August 28, 2014

Ms. Jean Ridley, Director
Waste Disposition Programs Division
U.S. Department of Energy
Savannah River Operations Office
P.O. Box A
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SUBJECT: THE U.S. NUCLEAR REGULATORY COMMISSION MAY 27-29, 2014, ONSITE OBSERVATION VISIT REPORT FOR THE SAVANNAH RIVER SITE SALTSTONE DISPOSAL FACILITY (DOCKET NO. PROJ0734)

Dear Ms. Ridley:

The enclosed report describes the U.S. Nuclear Regulatory Commission (NRC) onsite observation visit on May 27 – 29, 2014, at the Savannah River Site (SRS) Saltstone Disposal Facility (SDF). That onsite observation visit was conducted in accordance with Section 3116(b) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA), which requires NRC to monitor certain disposal actions taken by the U.S. Department of Energy (DOE) for the purpose of assessing compliance with the performance objectives set out in Title 10 of the Code of Federal Regulations (CFR) Part 61, Subpart C. This is the fifteenth SDF onsite observation visit since NRC began monitoring DOE SDF disposal actions under NDAA Section 3116(b) in October 2007.

On April 30, 2012, NRC issued both a Technical Evaluation Report (TER) [available via the NRC's Agencywide Documents Access and Management System (ADAMS) at Accession Number ML121020140] and a Type-IV Letter of Concern [ML120650576] pertaining to waste disposal at the SRS. The TER concluded that NRC did not have reasonable assurance that salt waste disposal at the SDF met the performance objective of §61.41. The Type-IV Letter of Concern formally communicated NRC's concerns to both DOE and the South Carolina Department of Health and Environmental Control. DOE provided responses to the Type-IV Letter to NRC in multiple submittals. Those submittals included an updated technetium-99 (Tc-99) inventory projection for the newly constructed SRS saltstone disposal structures similar in design to Saltstone Disposal Structure (SDS) 2A[1]; and information about DOE Case K and K1 uncertainty and sensitivity analyses. In August 2012, NRC issued a letter of acknowledgement [ML12213A447] including 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's TER analyses and DOE's revised Tc-99 inventory, the staff determined that, if DOE's new projected Tc-99 inventory for the newly constructed disposal structures is correct, then it is unlikely that the salt waste disposal would

[1] Inventory projections described in DOE's response to NRC's Type-IV Letter are listed in reference to Saltstone Disposal Structures 2A, 2B, 3A, 3B, 5A, and 5B.

cause an off-site peak dose exceeding the requirements of §61.41 (i.e., 0.25 mSv/yr (25 mrem/yr)).

The main activities conducted during the May 2014 onsite observation visit were a tour of construction of SDS 6, new monitoring wells, and Z-Area Sedimentation Basin; and technical discussions only or technical discussions with tour on: (1) operating status, disposal structure status, and monitoring activity status; (2) main topics of future NRC Request for Additional Information Comments on the DOE Fiscal Year 2013 Saltstone Special Analysis document; (3) first year results of lysimeter experiment; (4) DOE Crosswalk of Select SDF Documents document, (5) information on technetium oxidation and mobility, (6) emplaced saltstone sampling with tour of saltstone core-drilling mockup apparatus; and (7) groundwater results and retention pond data. Also, there were other items discussed, such as the review of Follow-Up Action Items. Those activities were consistent with those described in NRC Observation Guidance Memorandum for the SRS SDF Onsite Observation Visit (dated April 16, 2014,) [ML14080A278]. That Guidance Memorandum was developed using the SDF Monitoring Plan, Rev. 1 (dated September 2013) [ML13100A113]. The SDF Monitoring Plan contains the monitoring areas and monitoring factors, which describe how NRC will monitor 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. NRC does not expect to close any of the 73 SDF monitoring factors (specific to a specific performance objective) or change the NRC staff TER overall conclusions as a result of this onsite observation visit. There were no SDF Open Issues before the May 2014 onsite observation visit and there were none opened during the onsite observation visit. Thus, there are currently no SDF Open Issues.

NRC does expect to open and close Follow-Up Action Items during onsite observation visits and clarification teleconference calls. Most of those Follow-Up Action Items are specific short-term actions to be performed by the NRC or DOE. Usually, most of those Follow-Up Action Items are closed before the next onsite observation visit or clarification teleconference call. The DOE and NRC continue to work in the monitoring process to resolve all outstanding concerns that led to issuance of the Type-IV Letter of Concern. Therefore, in accordance with the requirements of NDAA Section 3116(b), the NRC will continue to monitor DOE disposal actions at SRS.

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

Sincerely,

/RA/

Gregory Suber , Acting Director
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Docket No.: PROJ0734

Enclosure:
NRC Onsite Observation Visit Report

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U.S. NUCLEAR REGULATORY COMMISSION
MAY 27-29, 2014, ONSITE OBSERVATION VISIT REPORT FOR
THE SAVANNAH RIVER SITE SALTSTONE DISPOAL FACILITY

EXECUTIVE SUMMARY:

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its fifteenth onsite observation visit, Observation 2014-01, to the Saltstone Disposal Facility (SDF) at the Savannah River Site (SRS) on May 27-29, 2014. This is the first SDF onsite observation visit in Calendar Year 2014. On every onsite observation visit to SRS, NRC is focused on assessing compliance with four performance objectives in Title 10 of the Code of Federal Regulations (CFR) Part 61, Subpart C: (1) protection of the general population from releases of radioactivity (§61.41), (2) protection of individuals from inadvertent intrusion (§61.42), (3) protection of individuals during operations (§61.43), and (4) stability of the disposal site after closure (§61.44).

For SDF Observation 2014-01, NRC focused on the monitoring areas and monitoring factors in the SDF Monitoring Plan, Rev. 1 (September 2013). This is the first SDF onsite observation visit under SDF Monitoring Plan, Rev. 1. All previous NRC concerns have been rolled into the monitoring factors in the 2013 SDF Monitoring Plan. The NRC performs monitoring activities in coordination with the State, ~~so~~ therefore South Carolina Department of Health and Environmental Control (SCDHEC) staff also participated in SDF Observation 2014-01 and received the same information from DOE as NRC received from DOE during SDF Observation 2014-01.

