September 28, 2015

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 JULY 7 – 8, 2015, ONSITE OBSERVATION VISIT REPORT FOR THE SAVANNAH RIVER SITE SALTSTONE DISPOSAL FACILITY (DOCKET NO. PROJ0734)

Dear Ms. Ridley:

The enclosed onsite observation visit (OOV) report describes the U.S. Nuclear Regulatory Commission (NRC) OOV on July 7–8, 2015, 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. That was the seventeenth 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 July 2015 SDF OOV were tours and technical discussions. A tour focused on Saltstone Disposal Structure (SDS) 2A, SDS 2B, SDS 3A, SDS 3B, SDS 4, SDS 5A, SDS 5B, and construction of SDS 6. A tour and technical discussion focused on groundwater monitoring. The other technical discussions 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; (iv) DOE research update; (v) DOE collection of core samples; (vi) GoldSim Modeling; and (vii) NRC Request for Additional Information Questions (RAIs) on the DOE FY 2014 Special Analysis document.

Those OOV activities were consistent with the activities described in the NRC Observation Guidance Memorandum for the July 2015 SRS SDF OOV (dated June 8, 2015) [available via the NRC Agencywide Documents Access and Management System (ADAMS) at Accession No. ML15148A388]. 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. All previous NRC concerns have been rolled into the monitoring factors in the 2013 SDF Monitoring Plan.

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 July 2015 OOV. There were no SDF Open Issues before the July 2015 OOV and there were no SDF Open Issues identified during the July 2015 OOV. Thus, there are currently no SDF Open Issues.

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)).

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 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/

Andrew Persinko, Deputy Director
Division of Decommissioning, Uranium Recovery,
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Enclosure:
NRC Onsite Observation Visit Report

cc w /enclosure:
WIR Service List
WIR e-mail Contacts List

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U.S. NUCLEAR REGULATORY COMMISSION
JULY 7 – 8, 2015, ONSITE OBSERVATION VISIT REPORT FOR
THE SAVANNAH RIVER SITE SALTSTONE DISPOAL FACILITY

EXECUTIVE SUMMARY:

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its seventeenth onsite observation visit (OOV) to the Saltstone Disposal Facility (SDF) at the Savannah River Site (SRS) on July 7 – 8, 2015 (SDF Observation 2015-02). That was the second SDF OOV in Calendar Year (CY) 2015. 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 third 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. A tour focused on SDS 2A, SDS 2B, SDS 3A, SDS 3B, SDS 4, SDS 5A, SDS 5B, and construction of SDS 6. A tour and technical discussion focused on groundwater monitoring. The other technical discussions 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; (iv) DOE research update; (v) DOE collection of core samples; (vi) GoldSim Modeling; and (vii) NRC Request for Additional Information Questions (RAIs) on DOE FY 2014 Special Analysis document. 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.

The NRC received the updated DOE presentation (SRR-CWDA-2015-00086, 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. ML15223B096.

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)).

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.

2.0 NRC ONSITE OBSERVATION VISIT ACTIVITIES:

On June 8, 2015, the NRC issued the Observation Guidance [Accession No. ML15148A388] for the July 7 – 8, 2015, OOV, SDF Observation 2015-02. 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. A tour focused on SDS 2A, SDS 2B, SDS 3A, SDS 3B, SDS 4, SDS 5A, SDS 5B, and construction of SDS 6. A tour and technical discussion focused on groundwater monitoring. The other technical discussions 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; (iv) DOE research update; (v) DOE collection of core samples; (vi) GoldSim Modeling; and (vii) NRC RAIs on DOE FY 2014 Special Analysis document.

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:

- MA1 (Inventory):
  - MF 1.01 (Inventory in Disposal Structures)
- 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-2015-00086) [ADAMS Accession No. ML15223B096]. The key points from the presentation and technical discussion were:

- Technetium (Tc) concentrations will be higher in Salt Batch 8 than in Salt Batch 7.

- Higher than expected mercury (Hg) concentrations were found and the DOE speculated that it was because waste from the tanks in the H-Tank Farm have approximately 40 times higher Hg concentrations than tanks in the F-Tank Farm.

- There was a reduction in the fill height limit for the 150-foot disposal structures from 21.5 feet to 19.0 feet because of concerns about dimethyl mercury and the change was expected to be a temporary condition pending further analysis.

- The NRC staff was interested in the inventory of Tc in SDS 5B.

2.1.3 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 will provide the NRC with information on SDS 3A, SDS 3B, SDS 5A, and SDS 5B fill height restrictions related to resolution of mercury Potential Inadequacy in the Safety Analysis.

- The DOE will provide the NRC with the document "SRR-CWDA-2014-00124, Determination of SDF Inventories through 9/30/2014."

- The DOE will provide the NRC with the inventory in SDS 5B through 09/30/2015.

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

2.2.2 Observation Results:

The key points from the technical discussion were:

- The DOE provided the status summary of routine documents, including about inventory, provided by the DOE to the NRC.

- The NRC and the DOE agreed that at the start of SDF Observation 2015-02 there were two open Follow-Up Action Items and the DOE provided the information, including items about groundwater monitoring, to close out those two items during the OOV.

