12H Residual Radionuclide Release Testing Status</i> [SRNL-MS-2018-00142]
TFs-CY18-01-004	The DOE to provide the NRC with the <i>Annual 2017 TFs Groundwater Monitoring Report</i> [SRR-RP-2018-00226]
TFs CY18-01-005	The DOE to provide the NRC with a listing of documents with information about GSA electromagnetic borehole flowmeter-derived hydraulic conductivity data
TFs CY18-01-006	The DOE to provide the NRC with available documents from listing of follow-up items from the Tank 12 and Tank 16 Grouting TRR (ML16231A444)
TFs CY18-01-007	The NRC to hold teleconference with the DOE to follow-up on items from the Tank 12 and Tank 16 Grouting TRR (ML16231A444)

3.7 Issuance of NRC Technical Review Reports:

Between the previous OOV in 2016 and TFs Observation 2018-01, the NRC issued the following three TRRs related to the TFs:

Unique Identifier	Title	Date / Accession No.	No. of FUAIs
TFs-TRR-012	<i>Technical Review: Tanks 16H and 12H Grouting Operations with Emphases on Specifications, Testing, Recommendations and Placement Procedures</i>	09/06/16 / ML16231A444	18
TFs-TRR-013	<i>Technical Review: Final Inventory and Special Analysis Documentation for Tank 12H</i>	01/08/18 / ML17277B235	0
TFs-TRR-014	<i>Technical Review: Environmental Monitoring Reports For F-Area And H-Area Tank Farm Facilities</i>	04/20/18 / Pck: ML18051B154 Ltr: ML18051B009 Rpt: ML18051B153	0

All but six FUAIs from NRC issued TRRs were closed during TFs Observation 2018-01. The six FUAIs that are still open are from the *Tank 12 and Tank 16 Grouting TRR*:

- #5: The DOE will gather information regarding the impact of caustic solution on clean cap grout reactivity and flowability.

- #7: The DOE will provide data and information on Grade 120 tank grout wet chemistry test, flow test, compressive strength test, bleed test, and heat of hydration charted over time.
- #8: The DOE will clarify if the same strategy with respect to disposal of chromate-laden flushwater was used in Tank 12 as was used in Tank 16. The DOE will also provide any related work orders.
- #9: The DOE will provide a copy of SDDR No. 13307 and associated deviation disposition documents.
- #10: The DOE will provide clarification regarding the approach used for grouting the Tank 12 ventilation duct (see SRR-LWE-2014-00147).
- #11: The DOE will provide reference documents and confirmation to the NRC for the maximum drop height for Tank 12. The NRC staff will review the final configuration report for Tank 12 to see if any additional information is needed regarding Tank 12 grouting.

4.0 PARTICIPANTS:

U.S. NRC	SCDHEC	U.S. DOE	DOE Contractors
George Alexander	Leigh Beatty	Daniel Ferguson	Kevin Boerstler
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NRC Contractor			Larry Romanowski
Cynthia Dinwiddie			Kent Rosenberger
			Steve Thomas
			Jeff Thibault

5.0 REFERENCES:

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

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

U.S. Department of Energy (DOE), DOE Manual 435.1-1, Change 1, "Radioactive Waste Management Manual," June 2001. ML15022A083

____ DOE Order 435.1, Change 1, "Radioactive Waste Management," August 2001. ML15022A088

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

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

_____ SRR-CWDA-2012-00011, Rev. 0, "Features, Events, and Processes for Liquid Waste Performance Assessments," February 2012. ML17354A268

_____ SRR-CWDA-2012-00022, Rev. 0, "Evaluation of Features, Events, and Processes in the F-Area Tank Farm Performance Assessment," February 2012. ML18220B368

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

_____ DOE-WD-2012-001, Rev. 0, "DOE Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site," March 2012. ML121140043

_____ SRR-CWDA-2010-00128, Rev. 1, "Performance Assessment for the H-Area Tank Farm at the Savannah River Site," November 2012. Separate files in ADAMS Package: ML13044A313

_____ DOE/SRS-WD-2013-001, Rev. 0, "DOE Draft Basis for Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site," February 2013. ML13045A504

_____ DOE/SRS-WD-2014-001, Rev. 0, "DOE Basis for Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site," December 2014. ML15051A353

_____ DOE-WD-2014-001, Rev. 0, "DOE Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site," December 2014. ML15051A352

_____ SRNL-MS-2018-00142," Briefing: SRS Tank 12H Residual Radionuclide Release Testing Status," August 2018. ML18235A252

_____ SRR-CWDA-2018-00047, Rev. 1, "Presentation for Savannah River Site Tank Farms NRC Onsite Observation Visit," August 2018. ML18247A080

U.S. Nuclear Regulatory Commission (NRC), "Technical Evaluation Report for F-Area Tank Farm Facility, Savannah River Site, South Carolina," Rev. 0, October 2011. ML112371715

_____ "NRC 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," Rev. 0, January 2013. ML12212A192

_____ "Technical Evaluation Report for H-Area Tank Farm Facility, Savannah River Site, South Carolina," Rev. 0, June 2014. ML14094A514

_____ "NRC Plan for Monitoring Disposal Actions Taken by the U.S. Department of Energy at the Savannah River Site F-Area and H-Area Tank Farm Facilities in Accordance with the National Defense Authorization Act for Fiscal Year 2005," Rev. 0, October 2015. ML15238A761

_____ “Technical Review: Tanks 16H and 12H Grouting Operations with Emphases on Specifications, Testing, Recommendations and Placement Procedures,” September 2016. ML16231A444

_____ “Technical Review: Final Inventory and Special Analysis Documentation for Tank 12H,” January 2018. ML17277B235

_____ “Technical Review: Environmental Monitoring Reports for F-Area and H-Area Tank Farm Facilities,” April 2018. Package-ML18051B154; Ltr-ML18051B009, and Rpt-ML18051B153

_____ “Guidance for the August 13 – 14, 2018, Monitoring Onsite Observation Visit to the Savannah River Site Tank Farms,” July 2018. ML18192A328