As described in the Observation Guidance Memorandum for SDF Observation 2014-01 (April 2014), the NRC staff and the U.S. Department of Energy (DOE) (i.e., includes DOE contractors throughout this report) toured construction of Saltstone Disposal Structure (SDS) 6, new monitoring wells, and Z-Area Sedimentation Basin; and discussed the following technical topics only or technical topics with a tour: (1) operating status, disposal structure status, and monitoring activity status; (2) main topics of future NRC RAI Comments on the DOE Fiscal Year 2013 Saltstone Special Analysis document; (3) first year results of lysimeter experiment; (4) DOE Crosswalk of Select SDF Documents document, (5) information on technetium oxidation and mobility, (6) emplaced saltstone sampling with tour of saltstone core-drilling mockup apparatus; and (7) groundwater results and retention pond data. Also, there were other items discussed, such as the review of Follow-Up Action Items. This report provides a description of NRC activities during SDF Observation 2014-01, including observations made by NRC.

NRC does not expect to close any of the 73 SDF monitoring factors (specific to a specific performance objective) or change the NRC staff TER overall conclusions as a result of this onsite observation visit. There were no SDF Open Issues before the May 2014 onsite observation visit and there were none opened during the onsite observation visit. Thus, there are currently no SDF Open Issues. The DOE and NRC continue to work in the monitoring process to resolve all outstanding concerns that led to issuance of the Type-IV Letter of Concern.

The NRC staff received a DOE presentation (SRR-CWDA-2014-00054, Rev. 1) that pertained to the activities observed during SDF Observation 2014-01. The presentation that DOE provided

to the NRC staff is accessible via the NRC's document repository, the Agencywide Documents Access and Management System (ADAMS), via Accession No. ML14155A014.

1.0 BACKGROUND:

Section 3116(a) of the National Defense Authorization Act for Fiscal Year 2005 (NDAA) authorizes DOE, in consultation with the NRC, to determine that certain radioactive waste related to the reprocessing of spent nuclear fuel is not high-level waste, provided certain criteria are met. NDAA Section 3116(b) requires NRC to monitor DOE disposal actions to assess compliance with the performance objectives in 10 CFR Part 61, Subpart C.

On March 31, 2005, DOE submitted to NRC the *Draft Section 3116 Determination for Salt Waste Disposal Savannah River Site* (DOE-WD-2005-001, Rev. 0) 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, NRC staff reviewed the draft waste determination. In the TER issued in December 2005, 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, DOE issued the final waste determination in January 2006 (DOE-WD-2005-001, Rev. 1).

DOE submitted a revised Performance Assessment to NRC in 2009 (SRR-CWDA-2009-00017). NRC reviewed SRR-CWDA-2009-00017, including holding public meetings, sending requests for additional information, and reviewing the DOE responses. On April 30, 2012, NRC issued both the TER and the Type-IV Letter of Concern. In the 2012 TER, NRC concluded that it did not have reasonable assurance that salt waste disposal at the SDF met the performance objectives in 10 CFR Part 61, specifically 10 CFR 61.41. The Type-IV Letter of Concern formally communicated the NRC concerns to both DOE and SCDHEC.

In July 2012, DOE responded to the Type-IV Letter to NRC in multiple submittals. DOE's responses included an updated technetium-99 (Tc-99) inventory projection for the newly constructed SRS saltstone disposal structures similar in design to Saltstone Disposal Structure (SDS) 2A and information about DOE Case K and K1 uncertainty and sensitivity analyses. In August 2012, NRC issued a letter of acknowledgement [ML12213A447] including 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's TER analyses and DOE's revised Tc-99 inventory, the NRC staff determined that, if DOE's new projected Tc-99 inventory for the newly constructed disposal structures is correct, then it is unlikely that the salt waste disposal 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), NRC, in coordination with the State site regulator – SCDHEC, performs three types of activities: (1) technical reviews, (2) onsite observation visits, and (3) data reviews. Those activities focus on both: (1) key modeling assumptions identified in the NRC SDF Monitoring Plan, Rev. 1; and (2) the DOE disposal actions. Technical reviews generally focus on review of information generated to provide support for key assumptions that DOE made in the SDF Performance Assessment or supplements, such as special analyses. Onsite observation visits generally are performed to

either: (1) observe the collection of data and review the data to assess consistency with assumptions made in the SDF final Waste Determination; or (2) observe key disposal or closure activities related to technical review areas. Data reviews supplement 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 April 16, 2014, NRC issued the Observation Guidance for the May 27-29, 2014, onsite observation visit, SDF Observation 2014-01. An Observation Guidance is a plan for what NRC expects to cover during an onsite observation visit, which may not be followed based on what happens during the onsite observation visit.

SDF Observation 2014-01 began with a short briefing on the agenda presented by DOE contractor, Savannah River Remediation (SRR) that was attended by representatives from DOE, NRC, and SCDHEC. Afterwards, there were welcoming remarks and introductions. The following tour occurred during SDF Observation 2014-01: construction of SDS 6, new monitoring wells, and Z-Area Sedimentation Basin. The following topics were technical discussions only or technical discussions and a tour during SDF Observation 2014-01: (1) operating status, disposal structure status, and monitoring activity status; (2) main topics of future NRC RAI Comments on the DOE Fiscal Year 2013 Saltstone Special Analysis document; (3) first year results of lysimeter experiment; (4) DOE Crosswalk of Select SDF Documents document, (5) information on technetium oxidation and mobility, (6) emplaced saltstone sampling with tour of saltstone core-drilling mockup apparatus; and (7) groundwater results and retention pond data. NRC staff also reviewed the Follow-Up Action Items.

