UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 15, 2016

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

SUBJECT: THE U.S. NUCLEAR REGULATORY COMMISSION'S APRIL 19 – 21, 2016, ONSITE OBSERVATION VISIT REPORT FOR THE SAVANNAH RIVER SITE SALTSTONE DISPOSAL FACILITY (DOCKET NUMBER: PROJ0734)

Dear Ms. Ridley:

The enclosed onsite observation visit (OOV) report describes the U.S. Nuclear Regulatory Commission (NRC) OOV on April 19 – 21, 2016, at the Savannah River Site (SRS) Saltstone Disposal Facility (SDF). That 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 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 five 10 CFR Part 61 Subpart C performance objectives are: (i) §61.40 (General Requirements); (ii) §61.41 (Protection of the General Population from Releases of Radioactivity); (iii) §61.42 (Protection of Individuals Against Inadvertent Intrusion); (iv) §61.43 (Protection of Individuals During Operations); and (v) §61.44 (Stability of the Closure Site After Closure). That was the eighteenth SDF OOV since the NRC began monitoring the DOE SDF disposal actions under NDAA Section 3116(b) in October 2007.

The main activities conducted during the April 2016 SDF OOV were tours and technical discussions. The two tours were focused on: (i) viewing Saltstone Disposal Structure (SDS) 3A, SDS 3B, SDS 5A, SDS 5B, viewing construction of SDS 6, viewing Z-Area perimeter, and viewing intersection of the road with McQueen Branch and Upper Three Runs; and (ii) the saltstone cementitious property testing at Savannah River Ecology Laboratory (SREL). The five technical discussions were focused on: (i) DOE SDF operating status and disposal structure status; (ii) routine documentation and Follow-Up Action Items from previous NRC monitoring activities; (iii) groundwater monitoring report and characterization data; (iv) discussion of select DOE responses to NRC Request for Additional Information Questions (RAIs) on the DOE SDF Fiscal Year 2014 Special Analysis Document; and (v) DOE research results update.

Those OOV activities were consistent with the activities described in the NRC Observation Guidance Memorandum for the April 2016 SRS SDF OOV (dated March 21, 2016,) [available via the NRC Agencywide Documents Access and Management System (ADAMS) at Accession No. ML16074A343]. That Guidance Memorandum was developed using the SDF Monitoring Plan, Rev. 1 (dated September 2013) [ADAMS Accession No. ML13100A113]. The SDF Monitoring Plan contains the monitoring areas and monitoring factors, which describe how the

NRC will monitor the DOE SDF disposal actions to assess compliance with the performance objectives. As described in the 2013 SDF Monitoring Plan, the NRC monitoring activities to assess DOE compliance with §61.41, §61.42, §61.43, and §61.44 will be evaluated through a risk-informed process using technical reviews, data reviews, and onsite observation visits. In addition, the 2013 SDF Monitoring Plan states, "[if] the NRC concludes with reasonable assurance that DOE complies with §61.41, §61.42, §61.43, and §61.44, then NRC will also conclude with reasonable assurance that DOE complies with §61.40. Thus, the April 2016 SDF OOV was part of the NRC's overall monitoring approach to assess DOE compliance with the performance objectives.

If there is a significant concern that NRC staff identifies during monitoring, then the NRC may establish an "Open Issue" to document that concern and communicate that concern early to the DOE of the need for DOE to perform corrective actions before the NRC issues a Notification Letter. There were no SDF Open Issues before the April 2016 OOV and there were no SDF Open Issues identified during the April 2016 OOV. Thus, there are currently no SDF Open Issues.

All previous NRC concerns have been rolled into the monitoring factors in the 2013 SDF Monitoring Plan. During the monitoring process, the NRC does expect to open and close both monitoring areas and monitoring factors. Based on the April 2016 SDF OOV, the NRC has not: (i) closed any of the 10 SDF monitoring areas; (ii) closed any of the 73 SDF monitoring factors (specific to a performance objective); or (iii) changed the NRC 2012 Technical Evaluation Report (TER) overall conclusions.

During the monitoring process, the NRC does expect to open and close Follow-Up Action Items during OOVs and clarification teleconference calls. Most of those Follow-Up Action Items are specific short-term actions to be performed by the NRC or the DOE. Usually, most of those Follow-Up Action Items are closed before the next OOV or clarification teleconference call.

A main focus of the NRC staff performing an OOV under NDAA monitoring at the SDF is both the NRC 2012 TER [ADAMS Accession No. ML121020140] and the NRC Type-IV Letter of Concern [ADAMS Accession No. ML120650576], which were both issued on April 30, 2012, and both pertain to waste disposal at the SRS SDF. The NRC 2012 TER concluded that the NRC did not have reasonable assurance that salt waste disposal at the SDF met the performance objective of §61.41. The NRC Type-IV Letter of Concern formally communicated the NRC concerns to both the DOE and the South Carolina Department of Health and Environmental Control (i.e., South Carolina regulator of SRS). The DOE provided responses to the NRC Type-IV Letter to the NRC in multiple submittals. Those submittals included an updated technetium-99 (Tc-99) inventory projection for the constructed disposal structures similar in design to SDS 2A (i.e., SDS 2A, SDS 2B, SDS 3A, SDS 3B, SDS 5A, SDS 5B) and information about the DOE Case K and Case K1 uncertainty and sensitivity analyses.

In August 2012, the NRC issued a letter of acknowledgement to the DOE [ADAMS Accession No. ML12213A447], which included that: "… the NRC staff concludes that a Type-II Letter to the U.S. Congress is not needed at this time." Based on the NRC TER and the DOE revised Tc-99 inventory, the NRC staff determined that, if the DOE new projected Tc-99 inventory for the constructed disposal structures was correct, then it was unlikely that the salt waste disposal into those disposal structures would cause an off-site peak dose exceeding the requirements of §61.41 (i.e., 0.25 mSv/yr (25 mrem/yr)). However, the NRC Type-IV Letter and the NRC 2012

TER conclusion that the NRC did not have reasonable assurance that salt waste disposal at the SDF met the performance objective of §61.41 is still in place because that NRC conclusion refers to the projected dose from the entire SDF, not just the projected dose from disposal structures SDS 1, SDS 2A, SDS 2B, SDS 3A, SDS 3B, SDS 4, SDS 5A, and SDS 5B. Those disposal structures, which had already been constructed at the time of the NRC 2012 TER, were the only disposal structures covered by that NRC determination about the new Tc-99 inventory in that August 2012 NRC letter of acknowledgement to the DOE.

The NRC and the DOE continue to work in the monitoring process to resolve all outstanding concerns that led to issuance of the NRC Type-IV Letter of Concern. In addition, the NRC conducts routine monitoring activities described in the 2013 SDF Monitoring Plan that are not directly related to the specific issues in the NRC Type-IV Letter of Concern. In accordance with the requirements of NDAA Section 3116(b), the NRC will continue to monitor the DOE disposal actions at SRS SDF.

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

Sincerely,

/RA/

Andrea Kock, Deputy 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:
WIR Service List
WIR e-mail Contacts List

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

Sincerely,

/RA/

Andrea Kock, Deputy 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:
WIR Service List
WIR e-mail Contacts List

DISTRIBUTION:
RL Gladney GAlexander HArlt KPinkston MRoberts/Region I

ADAMS Accession No. ML16147A197

OFFFICE	DUWP:PM	DUWP:TL	DUWP:LA	PAB:BC	LLWB:BC	DUWP:DDD
NAME	HFelsher	CRidge	TMoon	CMcKenney	GSuber	AKock
DATE	05/26/16	05/27/16	05/31/16	06/02/16	06/29/16	7/15/16

OFFICIAL RECORD COPY

U.S. NUCLEAR REGULATORY COMMISSION
APRIL 19 – 21, 2016, ONSITE OBSERVATION VISIT REPORT FOR
THE SAVANNAH RIVER SITE SALTSTONE DISPOAL FACILITY

<u>EXECUTIVE SUMMARY</u>:

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its eighteenth onsite observation visit (OOV) to the Saltstone Disposal Facility (SDF) at the Savannah River Site (SRS) on April 19 – 21, 2016 (SDF Observation 2016-01). That was the first SDF OOV in Calendar Year (CY) 2016. On every OOV to SRS, the 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). Please see the attachment to this OOV report for the detailed technical information from this OOV.

For this OOV, the NRC focused on the monitoring areas and monitoring factors in the SDF Monitoring Plan, Rev. 1 (September 2013). This is the fourth SDF OOV under SDF Monitoring Plan, Rev. 1. All NRC concerns prior to the 2013 SDF Monitoring Plan were rolled into the monitoring factors in the 2013 SDF Monitoring Plan. The NRC performs monitoring activities in coordination with South Carolina, therefore the South Carolina Department of Health and Environmental Control (SCDHEC) staff also participated in the OOV and received the same information from the U.S. Department of Energy (DOE) as the NRC received from the DOE during the OOV.