2.2.3 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.

2.3 Tour – SDS 2A, SDS 2B, SDS 3A, SDS 3B, SDS 4, SDS 5A, SDS 5B, and Construction of SDS 6:

2.3.1 Observation Scope:

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

- MA 6 (Disposal Structure Performance):
    - 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)

2.3.2 Observation Results:

The key points from the tour were:

- The DOE discussion on the features of the drain system on SDS 4 and historical leak sites in SDS 4.

- Observing the application of pre-stressing wires in the construction of SDS 6 from an observation platform overlooking SDS 6.

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 Item resulted from the tour:

- The DOE will provide the NRC with photographs from the tour of the SDF disposal structures on 07/07/2015.

2.4 Tour and Technical Discussion – Groundwater Monitoring:

2.4.1 Observation Scope:

The tour and 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 tour and technical discussion was most relevant to the following MA and MFs in SDF Monitoring Plan, Rev. 1:

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

2.4.2 Observation Results:

The key points from the tour and technical discussion were:

- The challenge of the DOE modeling the area's groundwater model in order to compare with the observed concentrations in Well ZBG-2.

- The closure of Well ZBG-2 and replacement by the two new nearby Well ZBG-2C and Well ZBG-2D.

- The DOE 2015 mid-year groundwater monitoring report will include the last data from Well ZBG-2 and the first data from Well ZBG-2C. The first data from Well ZBG-2D will be in the DOE final 2015 annual groundwater monitoring report.

- Data from Cone Penetrometer Tests and Direct Push Technology will be available in the DOE final 2015 annual groundwater monitoring report. The NRC staff expects that the data will provide useful information about the Conceptual Site Model for contaminant transport in the upper and lower zones of the Upper Three Runs Aquifer.

- The SCDHEC concern that contaminants will migrate from the unlined sedimentation basins north of SDS 4 into the groundwater. The NRC staff will pursue the SCDHEC concern with DOE as part of our normal monitoring activities.

- The NRC and SCDHEC issues about the three production wells being installed in the Z Area in preparation for the hydrotest of SDS 6.

- The NRC was interested in information about tanks that the SDS 6 construction company built in Syracuse, New York.

- The NRC was interested in the future revised DOE General Separations Area groundwater model.

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 tour and technical discussion:

- The DOE will provide the NRC with the 2015 mid-year groundwater monitoring report, when available.
- The DOE will provide the NRC information available on production well (SDS 6) depth and potential impact on surface settlement.
- The DOE will provide to the NRC information about water tanks that the SDS 6 construction company built in Syracuse, New York and used as a model for SDS 6.

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 MA and MF in SDF Monitoring Plan, Rev. 1:

- MA 5 (Waste Form Chemical Degradation):
  - MF 5.01 (Radionuclide Release from Field-Emplaced Saltstone)

2.5.2 Observation Results:

The key points of the technical discussion were:

- The DOE was surprised by the small difference between rhenium release under oxic and anoxic conditions in one experiment.
- The DOE was surprised by an apparently abrupt change in Tc oxidation state in simulated saltstone samples aged between 350 and 450 days (indicative of Tc(VII) diminishing).
- The oxidation state of Tc in various sulfide and oxide species that may be present in saltstone.

2.5.3 Conclusions and Follow-Up Action Items:

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

- The DOE will provide the NRC with a listing of existing papers relative to technetium reduction/solubility.

2.6 Technical Discussion – DOE Collection of Core Samples:

2.6.1 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 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 3.03 (Applicability of Laboratory Data to Field-Emplaced Saltstone)
- MA 5 (Waste Form Chemical Degradation):
  - MF 5.01 (Radionuclide Release from Field-Emplaced Saltstone)
- MA 11 (Radiation Protection Program):
  - MF 11.01 (Dose to Individuals During Operations)

2.6.2 Observation Results:

The key points of the technical discussion were:

- The DOE experience and process used to collect the core samples.

- The worker dose for preparation was 822 person-mrem and the worker dose was between 587 person-mrem and 716 person-mrem for sampling from each of the three ports which resulted in a total job dose of 2,714 mrem.

- The eight tests of physical and chemical properties that DOE will perform on the core samples.

- The NRC commented that varying the solid-to-liquid ratio planned for the sorption coefficient tests would provide useful information about whether the results would be interpreted as sorption or solubility limited.

- The NRC recognized both the technical difficulty of the DOE obtaining the core samples and the worker dose involved.

- The NRC emphasized the importance of maintaining the core samples and conducting appropriate tests now to take advantage of the extensive work that was done to obtain the core samples.

2.6.3 Conclusions and Follow-Up Action Items:

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

- The DOE will provide the NRC with the following documents:
  - "SRR-CWDA-2015-00002, FY 2015 Saltstone Core Drilling Mock-up Summary;"
  - "SRR-CWDA-2015-00066, Summary of Saltstone Disposal Unit Cell 2A Core Drill Activities;"
  - "SRR-CWDA-2015-00087, Saltstone Disposal Facility SDU Cell 2A Core Drill Summary;" and
  - "SRNL-L3100-2015-00108, SDU 2A Core Sample Test Designation."