2.1 Technical Discussion – Operating Status, Disposal Structure Status, and Monitoring Activity Status:

2.1.1 Observation Scope:

Using the NRC SDF Monitoring Plan, Rev. 1, NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41, 10 CFR 61.42, and 10 CFR 61.43 performance objectives. The Monitoring Plan is also used to verify compliance with 10 CFR 61.41 and 10 CFR 61.42, through Monitoring Area 1 (Inventory) under Monitoring Factor 1.01 (Inventory in Disposal Structures) and Monitoring Factor 1.02 (Methods used to Assess Inventory) and Monitoring Factor 8 (Environmental Monitoring) under Monitoring Factor 8.01 (Leak Detection) and under a future monitoring factor for SDS 4 retention pond sampler. The Monitoring Plan is also used to ascertain compliance with 10 CFR 61.43, through Monitoring Area 11 (Radiation Protection Program) under Monitoring Factor 11.01 (Dose to Individuals During Operations).

2.1.2 Observation Results:

DOE provided NRC an overview presentation containing the topics of: Saltstone Facility Status – including SDF and Saltstone Production Facility (SPF); Current Map of Saltstone Facility; Complete SPF Operational Status; Fiscal Year (FY) 2013 and FY 2014 SPF Operations Status; Detailed June, August, and December 2013 SPF Operations Status; SPF Operations as of 05/13/2014; SDS 3A, 3B, 5A, and 5B Status; SDS 6 Status; SDS 4 Stabilization Project;

FY 2014 SDS 4 Stabilization Project Status; Z-Area Groundwater Status; Z-Area Storm Water Outfall; Z-Area Sedimentation Basin No. 4 Status; Radiological Exposure; Periodic Documents; and Monitoring Activity Status. NRC and DOE discussed the information in the presentation. Highlights of that Technical Discussion are the following:

Regarding SPF Operations Status:

- DOE provided NRC an update on the salt solution processed during FY 2013 and FY 2014. SPF operations have been limited in Calendar Year 2014 because of freeze damage to the lines from the saltstone processing facility to the disposal structures.
    - Since the previous NRC onsite observation visit in June 2013, DOE processed approximately 52,000 gallons of salt waste.
        - The majority of that waste was processed and sent to SDS 2A.
        - A small fraction of that waste (i.e., 2,600 gallons of salt waste) was processed into saltstone and sent to SDS 5B before a pump problem caused DOE to stop adding saltstone to SDS 5B.
            - SDS 5B has not received any additional saltstone since DOE replaced the pump and lines.
        - SDS 3A, 3B, and 5A had not yet received any saltstone at the time of visit.

- DOE discussed why the allowable fill height for SDS 2A, 2B, 3A, 3B, 5A, and 5B was raised from 18.5 feet to 21.5 feet.
    - NRC questioned DOE regarding the basis for the revised fill height
    - DOE indicated that the allowable fill height was revised based on new safety basis calculations of flammability related to one of the solvents in the Modular Caustic Side Solvent Extraction Unit (MCU) system that can be carried over from the MCU system into saltstone.

- DOE performed a Unreviewed Waste Management Question Evaluation (UWMQE) to evaluate the effect of the reduced clean cap thickness on the sulfate attack of the roof concrete.
    - The as-modeled delay in degradation of the roof due to sulfate attack was decreased because of the decreased thickness of the clean cap.

Regarding Saltstone Disposal Structures Status:

- DOE indicated that construction of SDS 3A, 3B, 5A, and 5B has been completed.

- DOE provided NRC information about the SDS 3A leak detection system, including:
    - The volume of water detected in the leak detection system had increased from several gallons each time the system was checked to tens of gallons each time it was checked.
    - At one point, DOE discovered 70 to 80 gallons of water in the leak detection system on two consecutive days.

  - Although DOE had originally assumed the water entered SDS 3A during construction, the current volume of water being pumped from SDS 3A cannot be explained as construction water.
  - DOE is evaluating potential sources of the water into SDS 3A, including potential breaches in the High Density Polyethylene (HPDE) surrounding SDS 3A, breaches in the leak detection system, and other alternative sources of water.

- NRC asked DOE the following questions about the SDS 3A leak detection system:
  - Was the water detected in the leak detection system evidence of a breach in the HDPE surrounding SDS 3A?;
  - Could water infiltration that DOE observed in SDS 3A escape detection in other saltstone disposal structures because SDS 3A is the only one with a leak detection system?; and
  - How could a breach in the HDPE affect the performance assessment results?

- DOE provided NRC with an update on the status of construction of SDS 6:
  - Construction of the Lower Mud Mat, HDPE/Geosynthetic Clay Layer, and Upper Mud Mat was completed.
  - Tank construction began in mid-May 2014.

Regarding the SDS 4 Stabilization Project:

- DOE provided NRC information about the SDS 4 Stabilization Project:
  - DOE summarized the previous infiltration through the roof of SDS 4, which NRC and DOE discussed publicly on October, 3, 2013, (see ML13337A204).
  - DOE indicated that the north six cells (i.e., A, B, C, G, H, I) were coated with an elastomeric coating and sealed to limit infiltration and the same coating will be applied to the south cells (i.e., D, E, F, J, K, L).
  - DOE will place a clean cap over the saltstone in the six south cells to lower the dose rates for the workers who will install the roof coating.
    - That clean cap will be placed using a truck to eliminate the need for flush water to enter SDS 4.
    - To minimize bleed water, the water-to-cement ratio of the clean cap will be reduced to 0.45.

Regarding Z-Area Groundwater and Storm Water Outfall Status:

- DOE provided NRC information about the status of groundwater monitoring in the Z-Area, including:
  - Cone-penetrometer testing was in progress.
  - DOE will be installing three additional wells: two new wells downgradient of Z-Area Sedimentation Basin number 4 and one new well downgradient from SDS 4.
    - The well downgradient from SDS 4 will be screened beneath the Tan Clay Confining Zone (TCCZ).

- DOE provided NRC information on the status of the Z-Area Storm Water Outfall Z-01

and the Z-Area Sedimentation Basin Number 4:

- Efforts to reduce identified hot spots of contamination from the discharge of storm water from the Saltstone Storm Water Basin, which occurred in early 2013, were completed.
- Construction to enlarge the Z-Area Sedimentation Basin Number 4 has started and is expected to be completed in 2014.
  - The expansion of the basin will reduce the risk of future discharges of storm water.