As described in the Observation Guidance Memorandum for the OOV, the main activities conducted were tours and technical discussions between the DOE (i.e., includes DOE contractors throughout this OOV report), the NRC, and the SCDHEC. The two tours were focused on: (i) viewing Saltstone Disposal Structure (SDS) 3A, SDS 3B, SDS 5A, SDS 5B, viewing construction of SDS 6, viewing Z-Area perimeter, and viewing intersection of the road with McQueen Branch and Upper Three Runs; and (ii) the saltstone cementitious property testing at the Savannah River Ecology Laboratory (SREL). The five technical discussions were focused on: (i) DOE SDF operating status and disposal structure status; (ii) routine documentation and Follow-Up Action Items from previous NRC monitoring activities; (iii) groundwater monitoring report and characterization data; and (iv) discussion of select DOE responses to NRC Request for Additional Information Questions (RAIs) on the DOE SDF Fiscal Year (FY) 2014 Special Analysis Document; and (v) DOE research results update. This OOV report provides a description of the activities during the OOV, including observations made by the NRC.

The NRC does not expect to close any of the 73 SDF monitoring factors (specific to a specific performance objective) or change the NRC 2012 Technical Evaluation Report (TER) overall conclusions as a result of the OOV. There were no SDF Open Issues before the OOV and there were no SDF Open Issues identified during the OOV. Thus, there are currently no SDF Open Issues. The NRC and the DOE continue to work in the monitoring process to resolve all outstanding concerns that led to issuance of the NRC Type-IV Letter of Concern.

Enclosure

The NRC received the updated DOE presentation (SRR-CWDA-2016-00052, Rev. 1) that pertained to the activities during the OOV. That DOE presentation is accessible via the NRC Agencywide Documents Access and Management System (ADAMS), via Accession No. ML16134A185. As a followup to the OOV, the NRC staff held a telecon with DOE to discuss questions about the DOE research presented during the OOV. Those NRC questions are included at the end of the "Detailed Technical Information" at the end of this document.

1.0 BACKGROUND:

Section 3116(a) of the National Defense Authorization Act for Fiscal Year 2005 (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 March 31, 2005, the DOE submitted to the NRC the *Draft Section 3116 Determination for Salt Waste Disposal Savannah River Site* (DOE-WD-2005-001, Rev. 0) [ADAMS Accession No. ML051020072] to demonstrate compliance with the NDAA criteria, including demonstration of compliance with the performance objectives in 10 CFR Part 61, Subpart C. In its consultation role, the NRC staff reviewed the draft waste determination. In the NRC TER issued in December 2005 [ADAMS Accession No. ML053010225], the NRC documented the results of its review and concluded that there was reasonable assurance that the applicable criteria of NDAA could be met, provided certain assumptions made in the DOE analyses were verified via monitoring. Taking into consideration the assumptions, conclusions, and recommendations in the NRC 2005 TER, the DOE issued the final waste determination in January 2006 (DOE-WD-2005-001, Rev. 1) [ADAMS Accession No. ML102850319].

The DOE submitted a revised Performance Assessment (PA) to the NRC in 2009 (SRR-CWDA-2009-00017) [ADAMS Accession No. ML101590008]. The NRC staff reviewed SRR-CWDA-2009-00017, including holding public meetings, sending requests for additional information, and reviewing the DOE responses. On April 30, 2012, the NRC issued both a new TER [ADAMS Accession No. ML121020140] and a Type-IV Letter of Concern [ADAMS Accession No. ML120650576]. In the 2012 TER, the NRC concluded that it did not have reasonable assurance that the DOE salt waste disposal at the SDF met the performance objectives in 10 CFR Part 61, specifically 10 CFR 61.41. The NRC Type-IV Letter of Concern formally communicated the NRC concerns to both the DOE and the SCDHEC (i.e., South Carolina regulator of SRS).

In July 2012, the DOE responded to the NRC Type-IV Letter in multiple submittals. Those submittals [ADAMS Accession Nos. ML12198A258 and ML12215A081] included an updated technetium-99 (Tc-99) inventory projection for the constructed disposal structures similar in design to Saltstone Disposal Structure (SDS) 2A (i.e., SDS 2A, SDS 2B, SDS 3A, SDS 3B, SDS 5A, SDS 5B) and information about the DOE Case K and Case K1 uncertainty and sensitivity analyses. In August 2012, the NRC issued a letter of acknowledgement to the DOE, which included that: "… the NRC staff concludes that a Type-II Letter to the U.S. Congress is not needed at this time." Based on the NRC 2012 TER and the DOE revised Tc-99 inventory, the NRC staff determined that, if the DOE new projected Tc-99 inventory for the constructed disposal structures was correct, then it was unlikely that the salt waste disposal into those disposal structures would cause an off-site peak dose exceeding the requirements of §61.41 (i.e., 0.25 mSv/yr (25 mrem/yr)). However, the NRC Type-IV Letter and the NRC 2012 TER conclusion that the NRC did not have reasonable assurance that salt waste disposal at the SDF met the performance objective of §61.41 is still in place because that NRC conclusion refers to the projected dose from the entire SDF, not just the projected dose from disposal structures SDS 1, SDS 2A, SDS 2B, SDS 3A, SDS 3B, SDS 4, SDS 5A, and SDS 5B. Those disposal structures, which had already been constructed at the time of the NRC 2012 TER, were the only disposal structures covered by that NRC determination about the new Tc-99 inventory in that August 2012 NRC letter of acknowledgement to the DOE.

To carry out its monitoring responsibility under NDAA Section 3116(b), the NRC, in coordination with SCDHEC, performs three activities: (1) technical reviews, (2) OOVs, and (3) data reviews. Those activities focus on both: (1) key modeling assumptions identified in the NRC SDF Monitoring Plan, Rev. 1; and (2) the DOE disposal actions. Specifically, technical reviews generally focus on reviewing information generated to provide support for key assumptions that the DOE made in the SDF PA or supplements, such as special analysis documents. OOVs generally focus on either: (1) observing the collection of data and reviewing the data to assess consistency with assumptions made in the SDF final Waste Determination; or (2) observing key disposal or closure activities related to technical review areas. 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.

Information in an OOV report is relevant to all aspects of the NRC monitoring activities. The NRC will use the information in an OOV report to evaluate whether or not DOE disposal actions at the SDF comply with the performance objectives, whether to open new or close current SDF monitoring areas, and whether to open new or close current SDF 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 Follow-Up Action Item 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 technical review reports or technical evaluation reports and both types of those reports would be publicly available. The issues evaluated in technical review reports and technical evaluation reports will either be directly related to the issues in the NRC Type-IV Letter or will be related to routine NRC monitoring activities that are described in the 2013 SDF Monitoring Plan.

2.0 <u>NRC ONSITE OBSERVATION VISIT ACTIVITIES</u>:

On March 21, 2016, the NRC issued the Observation Guidance [Accession No. ML16074A343] for the April 19 – 21, 2016, OOV, SDF Observation 2016-01. An Observation Guidance is a plan for what NRC expects to cover during an OOV, which may be changed based on what happens during the OOV. Please see the attachment to this OOV report for the detailed technical information about this OOV.

The OOV began with a short briefing on the agenda presented by the DOE contractor, Savannah River Remediation (SRR) that was attended by representatives from the DOE, the NRC, and the SCDHEC. Afterwards, there were welcoming remarks and introductions. The rest of the OOV consisted of tours and technical discussions. The two tours were focused on: (i) viewing SDS 3A, SDS 3B, SDS 5A, SDS 5B, viewing construction of SDS 6, viewing Z-Area perimeter, and viewing intersection of the road with McQueen Branch and Upper Three Runs; and (ii) the saltstone cementitious property testing at the SREL. The purpose of the tour of the SDF was to observe as-built conditions of the disposal structures for comparison to the previous information submitted by the DOE. The purpose of the tour of the McQueen Branch and Upper Three Runs was to better understand the site hydrology related to Monitoring Area 8 (Environmental Monitoring). The five technical discussions were focused on: (i) DOE SDF operating status and disposal structure status; (ii) routine documentation and Follow-Up Action Items from previous NRC monitoring activities; (iii) groundwater monitoring report and characterization data; and (iv) discussion of select DOE responses to NRC RAIs on the DOE SDF FY 2014 Special Analysis Document; and (v) DOE research results update. In addition, as a followup to the OOV, the NRC staff held a telecon with DOE to discuss questions about the DOE research presented during the OOV.

2.1 Technical Discussion – DOE SDF Operating Status and Disposal Structure Status:

2.1.1 Observation Scope:

The technical discussion supported the NRC monitoring of the DOE disposal actions to assess compliance with 10 CFR 61.41, 10 CFR 61.42 and 10 CFR 61.43. The technical discussion was most relevant to the following monitoring areas (MAs) and monitoring factors (MFs) in SDF Monitoring Plan, Rev. 1:

- MA 1 (Inventory):
    - MF 1.01 (Inventory in Disposal Structures)
- MA 3 (Waste Form Hydraulic Performance):
    - MF 3.02 (Variability of Field-Emplaced Saltstone)
    - MF 3.03 (Applicability of Laboratory Data to Field-Emplaced Saltstone)
- MA 4 (Waste Form Physical Degradation):
    - MF 4.02 (Waste Form Macroscopic Fracturing)
- MA 8 (Environmental Monitoring):
    - MF 8.01 (Leak Detection)
- MA 11 (Radiation Protection Program):
    - MF 11.01 (Dose to Individuals During Operations)

2.1.2 Observation Results:

The DOE presented an overview of the SDF operating status and disposal structure status (SRR-CWDA-2016-00052) [ADAMS Accession No. ML16134A185. The key points from the presentation and technical discussion were:

- The DOE provided the NRC staff with data that showed that the SDF worker doses continue to meet 10 CFR 61.43.
- The DOE expects to generate approximately 6.5 million gallons of saltstone (i.e., expects to process approximately 3.8 million gallons of salt waste) before disposal space in SDS 6 is needed:
  - The DOE estimated that the remaining space in SDS 3A, SDS 3B, SDS 5A, and SDS 5B should last approximately two years.
- The DOE is working with the U.S. Army Corps of Engineers to evaluate the extent and cause of cracks found in the floor and underside of the SDS 6 roof:
  - The report will be made publicly available.
  - The NRC staff commented that the SDS 6 cracking is not expected to delay the NRC TER for the DOE SDF FY 2014 Special Analysis Document because the NRC staff expects that the SDS 6 cracking will be addressed by the DOE in an Unresolved Waste Management Question Evaluation (UWMQE).
- The DOE has not seen evidence of rainwater intrusion into SDS 4 since the repairs to the roof were completed.

