



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

May 5, 2017

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

SUBJECT: THE U.S. NUCLEAR REGULATORY COMMISSION'S JANUARY 25, 2017,  
ONSITE OBSERVATION VISIT REPORT FOR THE SAVANNAH RIVER SITE  
SALTSTONE DISPOSAL FACILITY (DOCKET NUMBER: PROJ0734)

Dear Ms. Ridley:

The enclosed onsite observation visit (OOV) report describes the onsite observation that the U.S. Nuclear Regulatory Commission (NRC) conducted on January 25, 2017, at the Savannah River Site (SRS) Saltstone Disposal Facility (SDF). That OOV was conducted in accordance with Section 3116(b) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA), which requires the NRC to monitor certain disposal actions taken by the U.S. Department of Energy (DOE) for the purpose of assessing compliance with the performance objectives set out in Title 10 of the *Code of Federal Regulations* (CFR) Part 61, Subpart C. The five 10 CFR Part 61 Subpart C performance objectives are: (i) §61.40 (General Requirements); (ii) §61.41 (Protection of the General Population from Releases of Radioactivity); (iii) §61.42 (Protection of Individuals from Inadvertent Intrusion); (iv) §61.43 (Protection of Individuals during Operations); and (v) §61.44 (Stability of the Disposal Site after Closure). The January 2017 SDF OOV was the nineteenth SDF OOV conducted since the NRC began monitoring the DOE SDF disposal actions under NDAA Section 3116(b) in October 2007.

The main activities conducted during the January 2017 SDF OOV were walk-down tours of portions of the Upper Three Runs and McQueen Branch near the SDF that focused on erosional and hydrogeological aspects. Specifically, the tours were conducted to examine indications of gully growth, areas that have a higher potential for producing seeps, and outcroppings of the Santee Formation.

Those OOV activities were consistent with the activities described in the NRC Onsite Observation Guidance Memorandum for the January 2017 SRS SDF OOV (dated December 13, 2016,) [available via the NRC Agencywide Documents Access and Management System (ADAMS) at Accession No. ML16337A153]. That Onsite Observation Guidance Memorandum was developed using the SDF Monitoring Plan, Rev. 1 (dated September 2013) [ADAMS Accession No. ML13100A113]. That SDF Monitoring Plan contains the monitoring areas and monitoring factors, which describe how the NRC will monitor the DOE SDF disposal actions to assess compliance with the performance objectives. As described in the 2013 SDF Monitoring Plan, the NRC monitoring activities to assess the DOE compliance with §61.41, §61.42, §61.43, and §61.44 will be evaluated through a risk-informed process using technical reviews, data reviews, and onsite observation visits. In addition, the 2013 SDF Monitoring Plan states, "[if] the

NRC concludes with reasonable assurance that DOE complies with §61.41, §61.42, §61.43, and §61.44, then NRC will also conclude with reasonable assurance that DOE complies with §61.40.” Thus, the January 2017 SDF OOV was part of the NRC’s overall monitoring approach to assess the DOE compliance with the performance objectives.

If there is a significant concern that the NRC staff identifies during monitoring, then the NRC may establish an “Open Issue” to document that concern. Early communication of an NRC staff concern to the DOE will allow the DOE to perform corrective actions before the NRC issues a Notification Letter. There were no SDF Open Issues before the January 2017 OOV and there were no SDF Open Issues identified during the January 2017 OOV. Thus, there are currently no SDF Open Issues.

All previous NRC concerns have been rolled into the monitoring factors in the 2013 SDF Monitoring Plan. During the monitoring process, the NRC does expect to open and close both monitoring areas and monitoring factors. Based on the January 2017 SDF OOV, the NRC has not: (i) closed any of the 10 SDF monitoring areas; (ii) closed any of the 73 SDF monitoring factors (specific to a performance objective); or (iii) changed the NRC 2012 Technical Evaluation Report (TER) overall conclusions.