2.7 Technical Discussion – GoldSim Modeling:

2.7.1 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 61.43. The technical discussion was most relevant to the following MA and MF in SDF Monitoring Plan, Rev. 1:

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

2.7.2 Observation Results:

The key points of the technical discussion were:

- The DOE answered the NRC questions about file structure and dynamic link libraries related to getting the GoldSim model to run.

- The DOE answered specific NRC questions about modeled fluid flows and contaminant fluxes in various parts of the model.

2.7.3 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 will provide to the NRC documentation on how to set up computer for a GoldSim run.

- The DOE will provide to the NRC documentation on how locations along the 100-meter boundary were determined for the GoldSim model.

2.8 Technical Discussion – NRC RAIs on DOE FY 2014 Special Analysis Document:

2.8.1 Observation Scope:

The 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.

2.8.2 Observation Results:

The key points of the technical discussion were:

- Given the short time since the DOE received the RAIs [ADAMS Accession No. ML15161A541], the NRC appreciated the thorough preparation by the DOE.

- The NRC mentioned that the DOE still needed to address: (1) mechanical degradation beginning at the time of closure; (2) gas phase transport of oxygen into unsaturated fractures; and (3) uncertainty in the reducing capacity of saltstone and its ability to reduce Tc(VII) to Tc(IV).

- The NRC provided major clarifications (i.e., RAIs: PAM-4, DSP-2, SP-1, SP-3, SP-4, SP-5, and SP-10) and minor clarifications to the RAIs that the DOE was interested in.

2.8.3 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:

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 2015-02 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 NRC emphasized the importance of maintaining the core samples and conducting appropriate tests now to take advantage of the extensive work that was done to obtain the core samples.*

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

SDF Observation 2015-02 is the third 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 2015-02. 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 16 previous NRC SDF OOVs. All but two of the Follow-Up Action Items from those OOVs were closed prior to SDF Observation 2015-02 and those two Follow-Up Action Items were closed during SDF Observation 2015-02.

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 2015-02.

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

The table below contains the 11 Follow-Up Action Items that were opened during SDF Observation 2015-02, including a unique NRC identifier for each Follow-Up Action Item:

Unique Identifier	Follow-Up Action Item
SDF-CY15-02-001	The DOE will provide the NRC with information on SDS 3A, SDS 3B, SDS 5A, and SDS 5B fill height restrictions related to resolution of mercury Potential Inadequacy in the Safety Analysis.
SDF-CY15-02-002	The DOE will provide the NRC with the document “SRR-CWDA-2014-00124, Determination of SDF Inventories through 9/30/2014.”
SDF-CY15-02-003	The DOE will provide the NRC with the inventory in SDS 5B through 09/30/2015.
SDF-CY15-02-004	The DOE will provide the NRC with photographs from the tour of the SDF disposal structures on 07/07/2015.
SDF-CY15-02-005	The DOE will provide the NRC with the 2015 mid-year groundwater monitoring report, when available.
SDF-CY15-02-006	The DOE will provide the NRC information available on production well (SDS 6) depth and potential impact on surface settlement.

SDF-CY15-02-007	The DOE will provide to the NRC information about water tanks that the SDS 6 construction company built in Syracuse, New York and used as a model for SDS 6.
SDF-CY15-02-008	The DOE will provide the NRC with a listing of existing papers relative to technetium reduction/solubility.
SDF-CY15-02-009	The DOE will provide the NRC with the following documents: • "SRR-CWDA-2015-00002, FY 2015 Saltstone Core Drilling Mock-up Summary;" • "SRR-CWDA-2015-00066, Summary of Saltstone Disposal Unit Cell 2A Core Drill Activities;" • "SRR-CWDA-2015-00087, Saltstone Disposal Facility SDU Cell 2A Core Drill Summary;" and • "SRNL-L3100-2015-00108, SDU 2A Core Sample Test Designation."
SDF-CY15-02-010	• The DOE will provide to the NRC documentation on how to set up computer for a GoldSim run.
SDF-CY15-02-011	• The DOE will provide to the NRC documentation on how locations along the 100-meter boundary were determined for the GoldSim model.

3.7 Issuance of NRC Technical Review Reports:

Between the previous OOV and SDF Observation 2015-02, the NRC issued one SDF Technical Review Report via memorandum:

- Technical Review: "Oxidation of Reducing Cementitious Waste Forms" [ADAMS Accession No. ML15098A031] dated June 14, 2015, which had no Follow-Up Action Items.

4.0 PARTICIPANTS:

U. S. NRC	SCDHEC	U.S. DOE	SRR
George Alexander	Tom Knight	Dan Ferguson	Tim Coffield
Hans Arlt	Justin Koon	Sherri Ross	Steve Hommel
Terrence Brimfield	Alan Risa	Linda Suttora	Jerry Mangold
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Karen Pinkston	Jason Shirley		Kent Rosenberger
A. Christianne Ridge	Scott Simons		Steve Simner
	Andrea Skinner		Owen Stevens
			Steve Thomas
			David Watkins

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.