2.1.3 Conclusions and Follow-up Action Items:

The NRC staff will continue to monitor the DOE SDF activities. There were no Follow-Up Action Items that resulted from the technical discussion.

2.2 Technical Discussion – Routine Documentation and Follow-Up Action Items from Previous NRC Monitoring Activities:

2.2.1 Observation Scope:

The technical discussion supported the NRC monitoring of the DOE disposal actions to assess compliance with 10 CFR 61.41 and 10 CFR 61.42. The technical discussion was most relevant to the following MAs and MFs in SDF Monitoring Plan, Rev. 1:

- MA1 (Inventory):
  - MF 1.01 (Inventory in Disposal Structures)

- MA 5 (Waste Form Chemical Degradation):
    - MF 5.03 (Reducing Capacity of Saltstone)

2.2.2 Observation Results:

The key points from the technical discussion were:

- The DOE has changed the documentation process and three quarterly inventory updates have been grouped into one report (SRNL-STI-2015-00313).

- The future inventory updates will now be issued as memos instead of the previous lengthier reports:

    - The DOE anticipates that the memos will be completed closer to the end of each quarter than the reports historically have been.

- The DOE is currently processing Salt Batch 8 in the Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit (ARP/MCU):

    - Remnants of Salt Batch 7 in Tanks 49 and 50 have diluted the higher Technetium (Tc) concentrations of Salt Batch 8; however, the DOE expects Tc concentrations to increase soon.

- Regarding the slag used in emplaced saltstone:

    - The DOE still uses the ASTM C989 technical specification for slag used in emplaced saltstone, so the technical specification has not changed:

    - The DOE has used Grade 120 slag in emplaced saltstone and the DOE has observed no differences in heat generation.

    - The particle size distributions of Grade 120 slag and Grade 100 slag are very similar; however, the relative abundances of various elements, including calcium, are different.

2.2.3 Conclusions and Follow-up Action Items:

The NRC staff will continue to monitor the DOE SDF activities. The following Follow-Up Action Items resulted from the technical discussion:

- The DOE to provide the NRC with the following documents:

    - “Annual Review: Saltstone Disposal Facility (Z-Area) Performance Assessment” (SRR-CWDA-2015-00163);

    - “Results for the First, Second, and Third Quarter Calendar Year 2015 Tank 50H Waste Acceptance Criteria Slurry Samples” (SRNL-STI-2015-00313); and

  - "Results for the Fourth Quarter Calendar Year 2015 Tank 50H Salt Solution Sample" (SRNL-L3100-2015-00227).

- The DOE to provide the NRC with the DOE Presentation, "Research Results/Status – Savannah River Site Salt Waste Disposal NRC Onsite Observation Visit April 2016" (SRR-CWDA-2016-00053, Rev. 1).

- The DOE to provide the NRC with the document "VSL15R3740-1."

- The DOE to provide the NRC with information regarding the grinding of blast furnace slag used in the VSL experiments in document "VSL15R3740-1."

2.3 Tours – SDS 3A, SDS 3B, SDS 4, SDS 5A, SDS 5B, Construction of SDS 6 , Z-Area Perimeter, and intersection of road with McQueen Branch and Upper Three Runs; and Saltstone Cementitious Property Testing at SREL:

2.3.1 Observation Scope:

The two tours supported the NRC monitoring of the DOE disposal actions to assess compliance with 10 CFR 61.41 and 10 CFR 61.42. The two tours were most relevant to the following MAs and MFs in SDF Monitoring Plan, Rev. 1:

- MA 2 (Infiltration and Erosion Control):
  - MF 2.02 (Erosion Protection)

- MA 3 (Waste Form Hydraulic Performance):
  - MF 3.01 (Hydraulic Conductivity of Field-Emplaced Saltstone)
  - MF 3.02 (Variability of Field-Emplaced Saltstone)
  - MF 3.03 (Applicability of Laboratory Data to Field-Emplaced Saltstone)

- MA 4 (Waste Form Physical Degradation):
  - MF 4.01 (Waste Form Matrix Degradation)

- MA 5 (Waste Form Chemical Degradation):
  - MF 5.01 (Radionuclide Release from Field-Emplaced Saltstone)
  - MF 5.02 (Chemical Reduction of Tc by Saltstone)
  - MF 5.05 (Potential for Short-Term Rinse Release from Saltstone)

- MA 6 (Disposal Structure Performance):
  - MF 6.01 (Certain Risk-Significant K_d Values in Disposal of Concrete)
  - MF 6.02 (Tc Sorption in Disposal Structure Concrete)
  - MF 6.03 (Performance of Disposal Structure Roofs and HDPE/GCL Layers)
  - MF 6.04 (Disposal Structure Concrete Fracturing)
  - MF 6.05 (Integrity of Non-Cementitious Materials)

- MA 8 (Environmental Monitoring):
    - MF 8.01 (Leak Detection)
    - MF 8.02 (Groundwater Monitoring)

- MA 10 (Performance Assessment Model Revisions):
    - MF 10.02 (Defensibility of Conceptual Models)

2.3.2 Observation Results:

The key points from the two tours were:

- The NRC staff and DOE observed the Upper Three Runs and the McQueen Branch each at two locations near the SDF from a vehicle:

    - The NRC staff and DOE discussed a future walk-down of the streams by NRC staff led by DOE.

- The NRC staff observed the perimeter of the SDF from a vehicle.

- The NRC staff observed SDS 6 from the construction observation platform and the DOE discussed with the NRC staff about:

    - Cracking in the SDS 6 floor and underside of the roof; and

    - Details of the HDPE placement and floor construction.

- While at the SREL, the NRC staff observed the apparatus for:

    - The dynamic leaching of the SDS 2A core samples and laboratory-prepared saltstone samples; and

    - The setup for the U.S. Environmental Protection Agency (EPA) Test Method 1315 leaching procedure.

- While at the SREL, the NRC staff observed the setup for testing disposal structure concrete exposed to a sulfate solution with and without protective coatings.

- While at the SREL, the NRC staff discussed with the DOE that exposing the disposal structure concrete samples for three months followed by compressive strength testing would not be conclusive with respect to degradation:

    - The NRC staff commented that previous DOE documents showed that after three months of exposure, surface spalling was observed; however, an important crack network was observed after eight months.

2.3.3 Conclusions and Follow-up Action Items:

The NRC staff will continue to monitor the DOE SDF activities. The following Follow-Up Action Items resulted from the two tours:

- The DOE to provide the NRC with SDS 6 settlement marker elevation data.

- The DOE to provide the NRC with pictures of SDS 6 and SREL experimental setups taken during the two tours.

2.4 Technical Discussion – Groundwater Monitoring Report and Characterization Data:

2.4.1 Observation Scope:

The technical discussion supported the NRC monitoring of the DOE disposal actions to assess compliance with 10 CFR 61.41 and 10 CFR 61.42. The technical discussion was most relevant to the following MAs and MFs in SDF Monitoring Plan, Rev. 1:

- MA 8 (Environmental Monitoring):
  - MF 8.02 (Groundwater Monitoring)

- MA 10 (Performance Assessment Model Revisions):
  - MF 10.01 (Implementation of Conceptual Models)
  - MF 10.02 (Defensibility of Conceptual Models)

2.4.2 Observation Results:

The key points from the technical discussion were:

- The NRC staff and DOE discussed potential sources of the groundwater contamination at the SDF:

  - The DOE discussed with the NRC staff contamination events from the past in different years at SDS 4, including the events at SDS 4 Cell G and the delay of several years between soil contamination and soil remediation near SDS 4.

- The NRC staff and DOE discussed the interface of the gutter system added to SDS 4 with underground drainage pipes at the SDF and the drainage ditches east of SDS 4:

  - In response to NRC staff questions, the DOE indicated that the drainage ditches east of SDS 4 could not be excluded as contributing to the Tc-99 plume; however, DOE would expect that source to be more dilute than the soil contamination near SDS 4.

- Based on the DOE presentation for the April 2016 OOV, the NRC staff notes in this OOV report that the correct years for when the huts were constructed around SDS 4 were

2008 to 2009, rather than the year 2011, which was the year noted in the NRC OOV report for the July 2015 OOV (ML15236A299).

- The DOE expects that the General Separations Area (GSA) groundwater model update will be completed by the end of FY 2016 (i.e., September 30, 2016).

- The following information was discussed during groundwater monitoring rather than as part of the DOE RAI Response discussion (see Section 2.6 of this OOV report):

    - Regarding the DOE Response to RAI FFT-2, the DOE clarified that the groundwater velocity of 1.7 feet/day assumed for the saturated zone in the 2009 DOE SDF PA was based on a 1996 report.