During the monitoring process, the NRC does expect to open and close Follow-Up Action Items during OOVs, clarification teleconference calls, or technical 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, clarification teleconference call, or technical 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 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 the statement that: “... the NRC staff concludes that a Type-II Letter to the U.S. Congress is not needed at this time.” Based on the NRC TER and the DOE revised Tc-99 inventory, the NRC staff determined that, if the DOE new projected Tc-99 inventory for the constructed disposal structures was correct, then it was unlikely that the salt waste disposal into those disposal structures would cause an off-site peak dose exceeding the requirements of §61.41 (i.e., 0.25 mSv/yr (25 mrem/yr)). However, the NRC Type-IV Letter and the NRC 2012 TER conclusion that the NRC did not have reasonable assurance that salt waste disposal at the SDF met the performance objective of §61.41 is still in place because that NRC conclusion refers to the projected dose from the entire SDF, not just the projected dose from disposal structures SDS 1, SDS 2A, SDS 2B, SDS 3A, SDS 3B, SDS 4, SDS 5A, and SDS 5B.

Those disposal structures, which had already been constructed at the time of the NRC 2012 TER, were the only disposal structures covered by that NRC determination about the new Tc-99 inventory in that August 2012 NRC letter of acknowledgement to the DOE.

The NRC and the DOE continue to work in the monitoring process to resolve all outstanding concerns that led to issuance of the NRC Type-IV Letter of Concern. As we discussed during an onsite meeting the day following the OOV, the NRC is open to working with DOE on a focused plan to describe the information needs and expected timelines for the DOE to provide, and the NRC to review, the information necessary to resolve issues related to the release of technetium and iodine from saltstone. We will be in contact with you to initiate discussions on this issue.

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

If you have any questions or need additional information regarding this onsite observation visit report, then please contact Mr. Lloyd Desotell of my staff at [Lloyd.Desotell@nrc.gov](mailto:Lloyd.Desotell@nrc.gov) or at (301) 415-5969.

Sincerely,

*/RA/*

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

Docket No. PROJ0734

Enclosure:  
NRC Onsite Observation Visit Report

CC (w/ Enclosure):  
WIR Service List  
WIR External e-mail Contacts List  
WIR Internal e-mail Contacts List

J. Ridley

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SUBJECT: THE U.S. NUCLEAR REGULATORY COMMISSION'S JANUARY 25, 2017,  
ON-SITE OBSERVATION VISIT REPORT FOR THE SAVANNAH RIVER SITE  
SALTSTONE DISPOSAL FACILITY (DOCKET NUMBER: PROJ0734)

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WIR Service List  
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**U.S. NUCLEAR REGULATORY COMMISSION  
JANUARY 25, 2017, ONSITE OBSERVATION VISIT REPORT FOR  
THE SAVANNAH RIVER SITE SALTSTONE DISPOSAL FACILITY**

**EXECUTIVE SUMMARY:**

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its nineteenth onsite observation visit (OOV) to the Saltstone Disposal Facility (SDF) at the Savannah River Site (SRS) on January 25, 2017 (SDF Observation 2017-01). That was the first SDF OOV in Calendar Year (CY) 2017. On every OOV to SRS, the NRC is focused on assessing the U.S. Department of Energy (DOE) 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). If the NRC concludes with reasonable assurance that the DOE complies with §61.41, §61.42, §61.43, and §61.44, then the NRC will also conclude with reasonable assurance that the DOE complies with §61.40. 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 (dated September 2013) [available via the NRC Agencywide Documents Access and Management System (ADAMS) at Accession No. ML13100A113]. This is the fifth 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 this OOV and received the same information from the DOE as the NRC received from the DOE during this OOV.

As described in the NRC Onsite Observation Guidance Memorandum for this OOV (dated December 13, 2016) [ADAMS Accession No. ML16337A153], the main activities conducted were walk-down tours of portions of the Upper Three Runs and McQueen Branch near the SDF that focused on erosional and hydrogeological aspects. Specifically, the tours were conducted to examine indications of gully growth, areas that have a higher potential for producing seeps, and outcroppings of the Santee Formation. An Onsite Observation Guidance Memorandum is a plan for what the NRC expects to cover during an OOV, which may be changed based on what happens during the OOV.

The 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 this OOV. There were no SDF Open Issues before this OOV and there were no SDF Open Issues identified during this OOV. Thus, there are currently no SDF Open Issues. The NRC and the DOE continue to work in the monitoring process to resolve all outstanding concerns that led to issuance of the NRC Type-IV Letter of Concern.