Regarding Radiological Exposure at the SDF:

- DOE indicated that no unexpected exposures occurred and no individual exposures above the regulatory limits or the SRS Administrative Control Levels (ACLs) occurred.

- DOE provided data on the top 10 individual whole body doses received at SDF for Calendar Year 2013 and the first quarter of Calendar Year 2014.
  - Those doses are all below the SRS ACL of 500 millirem/year for whole body.

Regarding Periodic Documents:

- DOE provided NRC with an updated list of the routine documents that were provided to NRC since the last onsite observation visit in June 2013 and a list of additional documents that are now available, which DOE intends to provide to NRC.

Regarding Status of Follow-Up Action Items:

- DOE provided a summary of the Follow-Up Action Items from the June 2013 onsite observation visit and the information provided to NRC to address those Items.
  - NRC agreed with DOE that all of those Items are closed.

- DOE discussed four Follow-Up Action Items from NRC Public Meetings in October 2013 and February 2014 and from a clarifying teleconference call in April 2014.
  - DOE provided NRC information to complete one of those Items prior to this onsite observation visit and DOE provided NRC information to close the other three Items during this onsite observation visit.

2.1.3 Conclusions and Follow-up Action Items:

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

- 1. DOE to provide NRC follow-up documentation on ongoing monitoring of SDS 3A sump and potential impact on the SDF Performance Assessment.

- DOE to provide NRC electronic copies of the following saltstone and saltstone disposal structure research and development testing/studies reports:

  - SRR-SPT-2013-00056, “Physical Property Comparison of Core-Drilled and Cast Saltstone Simulant”
  - SRNL-STI-2013-00533, “Saltstone Osmotic Pressure” and
  - SRR-SPT-2013-00044, “Summary of Fiscal Year 2013 Activities Related to SDU Sampling and Analyses.”

- DOE to provide NRC electronic copies of the following recent versions of Periodic Documents:
  - SRR-CWDA-2014-00027, “FY 2013 Annual Review Saltstone Disposal Facility (Z-Area) Performance Assessment”
  - SRR-CWDA-2013-00140, “Determination of SDF Inventories through 9/30/2013”
  - SRNL-STI-2014-00074, “Results for the Fourth Quarter 2013 Tank 50 WAC Slurry Sample”

2.2 Tour – Construction of SDS 6, New Monitoring Wells, and Z-Area Sedimentation Basin:

2.2.1 Observation Scope:

Using the NRC SDF Monitoring Plan, Rev.1, NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41 and 10 CFR 61.42 performance objectives through Monitoring Area 8 (Environmental Monitoring) under Monitoring Factor 8.02 (Groundwater Monitoring) and under a future monitoring factor added to SDF Monitoring Plan related to the Z-Area Sedimentation Basin number 4 retention pond sampler.

2.2.2 Observation Results:

NRC toured Z-Area with DOE, including:

- The construction of SDS 6, the general location of new monitoring wells, and the Z-Area storm water outflow and sedimentation basin.
  - NRC observed the layout and construction of the SDS 6 floor, including the curvature of the floor, the presence of floor panels/construction joints, and the use of tapered walls.

- NRC questioned DOE regarding heave for SDS 6 (i.e., a §61.44 issue) and DOE indicated that:
  - SDS 6 has five elevation markers, which have indicated heave ranging from 0.25 inches to 0.4 inches during excavation; while modeling calculations projected heave of approximately 1.0 inch for SDS 6.

2.2.3 Conclusions and Follow-up Action Items:

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

- DOE to provide NRC an electronic copy of the Unreviewed Waste Management Question Evaluation (UWMQE) addressing increasing the allowable SDS 2A-type saltstone disposal structure fill height above 18.5 feet.

2.3 Technical Discussion – Main Topics of Future NRC Request for Additional Information Comments on the DOE Fiscal Year 2013 Saltstone Special Analysis Document:

2.3.1 Observation Scope:

Using the NRC SDF Monitoring Plan, Rev. 1, NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41, 10 CFR 61.42, and 10 CFR 61.43 performance objectives through all 11 Monitoring Areas (MAs) and all 73 specific Monitoring Factors.

2.3.2 Observation Results:

NRC discussed the main topics of the future NRC RAI Comments on the DOE Fiscal Year 2013 Saltstone Special Analysis (SRR-CWDA-2013-00062, Rev. 2). Since the NRC RAI Comments are now publicly available (see ML14148A153), only highlights of that Technical Discussion are discussed below:

- NRC confirmed that DOE responses to the RAI Comments are not expected to be provided to NRC:
    - NRC understands that DOE intends to use the NRC RAI Comments in development of the Fiscal Year 2014 Saltstone Special Analysis document;
    - If DOE does not address the concerns in the RAI Comments, then DOE should expect to see them again in the NRC RAI Questions/Comments for the Fiscal Year 2014 Saltstone Special Analysis document; and
    - NRC intends to issue a new Technical Evaluation Report that will be based on both the Fiscal Year 2013 and Fiscal Year 2014 Saltstone Special Analysis documents.

- NRC indicated that one of the overall areas of concern related to the need to link the conceptual model to the mathematical model and the mathematical model to the physical model.

- NRC indicated that one of the overall areas of concern related to aspects of the model that affect projected peak timing, including:
    - Support for re-reduction and concentration of Tc-99 in the PORFLOW Near-Field model;
    - Limited analysis of cementitious material degradation mechanisms;
    - Almost 4,000 year delay before beginning degradation of the Future Disposal Cell (FDC) saltstone;
        - "FDC" is DOE term for a saltstone disposal strucuture similar in design to SDS 2A.
    - Initial saltstone hydraulic conductivity that does not include the full range of observed values;
    - Concerns about the solubility limit used in the evaluation case;
    - Concerns about the use of reducing capacity as a basis for the release of Tc-99;
    - Inadequate support for the DOE assumed value of the reducing capacity of saltstone, if reducing capacity is determined to be an appropriate basis for Tc-99 release;

  - 1,400 year delay in the degradation of the FDC roofs,
  - Conceptual model for floor oxidation of the FDC; and
  - Assumed shedding/drainage of water around the FDCs.