    - Regarding the DOE Response to RAI PAM-4, the NRC staff discussed with DOE the expectation that there will be more detailed information about projected erosion in Z-Area as part of a future DOE SDF PA update.

    - Regarding the DOE Response to multiple RAIs (e.g., Figure FFT-1.5), the DOE agreed with the NRC staff that wells in the Upper Three Runs Upper Zone (UTR-UZ) and Upper Three Runs Lower Zone (UTR-LZ) should not be represented together in water table maps of Z-Area.

    - The NRC staff and DOE discussed the DOE determination that the Gordon aquifer is recharged primarily from the UTR-LZ with a small amount of recharge flowing upward from the underlying aquifer.

2.4.3 Conclusions and Follow-up Action Items:

The NRC staff will continue to monitor the DOE SDF activities. The following Follow-Up Action Items resulted from the technical discussion:

- The DOE to provide the NRC with a revision of a slide entitled "Saltstone Timeline" that was used at an SRS Citizen's Advisory Board Meeting with the addition of: (i) timing for leaking of SDS 4 Cell G; (ii) cleanup of the leaked material; and (iii) building of the huts surrounding SDS 4.

- The DOE to provide the NRC with information showing the locations of the three 2014 Direct Push Technology (DPT) locations adjacent to SDS 4.

- The DOE to provide the NRC with the U.S. Geological Survey (USGS) Regional Groundwater Model covering Central Savannah River Area and SRS.

- The DOE to provide the NRC with the existing DOE report on E-Area closure cap impact on groundwater.

- The DOE to provide the NRC with the Z-Area slides provided by Greg Flach during discussions about the DOE RAI Responses for Far Field.

- The DOE to provide the NRC with plots for specific time periods related to Bullet #6 and Bullet #7 of RAI DSP-11 at 0, 5,000, 10,000, and 20,000 years, including closeups for the top of both the small and large cylindrical disposal structures as well as closeups for the saltstone within those disposal structures.

- The DOE to provide the NRC with a velocity field and cross-section through Z-Area.

2.5 Technical Discussion – DOE Research Update:

2.5.1 Observation Scope:

The technical discussion supported the NRC monitoring of the DOE disposal actions to assess compliance with 10 CFR 61.41 and 10 CFR 61.42. The discussion was most relevant to the following MAs and MFs in SDF Monitoring Plan, Rev. 1:

- MA 3 (Waste Form Hydraulic Performance):
  - MF 3.01 (Hydraulic Conductivity of Field-Emplaced Saltstone)
  - MF 3.02 (Variability of Field-Emplaced Saltstone)
  - MF 3.03 (Applicability of Laboratory Data to Field-Emplaced Saltstone)
  - MF 3.04 (Effect of Curing Temperature on Saltstone Hydraulic Properties)

- MA 4 (Waste Form Physical Performance):
  - MF 4.01 (Waste Form Matrix Degradation)
  - MF 4.02 (Waste Form Macroscopic Fracturing)

- MA 5 (Waste Form Chemical Degradation):
  - MF 5.01 (Radionuclide Release from Field-Emplaced Saltstone)
  - MF 5.02 (Chemical Reduction of Tc by Saltstone)
  - MF 5.05 (Potential for Short-Term Release from Saltstone)

2.5.2 Observation Results:

The key points of the technical discussion were:

- The DOE compared data collected from SDS 2A cores (i.e., cores) to the data collected from laboratory-prepared simulated saltstone samples (i.e., laboratory-prepared samples) including the following:

  - Density, porosity, and water content;

  - Saturated hydraulic conductivity;

  - Tc-99 solubility;

  - Iodine-129, Tc-99, and Strontium-90 sorption coefficients (i.e., K_d values);

  - Tc-99 leaching with EPA Test Method 1315;

  - Dynamic leaching of Tc-99; and
  - Suitability of tests with rhenium as surrogate for tests with Tc-99.

- The DOE Research indicated the following:

  - The total porosity of cores was slightly higher than the total porosity of laboratory-prepared samples (i.e., 65.8 compared to 59.8), while density and water content were comparable between the two datasets.

  - The saturated hydraulic conductivity of cores were all lower than the value of 6.4 x 10^{-9} centimeters/second (cm/s) that was assumed in the DOE SDF FY 2014 Special Analysis Document:

    - Due to the large number of measurements below the detection limit of 1.0 x 10^{-9} cm/s in both datasets, it was difficult to compare data from the cores to data from the laboratory-prepared samples for saturated hydraulic conductivity.

  - The average Tc-99 solubility measured for cores in an anoxic environment was a factor of 2 higher than was assumed in the DOE SDF FY 2014 Special Analysis Document (i.e., 2.23 x 10^{-8} moles/liter (mol/L) compared to 1.0 x 10^{-8} mol/L) while values under both oxic and anoxic conditions were similar for both datasets.

  - The values for Iodine-129 desorption from cores were lower than was assumed in the DOE SDF FY 2014 Special Analysis Document (i.e., 0.0 to 0.3 mL/gram (mL/g) compared to 9 to 15 mL/g).

  - The values of Tc-99 leaching from cores using EPA Test Method 1315 were slightly less than leaching from laboratory-prepared samples.

  - The values of dynamic leaching of Tc-99 from cores were approximately a factor of 5 to 10 greater than leaching from laboratory-prepared samples.

  - The tests conducted with rhenium were not a good surrogate for tests conducted with Tc-99.

2.5.3 Conclusions and Follow-Up Action Items:

The NRC staff will continue to monitor the DOE research plans and results. The NRC staff will continue to monitor the DOE SDF activities. The following Follow-Up Action Items resulted from the technical discussion:

- The DOE to provide the NRC with the SDS 2A Core analysis report when available.

- The DOE to provide the NRC with the results of disposal structure concrete testing when available.

2.6 Technical Discussion – Select DOE Responses to NRC RAIs on DOE SDF FY 2014 Special Analysis Document:

2.6.1 Observation Scope:

The technical discussion supports the NRC monitoring of the DOE disposal actions to assess compliance with 10 CFR 61.41, 10 CFR 61.42, 10 CFR 61.43, and 10 CFR 61.44. The technical discussion was relevant to most of the MAs and most of the MFs in SDF Monitoring Plan, Rev. 1.

2.6.2 Observation Results:

The key points of the technical discussion were:

- The NRC staff appreciated the thoroughness of the DOE RAI Responses and areas where additional clarification is needed are in the Follow-Up Action Items below.
- Certain areas related to the SDF conceptual model and Far-Field transport are outside the scope of the DOE SDF FY 2014 Special Analysis Document:
    - The NRC staff and DOE discussed the possibility that DOE would include that information in the next revision to the DOE SDF PA.

2.6.3 Conclusions and Follow-Up Action Items:

The NRC staff will continue to monitor the DOE SDF activities. The following Follow-Up Action Items resulted from the technical discussion:

- The DOE to provide the NRC with clarification of "HDPE/GCL Degradation" in DOE Response to RAI DSP-8 and an update to Figure 4.2-42 on page 217 of the 2009 DOE SDF PA.
- The DOE to provide the NRC with a chart showing Radium-226 levels corresponding to Figure 2.1-8 in SRR-CWDA-2014-00095, Rev. 1, "Saltstone Disposal Facility Sensitivity Modeling to Address Concerns Related to Saturated Zone Transport":
    - Note that the NRC expects that this will help explain the consistent difference in non-peak doses between the thicker vadose zone results and the others.
- The DOE to provide the NRC with information on which parameters fall under Bullet #6 of DOE Response to RAI CC-2.
- The DOE to provide the NRC with information on what radionuclides are driving doses in realizations shown in Figure 6.5-1 of the DOE SDF FY 2014 Special Analysis Document for doses greater than 500 millirem/year.

- The DOE to provide the NRC with additional information explaining the impact of reducing capacity (i.e., most conservative value) in the figures in DOE Response to RAI SP-2 vs. the figures in DOE Response to RAI SP-8.

- The DOE to provide to the NRC any additional information available regarding oxygen levels in soil.

- The DOE to provide the NRC with a sensitivity analysis for selenium K_d in Far Field (i.e., as in DOE Response to RAI SP-11, including Far Field K_d value).

- The DOE to provide the NRC with additional information on the basis of cement leachate factors from SRNL-STI-2009-00473, Rev. 0, "Geochemical Data Package for Performance Assessment Calculations Related to the Savannah River Site."

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 SDF Observation 2016-01 will be used for multiple NRC Technical Review Reports via memoranda, review of the DOE SDF FY14 Special Analysis Document, and future OOVs, based on the topics discussed. There is no change to the NRC staff overall conclusions from the 2012 TER regarding compliance of DOE disposal actions with the 10 CFR Part 61 performance objectives. The main key message from the OOV was that the combination of new data from the SDS 2A core samples and the DOE responses to the NRC RAI on the SDF FY 2014 Special Analysis will provide a good basis for the NRC TER. During the OOV, the NRC staff commented on the thoroughness of the DOE RAI responses. Areas where additional clarification was needed in the DOE RAI Responses were captured in the Follow-Up Action Items. Certain areas in the DOE RAI Responses related to the SDF conceptual model and Far-Field Transport are outside the scope of the DOE SDF FY 2014 Special analysis. The NRC staff and DOE discussed that DOE might include the information related to the SDF conceptual model and Far Field Transport in the next revision to the SDF PA. The NRC staff had questions about the DOE monitoring of the Tc-99 plume at the SDF and will follow up with the SCDHEC to discuss the State-regulated groundwater monitoring program.