Enclosure

The NRC received the updated DOE presentation (SRR-CWDA-2017-00007, Rev. 1) [ADAMS Accession No. ML17034A540] that pertained to the activities during this OOV. The updated DOE presentation also included pictures that were taken during this OOV.

## **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 the statement that: "... the NRC staff concludes that a Type-II Letter to the U.S. Congress is not needed at this time." Based on the NRC 2012 TER and the DOE revised Tc-99 inventory, the NRC staff determined that, if the DOE new projected Tc-99 inventory for the constructed disposal structures was correct, then it was unlikely that the salt waste disposal into those disposal structures would cause an off-site peak dose exceeding the requirements of §61.41 (i.e., 0.25 mSv/yr (25 mrem/yr)). However, the NRC Type-IV Letter and the NRC 2012

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

To carry out its monitoring responsibility under NDAA Section 3116(b), the NRC, in coordination with SCDHEC, performs three activities: (1) technical reviews, (2) OOVs, and (3) data reviews. Specifically, technical reviews generally focus on reviewing information generated to provide support for key assumptions that the DOE made in the SDF PA or supplements, such as special analysis documents. OOVs generally focus on either: (1) observing the collection of data and reviewing the data to assess consistency with assumptions made in the SDF final Waste Determination; or (2) observing key disposal or closure activities related to technical review areas. Data reviews generally focus on supplementing technical reviews by focusing on monitoring data that may indicate future system performance or reviewing records or reports that can be used to directly assess compliance with the performance objectives.

Information in an OOV report is relevant to all aspects of the NRC monitoring activities. The NRC will use the information in an OOV report to evaluate whether or not DOE disposal actions at the SDF comply with the performance objectives, whether to open new or close current SDF monitoring areas, and whether to open new or close current SDF monitoring factors. During an OOV, the DOE may present preliminary data and commit to provide final data in a publicly available document or documents at a later time to the NRC. That DOE commitment to provide that future document or documents to the NRC would be a Follow-Up Action Item in an OOV report. The future NRC decisions on performance objectives, monitoring areas, and monitoring factors will be based on evaluating the final data in that future DOE document or documents and will not be based on the preliminary data discussed at an OOV and summarized in an OOV report. The NRC review of the final DOE data may be documented in technical review reports or technical evaluation reports and both types of those reports would be publicly available. The issues evaluated in technical review reports and technical evaluation reports will either be directly related to the issues in the NRC Type-IV Letter or will be related to routine NRC monitoring activities that are described in the 2013 SDF Monitoring Plan.

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

On December 13, 2016, the NRC issued the Onsite Observation Guidance [Accession No. ML16337A153] for the January 25, 2017, OOV, SDF Observation 2017-01. An Onsite Observation Guidance Memorandum is a plan for what the NRC expects to cover during an OOV, which may be changed based on what happens during the OOV. The detailed technical information collected during this OOV is presented as the Attachment to this OOV Report.

This OOV began with introductions and welcoming remarks followed by a short briefing on the agenda and safety information presented by the DOE contractor, Savannah River Remediation (SRR). This OOV was attended by representatives from the DOE, the NRC, and the SCDHEC. The remainder of this OOV consisted of walk-down tours of portions of the Upper Three Runs and McQueen Branch near the SDF that focused on erosional and hydrogeological aspects.

Specifically, the tours were conducted to examine indications of gully growth, areas that have a higher potential for producing seeps, and outcroppings of the Santee Formation.

During the safety briefing that preceded the walk-down tours, the DOE provided the NRC with a geomorphology handout entitled "Z-Area Geomorphology Trip 1/25/2017" (DOE document SRNS-STI-2017-00034, Rev. 0). That handout consisted of: (1) topographic information for the portions of Upper Three Runs and McQueens Branch areas that the DOE and the NRC would walk-down; and (2) select geological cross-section diagrams for the SRS Z-Area, which were referred to as "Geomorphology Area A" and "Geomorphology Area B." After the OOV, the NRC received the electronic of that handout from the DOE [ADAMS Accession No. ML17044A217].