- NRC indicated that one of the overall areas of concern related to the clarity of certain aspects of the Fiscal Year 2013 Saltstone Special Analysis document, including traceability of references, time period over which sensitivity analyses were conducted, and units in presentation of sensitivity analysis results.

2.3.3 Conclusions and Follow-up Action Items:

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

- DOE to provide NRC Fiscal Year 2013 Saltstone Special Analysis document Tecplot files in readable electronic form.

- DOE to provide NRC large scale diagrams of cell layout stream traces and cross-section of SDS 6 with Fiscal Year 2014 Saltstone Special Analysis document.

- DOE to provide NRC information regarding applicability of hydraulic conductivity values provided in SRNL-STI-2010-00745.

2.4 Technical Discussion – First Year Results of Lysimeter Experiment:

2.4.1 Observation Scope:

Using the NRC SDF Monitoring Plan, Rev. 1, NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41 and 10 CFR 61.42 performance objectives through Monitoring Area 5 (Waste Form Chemical Degradation) under Monitoring Factor 5.01 (Radionuclide Release from Field-Emplaced Saltstone), Monitoring Factor 5.02 (Chemical Reduction of Tc by Saltstone) and Monitoring Factor 5.05 (Potential for Short-Term Rinse-Release from Saltstone).

2.4.2 Observation Results:

DOE and NRC discussed the First Year Results of the Lysimeter Experiment (SRR-CWDA-2013-00121, Rev. 0). Highlights of that Technical Discussion are the following:

- The lysimeters were uncapped (i.e., opened to atmospheric conditions) in July 2012, with 4 of the 46 lysimeters containing saltstone with Tc-99 and I-129.
  - Prior to uncapping the lysimeters, the pucks were sitting for approximately 2 months in the presence of air.

- Leachate samples were collected on a quarterly basis:
  - The first samples had higher Tc-99 concentrations than subsequent samples, which appeared to be attributable to a surface rinse process; however, surface-rinse release would not account for all of the Tc-99 release.

        - NRC commented that field-emplaced saltstone could oxidize prior to water flow through saltstone, which could mimic the puck conditions.
    - After the first three quarters, the lysimeters containing Tc and no slag released approximately 50% to 60% of the Tc-99.
    - For the two lysimeters containing Tc and slag, one released 27% within the first three quarters and the second released approximately 11% within the first two quarters.
        - NRC commented that the slag does not appear to have as significant of an influence on Tc-99 retention as the DOE shrinking core model would project for Tc-99 (i.e., the presence of slag reduced Tc-99 release by only a factor of 2 to 4, as compared to the sample without slag).
    - DOE indicated that flow through the lysimeters was variable and that it may be that the measured difference in flow was not an artifact of differences in evaporation because a control experiment showed evaporation rates to be consistent among containers.

- After 1 year, the researchers retrieved the lysimeters containing Tc-99 and I-129, which were then stored in an anaerobic box containing nitrogen and 0 parts per million oxygen for potential future testing, depending on available funds.
    - NRC suggested that the spatial pattern of oxidation and Tc speciation in the lysimeter pucks could provide useful information; especially given the recent research that seems to indicate a lack of correlation between saltstone oxidation and Tc release (i.e., reports from Cementitious Barriers Partnership (CBP) (CBP-TR-2013-002) and DOE (SRNL-STI-2013-00541)).

- The researchers extrapolated the release from the saltstone-simulant pucks to the field-scale saltstone monoliths and calculated that the release would be approximately 0.04% per year.
    - DOE indicated that this was a simplistic calculation and that the condition of the lysimeter puck could vary from actual as-emplaced saltstone.

2.4.3 Conclusions and Follow-Up Action Items:

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

2.5 Technical Discussion – DOE Crosswalk of Select SDF Documents:

2.5.1 Observation Scope:

Using the NRC SDF Monitoring Plan, Rev. 1, NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41, 10 CFR 61.42, and 10 CFR 61.43 performance objectives through all 11 Monitoring Areas and all 73 specific Monitoring Factors.

2.5.2 Observation Results:

The NRC and DOE discussed the DOE Crosswalk of Select SDF Documents (SRR-CWDA-2014-00002, Rev. 1). Many of the main discussion points with respect to the DOE Crosswalk were also reflected in the discussion points of the NRC RAI Comments for the Fiscal Year 2013 Saltstone Special Analysis document (see Section 2.3 above). Highlights of the Technical Discussion regarding the DOE Crosswalk are the following:

- NRC commented that the DOE Crosswalk document tables that showed which references DOE used, and continues to use, to support the conceptual and mathematical models as they related to each MF were particularly useful (i.e., Tables 3.1-1, 3.2-1, 3.3-1).

- For MA 1 (Inventory), DOE will continue to provide NRC with periodic updates to the SDF inventory.

- For MA 2 (Hydraulic Performance of Closure Cap), NRC identified that specific questions about the closure cap were included in the NRC RAI Comments.

- For MA 3 (Waste Form Hydraulic Performance), DOE was no longer planning to pursue development of formed-core sampling and instead DOE plans to further develop core drilling methods.
    - NRC commented that the "DOE Saltstone Sampling and Analyses Plan" (see SRR-SPT-2012-00049) continues to appear to be a reasonable approach to addressing MFs related to the hydraulic performance of field-emplaced saltstone.

- For MA 4 (Waste Form Physical Degradation), NRC reiterated the point from the discussion on the RAI Comments that mechanical degradation mechanisms could begin during the delay in degradation described in DOE Crosswalk document Section 3.4.2.

- For MA 5 (Waste Form Chemical Degradation),
    - NRC referred to several RAI Comments related to the oxidation of saltstone over time and the effects of fracturing on saltstone oxidation.
    - NRC referred to several RAI Comments related to re-reduction of oxidized Tc in saltstone, which appears to be a significant feature.
    - NRC referred to several RAI Comments related to the lack of correlation between saltstone oxidation and Tc release in recent research reports (i.e., CBP-TR-2013-002 and SRNL-STI-2013-00541).
    - For several MFs related to Kd values, DOE proposed to respond to the MF by indicating that the projected dose from the radionuclide in question was low.
        - NRC indicated that DOE had not shown that the projected dose would remain low if the Kd value changed.