3.2 Status of Monitoring Factors in SDF Monitoring Plan, Rev. 1:

SDF Observation 2016-01 is the fourth OOV under SDF Monitoring Plan, Rev. 1. The NRC staff did not close any monitoring factors during the OOV. Therefore, all 73 monitoring factors in SDF Monitoring Plan, Rev. 1 remain open.

3.3 Status of Open Issues for SDF Monitoring:

All previous NRC concerns were rolled into the Monitoring Factors in the 2013 SDF Monitoring Plan, Rev. 1. There were no SDF Open Issues at the beginning of SDF Observation 2016-01. The NRC staff did not open any new Open Issues during the OOV. Therefore, there are currently no SDF Open Issues.

3.4 Status of Open Follow-up Action Items from Previous SDF OOV Reports:

There were 17 previous NRC SDF OOVs. All but one of the Follow-Up Action Items from those OOVs were closed prior to SDF Observation 2016-01. That one Follow-Up Action Item was not closed during SDF Observation 2016-01:

- SDF-CY15-02-001 – *DOE will provide NRC with information on SDS 3A, SDS 3B, SDS 5A, and SDS 5B fill height restrictions related to resolution of mercury Potential Inadequacy in Safety Analysis*

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

All Follow-Up Action Items from previous clarification teleconference calls were closed prior to SDF Observation 2016-01.

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

The table below contains the 23 Follow-Up Action Items that were opened during SDF Observation 2016-01, including a unique NRC identifier for each Follow-Up Action Item:

Unique Identifier	Follow-Up Action Item
SDF-CY16-01-001	DOE to provide NRC with the following documents: • "Annual Review: Saltstone Disposal Facility (Z-Area) Performance Assessment" (SRR-CWDA-2015-00163); • "Results for the First, Second, and Third Quarter Calendar Year 2015 Tank 50H Waste Acceptance Criteria Slurry Samples" (SRNL-STI-2015-00313); and • "Results for the Fourth Quarter Calendar Year 2015 Tank 50H Salt Solution Sample" (SRNL-L3100-2015-00227).
SDF-CY16-01-002	DOE to provide NRC with DOE Presentation, "Research Results/Status – SRS Salt Waste Disposal NRC Onsite Observation Visit April 2016" (SRR-CWDA-2016-00053, Rev. 1).
SDF-CY16-01-003	DOE to provide NRC with the document "VSL15R3740-1."
SDF-CY16-01-004	DOE to provide NRC with information regarding the grinding of blast furnace slag used in the VSL experiments in document "VSL15R3740-1."
SDF-CY16-01-005	DOE to provide NRC with SDS 6 settlement marker elevation data.

Unique Identifier	Follow-Up Action Item
SDF-CY16-01-006	DOE to provide NRC with pictures of SDS 6 and SREL experimental setups taken during the two tours.
SDF-CY16-01-007	DOE to provide NRC with a revision of a slide entitled “Saltstone Timeline” that was used at an SRS Citizen’s Advisory Board Meeting with the addition of: (i) timing for leaking of SDS 4 Cell G; (ii) cleanup of the leaked material; and (iii) building of huts surrounding SDS 4.
SDF-CY16-01-008	DOE to provide NRC with information showing the locations of the three 2014 Direct Push Technology (DPT) locations adjacent to SDS 4.
SDF-CY16-01-009	DOE to provide NRC with the U.S. Geological Survey (USGS) Regional Groundwater Model covering Central Savannah River Area and SRS.
SDF-CY16-01-010	DOE to provide NRC with the existing DOE report on E-Area closure cap impact on groundwater.
SDF-CY16-01-011	DOE to provide NRC with the Z-Area slides provided by Greg Flach during discussions about the DOE RAI Responses for Far Field.
SDF-CY16-01-012	DOE to provide NRC with plots for specific time periods related to Bullet #6 and Bullet #7 of RAI DSP-11 at 0, 5,000, 10,000, and 20,000 years, including closeups for the top of both the small and large cylindrical disposal structures as well as closeups for the saltstone within those disposal structures.
SDF-CY16-01-013	DOE to provide NRC with a velocity field and cross-section through Z-Area.
SDF-CY16-01-014	DOE to provide NRC with the SDS 2A Core analysis report when available.
SDF-CY16-01-015	DOE to provide NRC with the results of disposal structure concrete testing when available.
SDF-CY16-01-016	DOE to provide NRC with clarification of “HDPE/GCL Degradation” in DOE Response to RAI DSP-8 and an update to Figure 4.2-42 on page 217 of the 2009 DOE SDF PA.
SDF-CY16-01-017	DOE to provide NRC with a chart showing Radium-226 levels corresponding to Figure 2.1-8 in SRR-CWDA-2014-00095, Rev. 1, “Saltstone Disposal Facility Sensitivity Modeling to Address Concerns Related to Saturated Zone Transport”.
SDF-CY16-01-018	DOE to provide NRC with information on which parameters fall under Bullet #6 of DOE Response to RAI CC-2.
SDF-CY16-01-019	DOE to provide NRC with information on what radionuclides are driving doses in realizations shown in Figure 6.5-1 of the DOE SDF FY 2014 Special Analysis Document for doses greater than 500 millirem/year.
SDF-CY16-01-020	DOE to provide NRC with additional information explaining the impact of reducing capacity (i.e., most conservative value) in the figures in DOE Response to RAI SP-2 vs. the figures in DOE Response to RAI SP-8.
SDF-CY16-01-021	DOE to provide to NRC any additional information available regarding oxygen levels in soil.

Unique Identifier	Follow-Up Action Item
SDF-CY16-01-022	DOE to provide NRC with a sensitivity analysis for selenium K_d in Far Field (i.e., as in DOE Response to RAI SP-11, including Far Field K_d value).
SDF-CY16-01-023	DOE to provide NRC with additional information on the basis of cement leachate factors from SRNL-STI-2009-00473, Rev. 0, "Geochemical Data Package for Performance Assessment Calculations Related to the Savannah River Site."

3.7 Issuance of NRC Technical Review Reports:

Between the previous OOV and SDF Observation 2016-01, the NRC issued no SDF Technical Review Report via memorandum.

4.0 PARTICIPANTS:

U.S. NRC	SCDHEC	U.S. DOE	SRR	SREL
George Alexander	Justin Koon	Dan Ferguson	Tim Coffield	John Seaman
Hans Arlt	Greg O'Quinn	Sherri Ross	Kent Fortenberry	
Harry Felsher	Scott Simons	Pat Suggs	Steve Hommel	**SRNL**
Christepher McKenney		Armanda Watson	Keith Liner	Greg Flach
Karen Pinkston			Larry Romanowski	
A. Christianne Ridge			Kent Rosenberger	**SRNS**
			Steve Simner	Gerald Blount
			Owen Stevens	Terry Killeen
			Steve Thomas	
			David Watkins	
			Leslie Wooten	

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.

National Research Council, "Assessment of the Performance of Engineered Waste Containment Barriers," 2007, The National Academies Press, Washington, D.C.

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.

_____ DOE-WD-2005-001, Rev. 0, “DOE Draft Basis for Section 3116 Determination Salt Waste Disposal at the Savannah River Site,” February 2005. ML051020072.

_____ DOE-WD-2005-001, Rev. 1, “DOE Basis for Section 3116 Determination Salt Waste Disposal at the Savannah River Site,” January 2006. ML102850319.

_____ K-ESR-Z-00002, Rev. 0, “Saltstone Disposal Cells No. 3 and 5 Geotechnical Investigations Report”, July 2009. ML102160523.

_____ “Response to NRC Letter of Concern (Type-IV) Regarding DOE Disposal Activities at the Savannah River Site Saltstone Disposal Facility,” July 2012. ML12198A258.

_____ “Additional Response to NRC Technical Evaluation Report for Revised Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site, South Carolina and the Letter of Concern,” July 2012. ML12215A081.

_____ SRNL-STI-2009-00473, Rev. 0, "Geochemical Data Package for Performance Assessment Calculations Related to the Savannah River Site," March 15, 2010. ML111600624.

_____ SRR-CWDA-2009-00017, Rev. 0, “Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site,” October 2009. ML101590008.

_____ “SRR-CWDA-2013-00062, Rev. 2, “Fiscal Year 2013 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site,” October 2013. ML14002A069.

_____ “SRR-CWDA-2013-00073, Rev. 2, “Updates to the Saltstone Disposal Facility Stochastic Fate and Transport Model,” August 2014. ML15225A473.

_____ “SRR-CWDA-2014-00006, Rev. 2, “Fiscal Year 2014 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site,” September 2014. ML15097A366.

_____ SRR-CWDA-2014-00095, Rev. 1, “Saltstone Disposal Facility Sensitivity Modeling to Address Concerns Related to Saturated Zone Transport,” January 2015. ML16106A245.

_____ SRR-CWDA-2014-00999, Rev. 1, “Comment Response Matrix for the U.S. NRC Staff Request for Additional Information on the Fiscal Year 2013 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site,” January 2015. ML15020A672.

_____ SRR-CWDA-2016-00004, Rev. 1, “Comment Response Matrix for the U.S. NRC Staff Request for Additional Information on the Fiscal Year 2014 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site,” March 2016. ML16105A043.

_____ SRR-CWDA-2016-00052, Rev. 1, “Presentation for Savannah River Site Salt Waste Disposal NRC Onsite Observation Visit,” April 2016. ML16134A185.