## 2.1 Tours – Walk-Downs of Portions of the Upper Three Runs and McQueens Branch Adjacent to Z-Area that Focused on Hydrogeology and Erosion

### 2.1.1 Observation Scope:

The tours supported the NRC monitoring of the DOE disposal actions to assess compliance with 10 CFR 61.41, 10 CFR 61.42 and 10 CFR 61.44. The tours were most relevant to the following Monitoring Areas (MAs) and Monitoring Factors (MFs) in SDF Monitoring Plan, Rev. 1:

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

MA 2 Infiltration and Erosion Control relates primarily to the performance of the closure cap and affects the overall performance of the SDF because the cap is designed to: (1) provide physical stabilization, (2) limit infiltration, and (3) act as an intruder deterrent. The walk-down examined the steeper valley slopes and any left-bank tributaries for indications of gully growth. Observing the present conditions of the steeper slopes surrounding the Z-Area provided a realistic assessment of erosional and stability conditions at present or in the very near future and of the initial site stability conditions for a 10,000-year modeling time period.

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

MA 8 Environmental Monitoring relates to a variety of environmental media, including groundwater; surface water; rainwater; air; vegetation; deer and hog meat; and soil. The most useful environmental data to monitor is likely to be the groundwater data from the Z-Area because NRC staff expects that groundwater will be the dominant pathway for long-term releases from the SDF. The walk-down examined evidence of the elevation of various soil layers that influence water flow (e.g., the Tan Clay Confining Zone and Santee formation) and the relative location of seeps. This information is needed to evaluate DOE's well locations and screening depths as part of groundwater monitoring, as well as to interpret DOE's groundwater monitoring data.

- MA 9 (Site Stability):
  - MF 9.02 (Settlement Due to Dissolution of Calcareous Sediment)

MA 9 Site Stability pertains to monitoring processes that might degrade the integrity of the cover and threaten the long-term stability of the site, e.g., damage due to settlement, and is also

related to limiting infiltration through the disposal site and maintaining an adequate barrier to intrusion. The walk-down examined exposures of the Santee Formation. This formation can consist of very calcareous material (e.g., shells from marine animals) that can dissolve in water over time and leave underground voids. These voids can collapse and open a sinkhole at the ground surface and threaten site stability.

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

MA 10 Performance Assessment Model Revisions is a broad monitoring area related to the models used to quantify the potential dose to potential receptors. This MA includes items that are cross-cutting among the other MAs. The walk-down examined any areas that have a higher potential for producing seeps (e.g., topographical low points of the top of Tan Clay Confining Zone (TCCZ) that outcrop at valley slopes); and observed outcroppings of the Santee Formation in Area A and the TCCZ. These observations were needed to evaluate DOE's conceptual model assumption that contamination primarily flows from the Upper Three Runs Aquifer (UTRA) – Upper Zone to the UTRA-Lower Zone without significant transport along the top of the TCCZ.

#### 2.1.2 Observation Results:

The key points from the tours were:

- The tours occurred under ideal conditions:
  - good visibility due to a cloudless sky and leafless vegetation;
  - unfrozen soils due to moderate temperatures; and
  - recent precipitation increased the chance of observing the presence of ephemeral contact springs (i.e., seeps).
- Based on criteria provided in advance by the NRC to the DOE, the tours were conducted as walk-downs of locations that had previously been scouted and marked by the DOE.
- No sheet or rill erosion was evident under the current average annual precipitation rate and the slopes appear to be stable.
- Although gully erosion had existed in the past, no active gully erosion was evident in the areas toured.
- Marshy areas were observed in some areas that appeared to be above the Tan Clay Confining Zone (TCCZ).
- One marshy area acted as a source for a stream. Although there had been significant rainfall recently, the stream flow rate appeared to be low.
- A geological unit identified by the DOE as the Santee Formation consisted of a light-colored sand interspersed with only a small amount of calcareous material.