- For MA 6 (Disposal Structure Performance), NRC referred to several RAI Comments regarding the lower lateral drainage layer and NRC reiterated the concern about Kd values that was made during the discussion of MA 5.

- For MA 7 (Subsurface Transport), NRC reiterated the concern related to Kd values that was made during the discussion of MA 5 and indicated that Kd values for subsurface transport were also addressed in the RAI Comments.

- For MA 8 (Environmental Monitoring), NRC did not have significant comments regarding the DOE Crosswalk document.

- For MA 9 (Site Stability), NRC did not have significant comments regarding the DOE Crosswalk document.

- For MA 10 (Performance Assessment Model Revisions):
    - NRC reviewed the most significant changes to the SDF model from the Fiscal Year 2013 Saltstone Special Analysis document.
    - NRC indicated that DOE made several improvements, including modeling of joints in disposal structure floors and between floors and walls, and inclusion of solubility-controlled release instead of simply sorption governed release for Tc.
    - NRC referred to RAI Comments related to: (1) the delay before saltstone degradation was modeled to begin, (2) the delay before disposal structure degradation was modeled to begin, and (3) changes in the DOE biosphere model.
    - NRC referred to RAI Comments related to a more integrated presentation of the site conceptual model, including that in different places in the Fiscal Year 2013 Saltstone Special Analysis document, DOE used different conceptual models to represent oxidation of disposal structure floors, which resulted in different projected outcomes.

2.5.3 Conclusions and Follow-Up Action Items:

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

- DOE to provide NRC information on causes of increased dose values at the end of the curve (i.e., 17,000 – 20,000 years) shown in Figure 3.10-1 of the DOE Crosswalk document.

2.6 Technical Discussion – Information on Technetium Oxidation and Mobility:

2.6.1 Observation Scope:

Using the NRC SDF Monitoring Plan, Rev. 1, NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41 and 10 CFR 61.42 performance objectives through MA5 (Waste Form Chemical Degradation) under MF 5.02 (Chemical Reduction of Tc by Saltstone).

2.6.2 Observation Results:

DOE and NRC discussed Tc oxidation and mobility. Highlights of that Technical Discussion are the following:

- Some relevant aspects of this technical discussion are included in the discussion of the First Year Results of the Lysimeter Study (see Section 2.4 above).
    - During this discussion, DOE referenced Section 2.1 of the DOE Crosswalk document and testing and research activities discussed in Section 2.3.1. of "Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program, FY2014 Implementation Plan" (SRR-CWDA-2013-00133, Rev. 0).

- DOE provided an overview of the Critical Property Testing plan elements related to Tc oxidation.

- In addition to the discussion in Section 2.4, NRC reiterated the concerns related to:
    - The need for evidence to support the large degree of re-concentration of Tc that was projected in the DOE PORFLOW model supporting the Fiscal Year 2013 Saltstone Special Analysis document.
    - Recent findings regarding the relationship between saltstone oxidation with Tc mobility, as discussed with DOE in the NRC Public Meeting on February 10, 2014, (see ML14057A578).

2.6.3 Conclusions and Follow-Up Action Items:

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

2.7 Technical Discussion and Tour – Emplaced Saltstone Sampling with Tour of Mockup:

2.7.1 Observation Scope:

Using the NRC SDF Monitoring Plan, Rev. 1, NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41 and 10 CFR 61.42 performance objectives through Monitoring Area 3 (Waste Form Hydraulic Performance) under Monitoring Factor 3.01 (Hydraulic Conductivity of Field-Emplaced Saltstone), Monitoring Factor 3.02 (Variability of Field-Emplaced Saltstone, Monitoring Factor 3.03 (Applicability of Laboratory Data to Field-Emplaced Saltstone) and through Monitoring Area 5 (Waste Form Chemical Degradation) under Monitoring Factor 5.01 (Radionuclide Release from Field-Emplaced Saltstone).

2.7.2 Observation Results:

DOE discussed with NRC the emplaced saltstone sampling and provided a tour of the saltstone core-drilling mockup apparatus. Highlights of that Technical Discussion and Tour are the following:

- DOE discussed that research is being conducted, which is intended to demonstrate that the properties of the laboratory-prepared saltstone are representative of the properties of as-emplaced saltstone:
    - That research will include an analysis of the saturated hydraulic conductivity, the reduction capacity, and the leaching characteristics.
    - Six saltstone cores, each 6 feet in length, will be extracted from SDS 2A, which would potentially provide 36 samples.
        - The additional saltstone being added to the disposal structure will increase the thickness of the core samples from what was documented in the original work plan, which could potentially cause technical coring issues to arise.
        - The extracted cores need to be separated at the bottom of the core from the main grout body.
        - Cold joints will be relied upon to make that separation easier.
    - Laboratory-prepared samples will be cured at a specified temperature profile and humidity will be greater than 95%.
        - The sensor will not provide information greater than 95% humidity; but, ponding has occurred on the samples.
        - A color difference was seen between the cast core samples and drilled core samples for the mockup study and DOE is investigating the cause.
        - Additional details about the experimental plan are in SRR-CWDA-2014-00054.

- DOE provided NRC with a tour of the onsite core-drilling mockup study.

- Related to the mockup study, DOE discussed that:
    - The purpose of the study was to: (1) investigate different drilling techniques, (2) demonstrate the ability of core-drilling to retrieve and extract samples, and (3) determine if core-drilling adversely affects the properties of the grout.
    - The core-drilled samples had similar saturated hydraulic conductivity values as cast saltstone samples; however, the compressive strength between the two different samples varied by approximately a factor of 2.
    - It was not clear if the differences in compressive strength were due to an artifact of core-bit wobble or differing moisture contents between the cored and cast samples.