_____ 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.

_____ "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.

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

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

_____ SRR-CWDA-2015-00086, Rev. 1, "Presentation for Savannah River Site Salt Waste Disposal NRC Onsite Observation Visit," July 2015. ML15223B096.

_____ SRR-CWDA-2014-00099, Rev. 1, "Comment Response Matrix for NRC 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-SPT-2012-00049, Rev. 1, "Saltstone Sampling and Analyses Plan," May 2013. ML14196A215.

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 February 4 – 5, 2015, Onsite Observation Visit Report for the Savannah River Site Saltstone Disposal Facility,” May 2015. ML15041A562.

_____ “NRC Onsite Observation Guidance for July 7 – 8, 2015, Monitoring Visit to the Savannah River Site, Saltstone Disposal Facility,” June 8, 2015. ML15148A388.

_____ “NRC Technical Review: “Oxidation of Reducing Cementitious Waste Forms,” June 2015. ML15098A031.

_____ “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.

DETAILED TECHNICAL INFORMATION FROM
U.S. NUCLEAR REGULATORY COMMISSION
JULY 7 – 8, 2015, ONSITE OBSERVATION VISIT TO
THE SAVANNAH RIVER SITE SALTSTONE DISPOAL FACILITY

Technical Discussion – DOE SDF Operating Status and Disposal Structure Status

The DOE provided updates on processing of Salt Batch 7 and Salt Batch 8. Salt Batch 8 will have a higher technetium (Tc) concentration than Salt Batch 7. Tank 50 contained part of Salt Batch 7 with a small amount of Salt Batch 8, which did not appreciably affect the Tc concentrations. There will be a delay before processing the remainder of Salt Batch 8.

The DOE indicated that there was a Toxicity Characteristic Leaching Procedure (TCLP) test result that had a higher mercury (Hg) concentration than expected. The DOE was in the process of meeting with the State of South Carolina (i.e., SRS regulator of Savannah River Site (SRS)) to resolve that Hg issue. The DOE speculated that the increase in the Hg concentration was attributable to a change in the origin of the waste because the waste with the unexpectedly high Hg concentration originated from the H-Tank Farm. Tanks in the H-Tank Farm have approximately 40 times higher Hg concentrations than tanks in the F-Tank Farm.

The DOE indicated that there had been a reduction in the fill height limit for the 150-foot disposal structures from 21.5 feet to 19.0 feet because of concerns about dimethyl mercury. The change in fill height was expected to be a temporary condition pending further analysis. As a Follow-Up Action Item, the DOE will provide the NRC with information on Saltstone Disposal Structure (SDS) 3A, SDS 3B, SDS 5A, and SDS 5B fill height restrictions related to resolution of "Mercury Potential Inadequacy in the Safety Analysis." An analysis had already been done that supported the safety of SDS 2A and SDS 2B, both of which were already filled to 21.25 feet.

In response to an NRC staff question, the DOE indicated that, as of June 30, 2015, there were approximately 64 curies (Ci) of Tc in SDS 5B. When SDS 5B is full, it will contain about 100 Ci of Tc. As a Follow-Up Action Item, the DOE will provide the NRC with the document "SRR-CWDA-2014-00124, Determination of SDF Inventories through 9/30/2014." As a Follow-Up Action Item, the DOE will provide the NRC with the inventory in SDS 5B through 09/30/2015. At the OOV, the SDS 5B inventory Follow-Up Action Item was going to be through 06/30/2015, but after the OOV, the NRC and the DOE agreed to change it to 09/30/2015.

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

The DOE provided the status summary of routine documents, including documents about inventory, provided by the DOE to the NRC (see more information about routine documents in the DOE presentation for SDF Observation 2015-02 [ADAMS Accession No. ML15223B096]).

The NRC and the DOE agreed that all but two of the previous Follow-Up Action Items were closed prior to the OOV (see more information about closing Follow-Up Action Items in the DOE presentation for the OOV). The two open Follow-Up Action Items were discussed by the DOE

during the OOV and the NRC determined that those two Follow-Up Action Items, including items about groundwater, were closed.

- SDF-CY15-01-001: *(the DOE provided the photos in the presentation for the OOV)*
    - DOE to provide NRC with additional photos of construction of SDS 6 including:
        - tension wires; and
        - wall to roof connections

- SDF-CY15-01-008: *(the DOE provided the information during the OOV)*
    - The DOE to provide the NRC staff with additional groundwater data relative to:
        - historical data on Z-Area wells
            - water thickness of upper zone of the Upper Three Runs Aquifer over time.
        - additional well data related to changes in position of the water line between the lower and upper zones of the Upper Three Runs Aquifer over time

<u>Tour – SDS 2A, SDS 2B, SDS 3A, SDS 3B, SDS 4, SDS 5A, SDS 5B, and Construction of SDS 6</u>

The tour consisted of the DOE driving the NRC around SDS 2A, SDS 2B, SDS 3A, SDS 3B, SDS 5A and SDS 5B; the DOE leading the NRC on a walking tour around SDS 4; and the DOE and the NRC observing application of pre-stressing wires in the construction of SDS 6 from an observation platform overlooking SDS 6. As a Follow-Up Action Item, the DOE will provide the NRC with photographs from the tour of the SDF disposal structures on 07/07/2015.