_____ WSRC-STI-2007-00184, Rev. 2, “FTF Closure Cap Concept and Infiltration Estimates,” October 2007. ML111240587.

U.S. Nuclear Regulatory Commission (NRC), “Technical Evaluation Report for Draft Waste Determination for Salt Waste Disposal,” December 2005. ML053010225.

_____ “NRC Plan for Monitoring Disposal Actions Taken by DOE at the Savannah River Site Saltstone Disposal Facility in Accordance with the National Defense Authorization Act for Fiscal Year 2005,” Rev. 0, May 2007. ML070730363.

_____ “NRC Staff Guidance for Activities Related to DOE Waste Determinations – Draft Final Report for Interim Use,” August 2007. ML072360184.

_____ “Technical Evaluation Report for the Revised Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site, South Carolina,” April 2012. ML121020140.

_____ “Letter of Concern (Type-IV) Regarding DOE Disposal Activities at the Savannah River Site Saltstone Disposal Facility,” April 2012. ML120650576.

_____ “Letter to Terrel Spears of DOE, Acknowledging Receipt of July 12, 2012, Letter Regarding NRC's Letter of Concern (Type-IV) Regarding Disposal at the Savannah River Site,” August 29, 2012. ML12213A447.

_____ “NRC Plan for Monitoring Disposal Actions Taken by DOE at the Savannah River Site Saltstone Disposal Facility in Accordance with the National Defense Authorization Act for Fiscal Year 2005,” Rev. 1, September 2013. ML13100A113.

_____ “NRC Comments and Requests for Additional Information on the ‘DOE Fiscal Year 2013 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site, SRR-CWDA-2013-00062, Rev. 2,’” June 2014. ML14148A153.

_____ “NRC Request for Additional Information Questions on the ‘DOE Fiscal Year 2014 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site, SRR-CWDA-2014-00006, Rev. 2,’” June 2015. ML15161A541.

_____ “NRC July 7 – 8, 2015, Onsite Observation Visit Report for the Savannah River Site Saltstone Disposal Facility,” September 2015. ML15236A299.

_____ “NRC Onsite Observation Guidance for April 19 – 21, 2016, Monitoring Visit to the Savannah River Site, Saltstone Disposal Facility,” March 21, 2016. ML16074A343.

DETAILED TECHNICAL INFORMATION FROM U.S. NUCLEAR REGULATORY COMMISSION APRIL 19 – 21, 2016, ONSITE OBSERVATION VISIT TO THE SAVANNAH RIVER SITE SALTSTONE DISPOAL FACILITY

Technical Discussion – DOE SDF Operating Status and Disposal Structure Status:

All information for the topic of this Section is in the main body of the OOV report.

Technical Discussion – Routine Documentation and Follow-Up Action Items from Previous NRC Monitoring Activities:

All information for the topic of this Section is in the main body of the OOV report.

Tours – SDS 3A, SDS 3B, SDS 4, SDS 5A, SDS 5B, Construction of SDS 6 , Z-Area Perimeter, and intersection of road with McQueen Branch and Upper Three Runs; and Saltstone Cementitious Property Testing at SREL:

All information for the topic of this Section is in the main body of the OOV report.

Technical Discussion – Groundwater Monitoring Report and Characterization Data:

The NRC staff and the DOE discussed potential sources of the contaminant plume at the SDF. The DOE indicated that the source was weeping of bleed water and contaminated rainwater from SDS 4 Cell G in the 1990s. The NRC staff asked about a future field study to exclude the possibility that additional contamination was contributed from the unlined drainage ditches near SDS 4. The DOE replied that it could not rule that out as a source because the ditches are contaminated, but the levels of contamination are much smaller than the historical soil contamination near SDS 4. In response to an NRC staff question, the DOE explained that it expected that source to have been stopped in 2008 – 2009 when the weather enclosures (i.e., huts) were built along the sides of SDS 4 to protect the contaminated soil from infiltration. The NRC staff explained that it was important to understand the source of the groundwater contamination in order to interpret the observed movement of the groundwater plume.

The NRC staff discussed the need for the DOE to provide more detailed information about projected erosion in Z-Area (see PAM-4 Discussion below) as part of a future SDF PA update. The NRC staff suggested that information similar to information provided on pages 305 – 307 of WSRC-STI-2007-00184) would be appropriate.

The NRC staff explained that elevation data for wells in the Upper Three Runs Lower Zone (UTR-LZ) in Figure FFT-1.5 in the DOE response to the NRC RAI on the DOE SDF FY 2014 Special Analysis Document showed a potentiometric surface and not the water table, and thus, should not be mixed with data from the Upper Three Runs Upper Zone (UTR-UZ). The DOE agreed that wells in the UTR-UZ and UTR-LZ should not be represented together in water table maps of Z-area (e.g., in Figure FFT-1.5 in the DOE RAI response).

Attachment

The DOE indicated that the revision of the GSA PORFLOW model should be completed by September 30, 2016. In response to NRC staff questions, the DOE explained that monitoring of the groundwater plume in Z-Area was being discussed with SCDHEC. The NRC staff indicated that it would follow up with SCDHEC to understand the future plans for the State-regulated groundwater monitoring program.

The NRC staff discussed the Z-Area Groundwater Characterization Data Report (SRNS-RP-2015-00902) was discussed with the DOE and DOE contractor's, Savannah River Nuclear Solutions' (SRNS), staff. The NRC staff asked why Well ZDPT-07 and Well ZDPT-09 were relatively dry, although they appear to be in a trough on top of the tan clay confining zone (TCCZ). In addition, although the DOE had described the Well ZBG-02 area as acting as a sump during a previous OOV and Figure 23 from SRNS-RP-2015-00902 showed such a depression, the contaminants seem to be flowing right by Well ZBG-02. The SRNS staff indicated that they do not have a satisfactory explanation for either question and that much is still not known.

The NRC staff discussed with the DOE and DOE contractor, Savannah River National Laboratory (SRNL), staff about the 2012 NRC TER regarding the 2009 DOE SDF PA. The NRC staff emphasized concerns from the Far Field Transportation section of the TER, specifically about: (1) lack of calibration targets in the vicinity of the SDF; (2) non-uniqueness of the calibration process; (3) effect of the permanent engineered surface cover not considered in the final calibration; (4) possible shift of the groundwater divide within the Z-Area that could influence dose outcomes; and (5) calcareous material or clay particles may preferentially transport contaminants. The NRC staff asked the DOE and the SRNL staff to consider those technical issues and concerns when updating the SDF models and revising the SDF PA.

Technical Discussion – DOE Research Update:

The DOE described the results of recent research comparing the properties of SDS 2A cores with laboratory-prepared samples. The data collected included: (1) density, porosity, and water content; (2) saturated hydraulic conductivity; (3) Tc-99 solubility; (4) Iodine-129, Tc-99, and Strontium-90 sorption coefficients (i.e., K_d values); (5) Tc-99 leaching with EPA Test Method 1315; (6) dynamic leaching of Tc-99, and (7) suitability of tests with rhenium as surrogate for tests with Tc-99.

Physical property testing was performed on 18 core samples (i.e., three subsamples of each of the 6 cores) and 9 laboratory-prepared subsamples (i.e., three subsamples of each of the 3 laboratory-prepared monoliths).

The mean total porosity of the 18 core samples was slightly higher than the mean total porosity of the 9 laboratory-prepared samples (i.e., 65.8 compared to 59.8). The density and water content were comparable, although the mean density was slightly lower (i.e., 1.7 percent lower) in the core samples. The DOE attributed the higher porosity and lower bulk density of the core samples to a higher water-to-cementitious material ratio in the core samples caused by the periodic addition of flush water.

Based on a comparison of the water contents to the permeable porosities, the testing indicated that both the core samples and laboratory-prepared samples were only 70 percent – 75 percent saturated. It was not clear to the NRC staff if the relatively low saturation of the samples relative to the as-modeled saturation reflected what should be expected in field-emplaced saltstone or if it was due to either: (1) dessication during sample handling; or (2) a difference in how the values were calculated (e.g., by weight versus by volume).

Saturated hydraulic conductivity of the core samples were all lower than the value of 6.4×10^{-9} cm/s used in the DOE SDF FY 2014 Special Analysis Document. Comparison of the values from the core samples to the values of the laboratory-prepared samples was difficult because of the large number of measurements below the detection limit (i.e., 1×10^{-9} cm/s) in both datasets.

The DOE described to the NRC staff the test result that Tc-99 solubility was similar for samples measured under both anoxic and oxic conditions. That result was initially surprising to the DOE because the previous studies concluded that Tc-99 was readily oxidized by exposure to relatively low concentrations of oxygen. The DOE hypothesized that in many of those previous studies, the release of Tc-99 was incorrectly attributed to oxidation of Tc(IV) to Tc(VII). The DOE suggested to the NRC staff that the observed release of Tc-99 in those previous studies reflected the solubility of Tc(IV) and not Tc oxidation and subsequent release of Tc(VII). The Tc-99 solubility measured for the core samples under both oxic and anoxic conditions was approximately a factor of 2 higher than that assumed in the DOE SDF FY 2014 Special Analysis Document (i.e., 2.23×10^{-8} mol/L compared to 1.0×10^{-8} mol/L). The sensitivity analyses in the DOE SDF FY 2014 Special Analysis Document showed the dose implications for solubilities up to 1.0×10^{-7} mol/L.