- NRC discussed that:
    - SDS 6 will include many more saltstone lifts and consequently many more cold joints, relative to SDS 2A, 2B, 3A, 3B, 5A, and 5B, which may create more laterally-oriented preferential flow paths.
    - The curing conditions can have significant effects on hydraulic conductivity measurements.
      In a previous SDF onsite observation visit, DOE discussed that the absence of a temperature ramp-up to the isothermal curing temperature may have resulted in high hydraulic conductivity values in SRNL-STI-2010-00745. DOE indicated that in more recent testing, discussed in VSL-14R3210-1, utilizing cure-temperature ramping similar to that measured in the disposal units did not result in high

hydraulic conductivity values.
  - Saltstone simulants may not perfectly represent saltstone made with treated salt waste.
    - For example, trace chemicals from salt waste processing may be carried over into the treated salt waste.
    - Differences between field-scale treated salt waste and simulated treated salt waste could affect how well simulated saltstone represents the hydraulic and chemical performance of as-emplaced saltstone.

- DOE plans to address that NRC concern about saltstone simulants in the "DOE Sampling and Analyses Plan" (see SRR-SPT-2012-00049, Rev. 1).

2.7.3 Conclusions and Follow-Up Action Items:

The NRC staff will continue to monitor DOE SDF activities. No Follow-Up Action Items resulted from that technical discussion and tour.

2.8 Technical Discussion – Groundwater Results and Retention Pond Data:

2.8.1 Observation Scope:

Using the NRC SDF Monitoring Plan, Rev. 1, NRC monitors DOE disposal actions to assess compliance with 10 CFR 61.41 and 10 CFR 61.42 performance objectives through Monitoring Area 8 (Environmental Monitoring) under Monitoring Factor 8.02 (Groundwater Monitoring).

2.8.2 Observation Results:

DOE hydrogeologists familiar with the groundwater flow and contaminant transport at the SDF and NRC discussed groundwater results and retention pond data. Highlights of that Technical Discussion are the following:

- NRC discussed that Tc-99 and NO_3 contamination was detected in groundwater well ZGB-2, which is downgradient of SDS 4.

- DOE explained that contamination was detected in ZGB-2, and not in three other wells closer to SDS 4, because ZGB-2 was installed with the filter pack extending above the TCCZ, whereas ZGB-3, ZGB-4, and ZGB-5 were screened entirely below the TCCZ.

- DOE discussed a conceptual model where contamination from the saltstone disposal structures would be transported primarily above the TCCZ.

- NRC discussed that this conceptual model was different than the DOE conceptual model used in the 2009 Performance Assessment, where a significant fraction of contamination would be transported into the Upper Three Runs – Lower Zone (UTR-LZ) aquifer within 100 meters of the disposal site.

- DOE confirmed previous verbal statements by DOE that no sinkholes or natural

depressions had been discovered or detected within the Z-Area.

- DOE discussed that a structure contour map of the top of the TCCZ is being developed because intermittent flow and possible transport along the top of the TCCZ would follow channels in the TCCZ that would be generally lower in elevation.

- NRC discussed that it is difficult to understand the hydrogeologic system without knowing the screen depths and hydrogeologic units of the current Z-Area wells.
    - This topic will be included at the next SDF onsite observation Visit.

2.8.3 Conclusions and Follow-Up Action Items:

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

- DOE to provide NRC information regarding screen depth and zone of Z-Area wells.

- DOE to provide NRC information on the structure contour map of the top of the tan clay confining zone, which will be shared with NRC at the next SDF onsite observation visit.

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 2014-01 will be used for multiple NRC Technical Review Reports via memoranda, review of the upcoming DOE 2014 Saltstone Special Analysis document, and future onsite observation visits, based on the topics discussed. There is no change to the NRC staff overall conclusions from the SDF TER regarding compliance of DOE disposal actions with the 10 CFR Part 61 performance objectives.

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

SDF Observation 2014-01 is the first onsite observation visit under SDF Monitoring Plan, Rev. 1. NRC staff did not close any Monitoring Factors during SDF Observation 2014-01. 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 have been rolled into the Monitoring Factors in SDF Monitoring Plan, Rev.1. The NRC staff did not open any new Open Issues during SDF Observation 2014-01. Therefore, there are currently no SDF Open Issues.

3.4 Status of Open Follow-up Action Items from Previous SDF Onsite Observation Visit Reports:

There were fourteen previous NRC SDF onsite observation visits. All Follow-Up Action Items from reports for those previous SDF onsite observation visits have been closed.

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

All Follow-Up Action Items from previous clarification teleconference calls have been closed.

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

The table below contains the ten Follow-Up Action Items that were open during this onsite observation visit, including a unique NRC identifier for each Follow-Up Action Item:

Unique Identifier	Follow-Up Action Item
SDF-CY14-01-001	• DOE to provide NRC follow-up documentation on ongoing monitoring of SDS 3A sump and potential impact on the SDF Performance Assessment.
SDF-CY14-01-002	• DOE to provide NRC electronic copies of the following saltstone and saltstone disposal structure research and development testing/studies reports: o SRR-SPT-2013-00056, “Physical Property Comparison of Core-Drilled and Cast Saltstone Simulant;” o SRNL-STI-2013-00533, “Saltstone Osmotic Pressure;” and o SRR-SPT-2013-00044, “Summary of Fiscal Year 2013 Activities Related to SDU Sampling and Analyses.”
SDF-CY14-01-003	• DOE to provide NRC electronic copies of the following recent versions of Periodic Documents: o SRR-CWDA-2014-00027, “FY 2013 Annual Review Saltstone Disposal Facility (Z-Area) Performance Assessment;” o SRR-CWDA-2013-00140, “Determination of SDF Inventories through 9/30/2013;” and o SRNL-STI-2014-00074, “Results for the Fourth Quarter 2013 Tank 50 WAC Slurry Sample.”
SDF-CY14-01-004	• DOE to provide NRC an electronic copy of the Unreviewed Waste Management Question Evaluation addressing increasing the allowable SDS 2A-type saltstone disposal structure fill height above 18.5 feet.
SDF-CY14-01-005	• DOE to provide NRC Fiscal Year 2013 Saltstone Special Analysis document Tecplot files in readable electronic form.
SDF-CY14-01-006	• DOE to provide NRC large scale diagrams of cell layout stream traces and cross-section of SDS 6 with Fiscal Year 2014 Saltstone Special Analysis document.
SDF-CY14-01-007	• DOE to provide NRC information regarding applicability of

	hydraulic conductivity values provided in SRNL-STI-2010-00745.
SDF-CY14-01-008	• DOE to provide NRC information on causes of increased dose values at the end of the curve (i.e., 17,000 – 20,000 years) shown in Figure 3.10-1 of the DOE Crosswalk document.
SDF-CY14-01-009	• DOE to provide NRC information regarding screen depth and zone of Z-Area wells.
SDF-CY14-01-010	• DOE to provide NRC information on the structure contour map of the top of the Tan Clay Confining Zone, which will be shared with NRC at the next SDF onsite observation visit.