During the walking tour of SDS 4, the DOE described features of the drain system and historical releases from SDS 4. During operations in the 1990s, Cell G of SDS 4 leaked. Previously, the DOE determined that contaminants from that leak reached the unsaturated zone and saturated zone. The DOE again indicated that the release was responsible for the elevated nitrate and Tc concentrations measured in Well ZBG-2.

In 2011, precipitation accumulating on top of SDS 4, may have flowed through cracks in SDS 4, and contaminated the ground surface. The DOE remediated the soil around SDS 4 and determined that the remaining contaminants were immobile. The DOE constructed a drain system just under the surface that encircled SDS 4. The drain system was intended to capture any future storm water runoff from SDS 4 and direct it into a sedimentation basin. Also, the DOE built “huts” around the base of SDS 4 to cover the contaminated areas to prevent recharge. The DOE indicated that the contaminants from that leak did not reach the saturated zone and were not present under SDS 4.

In early 2013, contaminated storm water from the SDS 4 area traveled through the drain system and flowed into the outfall culvert area and then to the sedimentation basin. The outfall culvert area is approximately 260 meters (850 feet) long. The DOE probe surveys identified areas with radiation above background levels.

In response to an NRC staff question, the DOE indicated that a comparison between observed concentrations in Well ZBG-2 and predictions of the area's groundwater model were performed and that the model predictions matched the measured values in Well ZBG-2 reasonably well. Modeling was challenging because of uncertainty about the initial inventory that was released. Also, any standing water during the storm event would have driven the plume into the soil faster than predicted by a model that only considered average infiltration rates. In addition, the modeling effort was complicated by the potential for perched water on top of the Tan Clay Confining Zone (TCCZ). The NRC staff agreed with those DOE statements about the challenging aspects of modeling. The NRC indicated that the SDF Performance Assessment (PA) model predicted contamination moving into the Lower Zone of the Upper Three Runs (UTR) Aquifer (UTRA-LZ) (i.e., below the TCCZ); whereas Well ZBG-2 has shown contamination in the Upper Zone of the UTR aquifer (UTRA-UZ) (i.e., above the TCCZ).

Tour and Technical Discussion – Groundwater Monitoring

The tour consisted of visiting locations of both existing and planned DOE groundwater monitoring wells as well as sites where the DOE plans to use Direct Push Technology (DPT) and Cone Penetrometer Tests (CPT). The NRC and DOE staff discussed the closure of Well ZBG-2 and the development of nearby Well ZBG-2C and Well ZBG-2D. As indicated in the NRC report for SDF Observation 2015-01 (ADAMS Accession No. ML15041A562), the DOE decided to close ZBG-2 because it penetrates the top of the TCCZ and the DOE determined that closing the well would reduce the potential for cross-contamination of the aquifers. Well ZBG-2 will be replaced by both Well ZBG-2C, which will be screened entirely below the TCCZ, and Well ZBG-2D, which will be screened entirely above the TCCZ.

The DOE explained that the DOE 2015 mid-year groundwater monitoring report will be the last report to show data from Well ZBG-2, which previous reports showed had elevated concentrations of nitrate and Tc. The DOE indicated that the DOE 2015 mid-year groundwater monitoring report will show data from Well ZBG-2C; but, data from Well ZBG-2D will be first available in the final DOE 2015 annual groundwater monitoring report. As a Follow-Up Action Item, the DOE will provide the NRC with the 2015 mid-year groundwater monitoring report, when available.

In addition, data from Cone Penetrometer Tests and Direct Push Technology will be available in the DOE final 2015 annual groundwater monitoring report. The NRC staff expects that the data will provide useful information about the Conceptual Site Model for potential groundwater flow within the UTRA-UZ for much of the Z-Area and for contaminant transport, within and between, the TCCZ, the UTRA-LZ, and the UTRA-UZ.

During the technical discussion of groundwater data, the SRS South Carolina regulator, South Carolina Department of Health and Environmental Control (SCDHEC), staff raised a concern that contaminants will migrate from the unlined sedimentation basins north of SDS 4 into the groundwater. The NRC staff will continue to monitor contaminant concentrations in Well ZBG-16C which is downgradient of the sedimentation basins. Well ZBG-16D, which is also downgradient of the sedimentation basins, is typically dry. The NRC staff will follow up with DOE as part of our normal monitoring activities if NRC staff has any concerns.