The sorption values for Iodine-129 for the core samples were significantly lower than what the DOE assumed in the DOE SDF FY 2014 Special Analysis Document. In an anoxic environment, the measured value was 0.3 mL/g as compared to 9 mL/g assumed in the DOE SDF FY 2014 Special Analysis Document. In an oxic environment, the measured value was negative (taken to be 0.0 mL/g) compared to 15 mL/g assumed in the DOE SDF FY 2014 Special Analysis Document. The NRC staff indicated to the DOE that a sensitivity analysis provided in the DOE response to the NRC RAI on the DOE SDF FY 2014 Special Analysis Document already addressed the dose implications of sorption at those reduced values.

When tested with EPA Test Method 1315, the core samples showed slightly less Tc-99 leaching than the laboratory-prepared samples. However, the core samples had approximately a factor of 5 to 10 greater fraction Tc-99 leached in the dynamic leaching tests as compared to the laboratory-prepared samples. Those tests are continuing and the reasons for the difference between those results are being considered by the DOE.

<u>Technical Discussion – Select DOE Responses to NRC RAIs on DOE SDF FY 2014 Special Analysis Document:</u>

General Discussion:

The NRC staff commented on the thoroughness of the DOE RAI response package. Areas where additional clarification was needed were captured in the Follow-Up Action Items.

Certain areas related to the SDF conceptual model and far-field transport are outside the scope of the DOE SDF FY 2014 Special Analysis Document. The NRC staff and the DOE discussed that DOE might include information about the following areas in the next revision to the SDF PA:

- infiltration and erosion projections that reflect the uncertainty in future climate states;
- additional information about long-term erosion expected at the SDF, which is similar to information on pages 305 – 307, WSRC-STI-2007-00184;
- updates to the meteorological data used to calculate expected ranges for infiltration that reflect uncertainty rather than a smaller range than values actually observed at the site (i.e., see DOE Response to RAI FFT-1);
- a water budget generated with the SDF PORFLOW far-field model; and
- PORFLOW results showing effect of the closure cap generated with the SDF PORFLOW far-field model.

PAM-2 Discussion:

In response to an NRC staff question, the DOE acknowledged that the correlation of higher Tc-99 dose projections with longer UZ thicknesses could be spurious. The NRC staff then asked if the DOE had additional insights as to the relatively high peak dose result (i.e., 2.9 rem/yr at 39,720 years after closure) for Realization 896. That realization was of particular interest because, as stated in the DOE Response, it "sampled many values that were similar to (or the same as) the Evaluation Case of the [DOE SDF FY 2014 Special Analysis Document]." It used the "best estimate" degradation rate and a Tc inventory that, while greater than the inventory used in the Evaluation Case, was within the variability expected between the SDF disposal structures. The DOE replied that, while variations in the Tc inventory were expected, it was not expected that such a high Tc inventory as used in that Realization for SDS 3B could occur in SDS 3B, which has a significant contribution to peak dose because of its location. The DOE indicated that the greatest Tc inventories were expected in SDS 6 and SDS 7.

PAM-4 Discussion:

In the DOE Response to the NRC RAI PAM-4, DOE stated "Based on the location of the SDF at SRS, it is unlikely that future erosion would modify the current conceptual model of hydrologic flow. The only likely scenario that would result in potential impacts to the SDF conceptual model of hydrologic flow would be a significant increase or decrease in rainfall." The NRC staff indicated that they had anticipated a DOE response similar to the analysis about erosion on pages 305 – 307 in WSRC-STI-2007-00184. The DOE analyzed a case with maximum infiltration to show that increased infiltration would not significantly change concentration and dose results. However, after the IEC-1 discussion (see below), the DOE and the NRC staff agreed that: (1) the current minimum, average, and maximum infiltration values would need to be reviewed by the DOE; and (2) before a future range of infiltration rates could be developed, the DOE would need to revise the current rates.

IEC-1 Discussion:

The following topics were discussed: (1) the general suitability of the HELP computer code; and (2) the DOE evaluation of other possible computer codes to replace the HELP computer code. The DOE decision as to whether or not to replace HELP will be made in the future. The NRC staff indicated that, although no computer code will be perfect for what is needed by the DOE, some computer codes will be better suited than others and the HELP computer code has numerous critics within that field, including having critical remarks on pages 81 – 82 in the National Research Council's 2007 "Assessment of Performance of Engineered Barriers."

The HELP computer model ran multiple simulations in the past with annual precipitation values ranging from a minimum of 29.8 in/yr to a maximum of 68.6 in/yr. Sensitivity analyses were described in the 2009 DOE SDF PA and both the DOE SDF FY 2013 and FY 2014 Special Analysis Documents using the maximum infiltration value derived from that maximum precipitation value. Figure FFT-1.3 from SRR-CWDA-2016-00004 and other sources showed that maximum precipitation value needs to be revised. The DOE agreed that those values would need to be evaluated (and potentially updated) in the next revision to the SDF PA. Additional NRC staff questions and concerns regarding applied infiltration and recharge rates were not discussed due to the anticipated revision to the SDF PA with its accompanying sensitivity analyses.

SP-2 and SP-8 Discussion:

The NRC staff questioned the DOE conclusion in DOE Response to RAI SP-2 that 0.52 meq e-/g was the most conservative value for the reducing capacity of saltstone. The NRC staff asked how that conclusion was consistent with the results of the DOE Response to RAI SP-8, which showed higher and earlier projected peak doses for PORFLOW runs with lower assumed reducing capacity in saltstone and disposal structure concrete. The NRC staff agreed with the DOE response that care must be taken to compare probabilistic and deterministic results. The DOE indicated that the DOE Response to RAI SP-8 considered the entire SDF, whereas DOE Response to RAI SP-2 only considered SDS 9. The NRC staff asked why Tc-99 releases from SDS 9 would have a different dependence on reducing capacity than other disposal structures, and the DOE indicated that the difference in flow rates (due to the geometry of the disposal structure) may result in different oxidation breakthroughs, but that some additional study was needed to confirm that. The DOE indicated that Tc-99 bypass was handled different in the DOE RAI Responses SP-2 and SP-8. The NRC staff indicated that looking at the red dots in Figure SP-2.11 of the DOE Response to the RAIs would limit the results to the low-bypass realizations, which would make the results more comparable to the case evaluated in DOE RAI Response SP-8.

The NRC staff suggested that the triangular shape of the results in Figure SP-2.11 of the DOE Response to the RAIs might be an artifact of the underlying distribution of values of reducing capacity that were sampled (see Figure SP-2.1 of the DOE RAI Responses to the RAIs). The NRC staff hypothesized that a greater number of relatively higher-dose realizations had occurred for realizations with a saltstone reducing capacity of approximately 0.52 meq e-/g because they were sampled more frequently and therefore had more chances of also having sampled other parameter values that actually were responsible for the higher projected flux.

During a follow-up discussion later during the OOV, the DOE showed new results using the same parameter values and distributions used to produce Figure SP-2.11, except that a uniform, instead of triangular distribution was used for saltstone reducing capacity. The DOE indicated that the result still showed the triangular trend discussed in the DOE Response to RAI SP-2. The NRC staff observed that the apparent triangular trend was less pronounced in those new results. Given the DOE Responses to both RAI Responses SP-2 and SP-8, the NRC staff asked the DOE what was determined to be the most conservative values of saltstone reducing capacity and disposal structure concrete reducing capacity. The DOE indicated that it would provide the NRC with additional information explaining the impact of reducing capacity in the figures in the two DOE Responses and that was captured as a Follow-Up Action Item.

The NRC staff then questioned the statement in the DOE Response to RAI SP-2 that the closure cap would limit oxygen ingress into saltstone because the DOE had not provided evidence that the closure cap would serve as a vapor barrier. The DOE indicated it would investigate if any additional information is available regarding oxygen levels in soil and provide it to the NRC and that was captured as a Follow-Up Action Item.

SP-12 Discussion:

The DOE agreed with the NRC staff that, unlike other DOE RAI Responses that contained sensitivity analyses that the DOE does not expect to occur, the change made to the mathematical model in the DOE Response to RAI SP-12 made the mathematical model more consistent with the DOE conceptual model. The DOE indicated that the information here should be interpreted given the recent data on Tc-99 leaching from the SDS 2A core samples.

DSP-5 a) Discussion:

With regard to the geotextile material, the DOE indicated a lessening of the effectiveness to keep separate the layers above and below over time. However, the DOE indicated that even if the effectiveness lessened, any decrease of the effectiveness of the closure cap over time would be reflected in a decrease in the time-delay and shift the release patterns of the radionuclide over time, but is unlikely to change any conclusions associated with dose-based risk. The DOE agreed with the NRC staff that if higher dose rates were shifted into the range of the compliance time period, then that shift could become significant.

The NRC staff pointed to the difference in the velocity flow field for the lower lateral drainage layer in Figures DSP-2.5 and DSP-2.6 from SRR-CWDA-2014-00099. Figure DSP-2.5 showed relatively strong velocity vectors in the lower lateral drainage layer. However, Figure DSP-2.6 showed that, by the year 20,000, the water flowing out from the drainage layer ebbed off considerably. The NRC staff questioned the DOE why Figures 4.4-12 and 4.4-13 from the DOE SDF FY 2014 Special Analysis Document seemed to contradict the velocity flow fields from the earlier two figures and why the relative decline in volumetric flow rates for the sand drainage layer was not discernable in the latter two figures. The DOE replied that the volumetric flow rates for the lower lateral drainage layer was a combination of both lateral flow from the disposal structure and vertical flow into the disposal structure, so it was not possible to see the decrease of lateral flow within the drainage layer over time. The NRC staff asked if the DOE would be able to separate the lateral from the vertical component in the lower lateral drainage layer and the DOE indicated that it would be possible to do so.