3.7 Issuance of NRC Technical Review Reports:

Between SDF Observation 2013-01 and SDF Observation 2014-01, NRC issued one SDF Technical Review Report via memorandum:

- "Technical Review: Solubility of Technetium Dioxides in Reducing Cementitious Material Leachates, a Thermodynamic Calculation," November 7, 2013, ML13304B159.

4.0 PARTICIPANTS:

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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.

Cementitious Barrier Partnership (CBP), CBP-TR-2009-002-C4, Rev. 0, "Chemical Degradation Review," CBP Technical Report, November 2009.

Lukens, W.W., J.I. Bucher, D.K. Shuh, and N.M. Edelstein, PIT-MISC-0017, "Evolution of Technetium Speciation in Reducing Grout," Environmental Science and Technology, Vol. 39, pp. 8,064 – 8,070, 2005. ML052720213.

Papathanassiu, A.E., et al., VSL-14R3210, "Final Report Saltstone Curing Assessment, Vitreous State Laboratory, The Catholic University of America, Revision 0, March 2014.

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. ML110800193.

_____ DOE Order 435.1, "Radioactive Waste Management," August 2001. ML101590125.

_____ DOE-WD-2005-001 Rev. 0, "U.S. Department of Energy Draft Basis for Section 3116 Determination Salt Waste Disposal at the Savannah River Site," February 2005. ML051020072.

_____ DOE-WD-2005-001, Rev. 1, "U.S. Department of Energy Basis for Section 3116 Determination Salt Waste Disposal at the Savannah River Site," January 2006. ML102850319.

WSRC-STI-2007-00607, Rev. 0, "Chemical Degradation Assessment of Cementitious Materials for the HLW Tank Closure Project," September 2007. ML081330358.

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

_____ SRNL-STI-2010-00035, Rev. 0, "Chemical Degradation Assessment for the H- Area Tank Farm Concrete Tanks and Fill Grouts," January 2010. ML111220404.

_____ SRNL-STI-2010-00745, Rev. 0, "Impact of Curing Temperature on the Saturated Liquid Permeability of Saltstone," February 2011. ML13015A119.

_____ SRR-CWDA-2012-00095, Rev. 1, "Projected Technetium-99 Inventory in Saltstone Disposal Facility Units 2, 3, and 5," July 2012. ML12198A307.

_____ "Response to Letter of Concern (Type-IV) Regarding U.S. Department of Energy Disposal Activities at the Savannah River Site Saltstone Disposal Facility," July 2012. ML12198A258.

_____ "Additional Response to 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-2012-00596, Rev. 0, "Technetium Sorption by Cementitious Materials under Reducing Conditions," September 30, 2012. ML12345A134.

_____ SRNL-STI-2012-00769, Rev. 1, “Solubility of Technetium Dioxides in Reducing Cementitious Material Leachates,” February 1, 2013. ML13070A135.

_____ SRNL-STI-2013-00118, Rev. 0, “Degradation of Cementitious Materials Associated with Saltstone Disposal Units,” March 2013. ML13189A205.

_____ SRR-CWDA-2013-00049, Rev. 1, “Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program,” May 2013. ML13148A277.

_____ SRR-SPT-2012-00049, Rev. 1, “Saltstone Sampling and Analyses Plan,” May 2013. ML14196A215.

_____ SRR-CWDA-2013-00062, “FY2013 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site,” Rev. 2, October 2013. ML14002A069.

_____ SRR-CWDA-2014-00054, Rev. 1, “U.S. DOE Savannah River Site Salt Waste Disposal Presentation for NRC Onsite Observation Visit on May 27-29, 2014,” Rev. 1, May 2014. ML14155A014.

U.S. Nuclear Regulatory Commission (NRC), NUREG/CR-5542, “Models for Estimation of Service Life of Concrete Barriers in Low-Level Radioactive Waste Disposal,” September 1990. ML121240822.

_____ “Technical Evaluation Report for Draft Waste Determination for Salt Waste Disposal,” December 2005. ML053010225.

_____ “NRC Staff Guidance for Activities Related to U.S. Department of Energy 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 U.S. Department of Energy 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 Staff Questions on Technetium Solubility Research Related to Monitoring of the Saltstone Disposal Facility,” June 26, 2013. ML13211A329.

_____ “April 30, 2013, Summary of Telephone Conference Call to Discuss Technetium Solubility Research Related to Monitoring of the Saltstone Disposal Facility,” July 3, 2013. ML13171A127.

_____ “U.S. Nuclear Regulatory Commission Plan for Monitoring Disposal Actions Taken by the U.S. Department of Energy at the Savannah River Site Saltstone Disposal Facility in

Accordance with the National Defense Authorization Act for Fiscal Year 2005," Rev. 1, September 2013. ML13100A076.

_____ "Technical Review: Solubility of Technetium Dioxides in Reducing Cementitious Material Leachates, a Thermodynamic Calculation," November 7, 2013. ML13304B159.

_____ "February 10, 2014, Public Meeting Summary: Meeting to Discuss Waste Disposal at the Savannah River Site in Accordance with the National Defense Authorization Act for Fiscal Year 2005," March 14, 2014. ML14057A578.

_____ "Onsite Observation Guidance for May 27 – 29, 2014, Monitoring Visit to the Savannah River Site, Saltstone Disposal Facility," April 16, 2014. ML14080A278.

_____ "U.S. NRC Staff Comments and Requests for Additional Information on the "Fiscal Year 2013 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site," SRR-CWDA-2013-00062, Rev. 2," June 13, 2014. ML14148A153.