The DOE, the NRC, and the SCDHEC staff discussed the three production wells being installed in the Z-Area in preparation for the hydrotest of SDS 6. The SCDHEC staff raised the concern that the production wells were spaced closely enough that they appeared likely to cause interference with each other (i.e., amount that could be pumped from all three wells simultaneously might not be three times the amount that could be pumped from one individual well). The NRC staff repeated previous concerns from the report for SDF Observation 2015-01 about the need to better understand whether there was potential for subsidence from pumping water from the Congaree Aquifer. The DOE clarified that, in contrast to the discussion during SDF Observation 2015-01, the wells will be screened in the Crouch Branch Aquifer, which is below the Congaree Aquifer. The DOE indicated that there are other locations onsite that pump from the Crouch Branch Aquifer at a similar rate and those locations experience rapid recovery from drawdown, so drawdown was not expected to cause significant subsidence at those three new production wells being installed in Z-Area. The SCDHEC staff raised a concern that although the DOE may have other wells that pump from the Crouch Branch Aquifer, it did not seem the DOE had measured ground surface deflection during pumping and therefore the DOE did not have evidence to show that there was no subsidence caused by pumping. The SCDHEC staff asked if the DOE had a basis for assuming that any deflection would not cause disposal structure cracking due to differential setting. As a Follow-Up Action Item, the DOE will provide the NRC information available on production well (SDS 6) depth and potential impact on surface settlement.

The DOE indicated that the construction company that is building SDS 6 anticipated approximately a 25 percent chance that SDS 6 would leak during the hydrotest. The company has a protocol in place for detecting and repairing leaks and any leaks would be repaired before the SDS 6 is put into service. In response to an NRC request, as a Follow-Up Action Item, the DOE will provide to the NRC information about water tanks that the SDS 6 construction company built in Syracuse, New York and used as a model for SDS 6.

The DOE indicated that funds were designated to update the General Separations Area (GSA) groundwater modeling. The NRC staff will follow-up on that GSA groundwater model update because it is important to monitoring the DOE disposal actions at both the SDF and two tank farms (i.e., F-Tank Farm, H-Tank Farm).

Technical Discussion – DOE Research Update

The DOE indicated that it had been using EPA test 1315 to study release of rhenium (Re) from spiked simulated saltstone samples at various curing times. In general, Tc releases were about an order of magnitude smaller than Re releases under the same conditions. The DOE was surprised that there was very little difference in the release seen with oxygen-saturated and anoxic leachates.

The DOE summarized anomalous results related to neptunium (Np) releases from the field-scale lysimeter study. One replicate showed an order of magnitude faster release of Np than the other; but, both releases were considered to be very low.

The DOE indicated that there were difficulties with the development of the dynamic leaching procedure. Specifically, there were difficulties in getting a good seal between the sample and

the test apparatus when a thinner sample was used to reduce the time needed to get several pore volumes through the sample. The DOE returned to using 5 centimeter (2 inch) thick samples to eliminate bypass flow. The DOE plans to use influents spiked with Tc(VII) to determine if re-reduction occurs when the influent passes through the simulated saltstone sample.

The DOE discussed ongoing work at Clemson University to use X-ray Absorption Spectrometry (XAS) to study the oxidation state of Tc, iron, and sulfur (S) after different sample curing durations. The researchers saw evidence of TC_2S_7 and Tc oxides. The NRC commented that one of the lines of reasoning supporting experimentally observed Tc solubility values used in the DOE FY 2014 Special Analysis Document was the theoretical agreement between the observed results and specific Tc oxide species. The DOE and the NRC discussed the oxidation state of Tc in various sulfide and oxide species. As a Follow-Up Action Item, the DOE will provide the NRC with a listing of existing papers relative to technetium reduction/solubility.

The DOE described results showing XAS features indicative of Tc(VII) diminishing between 350 days and 450 days after the samples were poured. The DOE indicated that more work was needed to better understand that result because the expectation was a more gradual decline; however, no additional work has been funded. In response to an NRC staff question, the DOE indicated that the report covering FY15 activities was expected to be issued at the end of FY15.

Technical Discussion – DOE Collection of Core Samples

In the NRC 2007 SDF Monitoring Plan [ADAMS Accession No. ML070730363], the NRC identified scaling the properties of laboratory samples to field-emplaced saltstone as important for NRC monitoring at the SDF. That issue was carried forward as MF 3.03 and MF 5.01 in the NRC 2012 SDF Monitoring Plan [ADAMS Accession No. ML13100A076]. The DOE developed the Saltstone Sampling and Analyses Plan (SRR-SPT-2012-00049, Rev. 1) [ADAMS Accession No. ML14196A215] as the plan to study how well laboratory-prepared samples represent the properties of field-emplaced samples. That plan included the collection of core samples.

The DOE discussed how they collected core samples from SDS 2A. Samples were collected from two locations in each of three camera ports (i.e., total of six samples). Despite successful drilling experiences with the mock-up, there were technical difficulties with the first and second field-scale drilling attempts. As a Follow-Up Action Item, the DOE will provide the NRC with the following documents:

- “SRR-CWDA-2015-00002, FY 2015 Saltstone Core Drilling Mock-up Summary;”
- “SRR-CWDA-2015-00066, Summary of Saltstone Disposal Unit Cell 2A Core Drill Activities;”
- “SRR-CWDA-2015-00087, Saltstone Disposal Facility SDU Cell 2A Core Drill Summary;” and
- “SRNL-L3100-2015-00108, SDU 2A Core Sample Test Designation.”