In another question about Figures 4.4-12 and 4.4-13 from the DOE SDF FY 2014 Special Analysis Document, the NRC staff questioned the DOE about the degree of increasing volumetric flow rates for all disposal structure components over time. It was not clear to the NRC staff why the degree of increasing volumetric flow rates lessened after about 5,400 years for all disposal structure components. The DOE explained that the lessening had to do with the opening of the columns as a preferred flowpath for incoming water (i.e., the increased hydraulic conductivity of the entire length of the column and the extent of the degradation by 5,400 years allowed infiltrating water to use the columns as preferred paths of flow). The DOE explained that, subsequently, all other components had less water flowing through them so that the degree of increasing volumetric flow rates lessened for all disposal structure components.

DSP-11 a) and b) Discussion:

The DOE indicated after all other components in a 375-ft. disposal structure have a higher hydraulic conductivity than the floor HDPE/GCL, which has a value of 6.44×10^{-7} cm/sec, then there will be a bathtub effect up to the middle of the floor. At that time, water within the disposal structure would not exit in the precise location where the DOE is currently modeling the water outflow. However, the DOE did not believe that the difference would produce any effect on the dose results.

FFT-1 Discussion:

The DOE contractor staff from SRNL participated in the discussion. The NRC staff commented that the DOE provided useful information in the DOE Response and that Figures FFT-1.1 through FFT-1.7 were especially useful. Much of the discussion focused on the SDF saturated zone transport model. The NRC staff recommended that the DOE produce a future document that exclusively describes the model structure and functions, its assumptions, and various aspects of the modeling results. The NRC staff commented that current descriptions and information on the transport model are spread out through many documents over many years, so it is difficult to review the adequacy of the transport model for the purposes intended for the transport model. In addition, few figures and diagrams exist that show input and output proprieties and various components of the model domain. The DOE indicated it was a reasonable request and was helpful for planning future revisions, products, and documents.

The NRC staff had been informed of the ongoing effort to update the regional GSA PORFLOW during the previous OOV and asked how that work was progressing. The DOE indicated that the work was progressing and that it should be completed by the end of Calendar Year 2016. The NRC staff restated the recommendation that more emphasis would be given to the Z Area in comparison to when the original GSA model was first constructed. At the time of creation of the original GSA model, only a few data points represented the Z-Area. The current SDF saturated zone transport model is based on that limited information in the original GSA model; however, new information and data has been gathered since then (e.g., new monitoring wells and new data on the location and thickness of the TCCZ).

The NRC staff appreciated the information found on the PORFLOW transport model in Figure FFT-1.2 of the DOE Response. The NRC staff asked the DOE if would be possible to provide velocity flow fields and water budget components to compliment Figure FFT-1.2. The DOE originally captured that and providing the velocity flow fields to the NRC was added as a

Follow-Up Action Item. However, the DOE indicated that providing a water budget of the model at various time steps would be time and labor intensive. Therefore, instead of having that as a Follow-Up Action Item, the NRC staff and the DOE discussed that the DOE might provide that information in the next revision to the SDF PA. The NRC staff was interested in a water budget at time zero consisting of the outflow components, such as evaporation, evapotranspiration, runoff, and lateral or vertical outflow to the model boundaries, and, in particular, separating the inflow components of surface recharge from lateral or vertical inflow from the model boundaries.

The NRC staff and the DOE then discussed Figures B-1 through B-5 from SRR-CWDA-2014-00095. In reply to an NRC staff question, SRNL staff confirmed that that the SDF saturated zone transport model simulated lateral flow and transport on top of the TCCZ, as seen in Figures B-1, B-3, and B-5. The SRNL staff discussed where the sources from the disposal structures were located with respect to the elements in the figures. The SRNL staff indicated that sources were located on top of the first element from the top that is 100 percent saturated so it was possible for the model to simulate diffusion transporting contaminants to the layer of elements partially saturated (i.e., between 50 percent and 100 percent) immediately above. The NRC staff used information from Figure B-2 from SRR-CWDA-2014-00095 and information from a 2009 DOE geotechnical report (i.e., K-ESR-Z-00002) as an example of the need for the DOE to update the SDF model: (1) in Figure B-2, the vertical cross section of the SDS 3A area clearly delineated the TCCZ as being in the model, which resulted in a possible lateral transport of contaminants; and (2) in K-ESR-Z-00002, the TCCZ was not present for some of those parts of the Z-Area. The SRNL staff agreed with the NRC staff that the SDF model should be updated in the future.

FFT-2 Discussion:

The DOE contractor staff from SRNS participated in the discussion. The NRC staff recommended to separate the following two items whenever possible: (1) create a water table map by using actual water table measurements from the UTR-UZ; and (2) create a potentiometric surface map by using potentiometric measurements from the UTR-LZ. As an example, the NRC staff pointed to Figure FFT-1.5 in the DOE Response, where Well ZBG-02D and Well ZGB-02C wells were represented with the values 220.32 ft. and 223.64 ft., and contour lines would look different depending on which measurement was used. The SRNS staff agreed in general that contour lines should not be plotted using a mixture of measurements taken from both above and below the TCCZ. The SRNS staff indicated that there was an effort to change that practice.

FFT-3 Discussion:

The DOE contractor staff from SRNS participated in the discussion. Referring to Figure FFT-3.2 through Figure FFT-3.5 of the DOE Response, the NRC staff asked the SRNS staff to discuss how the upper and lower extent of the TCCZ was determined. The NRC staff specifically questioned a previous comment by the SRNS staff that the majority of the TCCZ on the cone penetrometer test logs was not characterized as “clay”, but was “sandy silt” to “silty sand.” The SRNS staff gave a brief description of the methodology used to identify the TCCZ and explained that corrected tip stress, pore pressure, and resistivity were frequently the determining factors in the identification of the confining zone; while the actual physical description of the sedimentary layer was much less frequently the determining factor.

<u>Additional Questions about the DOE Research Presented during the OOV</u>

At the end of the OOV, the DOE asked the NRC staff if staff could use the new research data based on the OOV and associated slide presentations or if staff needed to wait for the DOE full technical reports before staff could reference the data. The NRC staff replied that staff would try to use the OOV and slide packages, but that staff might have questions to cover some of the information that would normally be included in a full technical report that was not yet available from the DOE.

See below for those NRC Questions:

1. On Slide 14 of the Research Results/Status presented by Steve Simner in SRR-CWDA-2016-00053, the Permeable Porosity and Water Content columns indicate a saturation of approximately 75%. Could DOE clarify if they believe that the 75% saturation of samples is representative of field conditions or if the observed values are due to another cause (e.g., calculation of the Permeable Porosity and Water Content values by volume versus by weight, drying of the SDS 2A core samples during transport)? Because the saturation of saltstone is important with respect to chemical properties (i.e., oxidation) and physical properties (e.g., relative permeability), clarification of the DOE expected saturation of saltstone in the field is needed.

2. In DOE document SREL Doc. R-15-0003, John Seaman presented EPA Test Method 1315 results from a Tc-spiked saltstone simulant core, including effective diffusivities for Re, I, NO_{3^-}, and Tc. During the SDF OOV, Steve Simner presented Tc-99 leaching data from the same Test Method on Slide 46 of SRR-CWDA-2016-00053 for both the Tc-spiked saltstone simulant and SDS 2A core samples. If the results are available, could DOE provide effective diffusion values, in particular for I, NO_3-, and Tc-99, from the SDS 2A core samples?

3. During a tour during the SDF OOV, DOE discussed an SREL study on potential degradation of disposal structure concrete due to sulfate attack. Could DOE clarify the composition of the solution that the disposal concrete samples are exposed to, in particular the pH and sulfate and nitrate concentrations of the solution?

4. In the table on Slide 14 of SRR-CWDA-2016-00053, the summary of Sample Set 9 stated that the means are the “Mean of 18 samples: 6 cores – 3 sub-samples”. Should it have indicated that there were samples from 5 cores with Core C-2 listed twice?

5. On Slide 14 of SRR-CWDA-2016-00053, are the values in brackets in the table the standard deviation of the measurements or the standard error of the mean?

6. On Slide 21 of SRR-CWDA-2016-00053, is the difference between the two phase diagrams just the presence of sulfur? What concentration of sulfur? What concentration of Tc?

7. Comparing Slide 46 and Slide 49 of SRR-CWDA-2016-00053, does SREL have a hypothesis about why the core samples showed slower leaching than the laboratory-prepared samples in the EPA Test Method 1315 test, but faster leaching in the dynamic leach test?

8. On Slide 49 of SRR-CWDA-2016-00053, the leaching data from Core 1 starts at the same Pore Volume at which the Core 2 data ends. Was any earlier leaching data collected for Core 1?

9. NRC needs more information about which experimental protocols correspond to which data sets in the slides (SRR-CWDA-2016-00053). Specifically, it is not clear to NRC if the same analytical method was use to generate the K_d data (Slide 29) and the solubility data (Slide 23). NRC would like to confirm which methods were used to generate each dataset in the slides.