To compare the cores from the field-emplaced samples to specific batches of saltstone, the samples were collected from SDS 2A at particular depths. Those depths corresponded to

saltstone poured into SDS 2A on the same day that samples were taken directly from the Saltstone Production Facility and cured in the laboratory (i.e., August 2013). The field-scale material at the depth corresponding to the August 2013 pour of interest was harder than the saltstone poured in either December 2013 or May 2014. Additional curing time was one hypothesis that had been discussed; but, it was unclear whether the difference in curing time between August and December 2013 could explain the difference in the saltstone hardness.

The worker doses were reported as: 822 person-mrem for drilling preparation, 716 person-mrem for sampling from Port A, 587 person-mrem for sampling from Port B, and 589 person-mrem for sampling from Port C. This resulted in a total job dose of 2,714 mrem.

The DOE plans to conduct the following tests on the core samples collected:

1. Saturated Hydraulic Conductivity
2. Density, Porosity, and Moisture Content
3. Total Activity for Tc-99, strontium (Sr)-90, selenium (Se)-79, iodine (I)-129, Radium (Ra)-226
4. Distribution Coefficient (K_d) for (Tc, Sr, Se, I, Ra)
5. Ratio of Tc(VII)/Tc(Total)
6. pH/Eh
7. TCLP on reduced samples
8. TCLP on oxidized samples

The DOE commented that, although it was preferable to conduct those tests as soon as possible to minimize the costs associated with storing the core samples in an anoxic environment, the testing would be delayed until FY16 due to funding availability.

In response to an NRC staff question, the DOE clarified that the measurement of Tc(VII) in Test #5 would actually be a measurement of leachable Tc, which may not be identical to the Tc(VII) in the sample. The DOE explained that the TCLP Test #7 and Test #8 were planned because SCDHEC was especially interested in Hg in the samples.

The NRC commented that all of the tests were focused on initial properties. The NRC staff asked if any testing was anticipated that could provide support for the predicted performance of samples over time. The DOE suggested that a dynamic leaching test could provide information about saltstone oxidation over time and the NRC agreed. However, the DOE clarified that a dynamic leaching test was not within the current budget. The DOE commented that dynamic leaching tests, if done, would be done with laboratory samples and not with field samples because the laboratory samples were easier to work with because they are not as radioactive. The DOE reiterated that the two goals of the project were to understand: (1) the initial properties of field-emplaced saltstone; and (2) how well the laboratory samples represent the properties of the field-emplaced saltstone. The DOE commented the field samples included interfaces that had been exposed to air between lifts being poured. However, the DOE commented that it would be difficult to study the oxidation near those lift boundaries because core samples typically broke near lift boundaries and any breaks would be exposed to coring water, which would affect sample oxidation.

The NRC commented that varying the solid to liquid ratio planned for the K_d Test #4 tests would provide useful information about whether the results should be interpreted as sorption or solubility limited.

The NRC recognized both the technical difficulty of the DOE obtaining the core samples and the worker dose involved. The NRC emphasized the importance of maintaining the core samples and conducting appropriate tests now to take advantage of the extensive work that was done to obtain the core samples.

Technical Discussion – GoldSim Modeling

The NRC staff asked the DOE specific questions related to the dynamic link libraries (DLL) files to allow the GoldSim SDF model to run. The DOE described the necessary DLL file locations. As a Follow-Up Action Item, the DOE will provide to the NRC documentation on how to set up computer for a GoldSim run. The DOE explained that the "readporflow" DLL is used to tell GoldSim which PORFLOW flow field data to use, that the "TSPROC" DLL is used for time series processing, and that the "Transition time" DLL is used for the GoldSim Tc model to determine when chemical transitions occur resulting in Tc releases.

In response to NRC staff questions, the DOE explained several modeling simplifications, including the use of mixing cells to model flow in the sheet drain and High Density Polyethylene. The DOE explained that in the document, "Updates to the Saltstone Disposal Facility Stochastic Fate and Transport Model, SRR-CWDA-2013-00073, Rev. 2 [ADAMS Accesssion No. ML15225A473] the "Fill Container" in Figure 4.1-22 was a modeling simplification that served as a reservoir for back-diffusion. The DOE explained that one reason there was a difference between the PORFLOW results and GoldSim results was because of differences in the modeling of lateral diffusion. In response to NRC staff questions, the DOE staff explained the purpose of several individual modeling containers, including where advective and diffusive releases were modeled.

In response to an NRC question, DOE staff explained that locations for the 100-meter concentrations represented the point in the sector with the highest concentrations, which might not be the center of either the sector or of an individual plume because of plume overlap. As a Follow-Up Action Item, the DOE will provide to the NRC documentation on how locations along the 100-meter boundary were determined for the GoldSim model.

Technical Discussion – NRC RAIs on DOE FY 2014 Special Analysis Document

The NRC provided an overview with the main themes of the NRC RAI Questions (RAIs) on the DOE FY 2014 SDF Special Analysis Document [ADAMS Accession No. ML15161A541]. Throughout the technical discussion, the DOE requested clarification on specific RAIs and provided suggestions for addressing various RAIs. The NRC discussed with the DOE whether the DOE proposed approach appeared to address that RAI. However, the NRC indicated that the NRC discussion points were preliminary and that the NRC will review the entirety of the future DOE written responses to the NRC RAIs for the new NRC TER. Given the short time since the DOE received the RAIs, the NRC appreciated the thorough preparation by the DOE.

Many minor clarifications were provided by the NRC during the technical discussion; but, only major clarifications are described below:

The NRC mentioned topics of RAIs that were included in the NRC RAI Comments on the DOE FY 2013 SDF Special Analysis Document [ADAMS Accession No. ML14148A153]. Those topics included the following issues: (1) mechanical degradation beginning at the time of closure; (2) gas phase transport of oxygen into unsaturated fractures; and (3) uncertainty in the reducing capacity of saltstone and its ability to reduce Tc(VII) to Tc(IV). The NRC acknowledged that the DOE Response to the NRC RAI Comments on the DOE FY 2013 SDF Special Analysis Document [ADAMS Accession No. ML15020A672] indicated several topics where research that DOE was planned to address those issues. However, until the DOE research results were available, those topics were repeated in the RAIs.

The NRC provided general comments about NRC RAI Question SP-10, which was about Tc release from saltstone. The RAI Question asks for information that could be supplied by the combination of the DOE sensitivity analysis cases that addressed: (1) less than expected re-reduction of Tc in reduced areas of saltstone; and (2) poor correlation of saltstone oxidation and Tc release. NRC staff indicated that a combination of those analyses does not represent arbitrary “worst case” conditions. The cases were physically related because they both represented uncertainty in the conceptual model that Tc release will be a simple function of the reducing capacity in a local area in saltstone. Previously, the NRC had questioned the accuracy of that DOE conceptual model. The DOE responded by indicating that the planned research related to Tc release will be put into a revised PA model. Specifically, the DOE discussed planned research to perform depth-discrete sampling to evaluate the mobilization of Tc in different locations in a sample.

Regarding the NRC RAI Question PAM-4, which was about conceptual model uncertainty related to climate change, the DOE indicated that DOE Order 435.1 requires conclusions of modeling results to 1,000 years post-closure, partially because uncertainties at longer times were difficult to predict. The NRC clarified that the RAI was not about predicting the effects of climate change; instead, the RAI was about the need for the DOE to address uncertainty in the PA model caused by possible future changes in disposal site events and processes due to climate change. The DOE expressed concern that it was difficult to communicate to the public that cases designed to bound uncertainty in future conditions were not the expected case. The NRC suggested that the DOE review the RAI in the context of MF 10.02 in the 2013 SDF Monitoring Plan.

The DOE and the NRC discussed several RAIs related to the projected rate of hydraulic degradation of saltstone. Regarding NRC RAI Question SP-1, which was about decalcification, the DOE indicated that shortening the predicted degradation time due to decalcification would not have a significant effect on the model output. The NRC indicated that the DOE view was the previous NRC staff understanding; but, that view does not seem consistent with the results of the DOE sensitivity analyses using degradation multipliers. In a similar discussion related to the rate of degradation (RAI Question SP-3), the DOE indicated that the assumption that degradation occurs at a linear rate was conservative. The NRC indicated that more support was needed for that conclusion because the peak dose was likely to be related to the rate of change of the hydraulic properties and other degradation curves that involved a time period with

faster degradation could result in a higher projected peak dose even if there is less degradation at earlier times. The NRC discussed the potential evolution of pathways for water in porous solids and discussed mechanisms that could cause relatively gradual or even imperceptible changes until a certain level of degradation was reached and at that point, hydraulic properties could change more rapidly. The DOE and the NRC discussed the idea that channeling through saltstone could be beneficial for performance if water was directed away from most of the inventory. Regarding two RAIs related to delays before degradation was modeled to begin (RAI Question SP-5 and RAI Question DSP-2), the DOE suggested that responses may refer to sensitivity case results where the hydraulic conductivity was increased at the time of closure. The NRC replied that appeared to be one way to address those RAIs.

The DOE questioned the risk-significance of NRC Question SP-4, which was about modeling hydraulic degradation in localized areas instead of modeling degradation as proceeding uniformly throughout saltstone. The NRC explained the concern that degradation localized in areas that were in more contact with water appeared to have the potential to focus water flow through areas where Tc had a higher chance of being oxidized. The NRC clarified that the RAI Question could potentially be answered with an analytical argument instead of results from a numerical model run.

The DOE questioned why, in several unidentified RAIs, the NRC asked for projected dose results instead of fluxes or fractional releases for times in excess of 20,000 years after closure. The NRC explained that, given the uncertainty in the timing of the projected peak doses, it was not clear to the NRC that the Tc peaks would occur more than 10,000 years after closure. The DOE indicated that results in terms of dose beyond 20,000 years would not be provided to the NRC. The NRC responded that fluxes to the unsaturated zone could be converted dose results. However, results presented in terms of the cumulative fractional release were more difficult to interpret because the slope of that line, rather than the cumulative fractional release value itself, was directly related to dose. After the OOV, the DOE informed the NRC that dose results for those runs in which the simulations had been carried out beyond 20,000 years would be provided.