### 2.1.3 Conclusions and Follow-up Action Items:

The NRC staff will continue to monitor the DOE SDF activities. The walk-down provided NRC staff an opportunity to observe field conditions related to the monitoring areas targeted for this OOV. Detailed technical information from these observations is provided in the Attachment to this report. The information gathered during this OOV enhanced the NRC staff's understanding of the site conditions related to the targeted monitoring areas and the overall site conditions. As described in Section 2.1.1, the information gathered during this visit will support conclusions about the representation of erosion, site stability, and water flow in the DOE conceptual model as well as providing information needed to interpret DOE groundwater monitoring data. Specifically, staff observed that, except for one ravine that appeared to have been formed from past farming practices, no gully, sheet, or rill erosion was evident. Staff did not observe significant calcareous formations that could contribute to site instability. Staff observed that water seeps were evident above the TCCZ, which is information staff needs to assess data from DOE's groundwater monitoring program and to evaluate DOE's conceptual model of subsurface radionuclide transport. As a result of this OOV, the NRC staff did not identify the need for any new MAs or MFs. The following Follow-Up Action Items resulted from the tours:

- The DOE to provide the NRC with pictures, including time stamps, taken during the tours.
- The DOE to provide the NRC with a map identifying the locations for the pictures from the tours.

## 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 2017-01 will be used for multiple NRC technical review reports, for example, review of the DOE SDF Fiscal Year 2014 Special Analysis Document, and future OOVs. 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 this OOV was that the NRC staff did not identify the need for any new monitoring areas or any new monitoring factors. The NRC appreciated the preparation by the DOE in advance of this OOV, which was extremely beneficial and made for efficient use of the time during the tours.

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

SDF Observation 2017-01 is the fifth OOV under SDF Monitoring Plan, Rev. 1. The NRC staff did not close any monitoring factors based on this 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 2017-01. The NRC staff did not open any new Open Issues during this 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 18 previous NRC SDF OOVs. All but five of the Follow-Up Action Items from those OOVs were closed prior to SDF Observation 2017-01. Those five Follow-Up Action Items were not closed during SDF Observation 2017-01:

- SDF-CY15-02-001 – *DOE will provide NRC with information on SDS 3A, SDS 3B, SDS 5A, and SDS 5B fill height restrictions related to resolution of mercury Potential Inadequacy in Safety Analysis*
- SDF-CY16-01-005 - *DOE to provide NRC with SDS 6 settlement marker elevation data*
- SDF-CY16-01-013 - *DOE to provide NRC with velocity field and cross-section through Z-Area*
- SDF-CY16-01-015 - *DOE to provide NRC with results of disposal structure concrete testing*
- SDF-CY16-01-023 - *DOE to provide NRC with additional information on basis of cement leachate factors from SRNL-STI-2009-00473, Rev. 0, "Geochemical Data Package for Performance Assessment Calculations Related to the Savannah River Site"*

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

All Follow-Up Action Items from previous clarification teleconference calls and technical teleconference calls were closed prior to SDF Observation 2017-01.

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

The table below contains the two Follow-Up Action Items that were opened during SDF Observation 2017-01, including a unique NRC identifier for each Follow-Up Action Item:

<b>Unique Identifier</b>	<b>Follow-Up Action Item</b>
SDF-CY17-01-001	DOE to provide NRC with pictures, including time stamps, taken during the tours.
SDF-CY17-01-002	DOE to provide NRC with a map identifying the locations for the pictures from the tours.

3.7 Issuance of NRC Technical Review Reports:

Between the previous OOV and SDF Observation 2017-01, the NRC issued one SRS technical review report and two SDF technical review reports related to the SDF via memorandum.

<b>Unique Identifier</b>	<b>Title</b>	<b>Date / Accession No.</b>	<b>No. of Follow-up Action Items</b>
SDF-TRR-003	<i>Technical Review: Quality Assurance Documentation for the Cementitious Barriers Partnership Toolbox</i>	08/01/16 ML16196A179	0
SRS-TRR-001	<i>Technical Review: Dose Calculation Methodology for Liquid Waste Performance Assessments</i>	12/23/16 ML16277A060	0
SDF-TRR-004	<i>Technical Review: Iodine Sorption Coefficients for use in Performance Assessments for the Saltstone Disposal Facility</i>	01/05/17 ML16342C575	0

4.0 PARTICIPANTS:

<b>U.S. NRC</b>	<b>SCDHEC</b>	<b>U.S. DOE</b>	<b>SRR</b>	<b>SRNS</b>
Hans Artt	Justin Koon	Dan Ferguson	Keith Liner	Terry Killeen
Lloyd Desotell	Trey Hiott	Sherri Ross	Larry Romanowski	Jeff Thibault
R. Lee Gladney	Roger Schweitzer	Matt Zenkovich	Kent Rosenberger	
A. Christianne Ridge			Steve Thomas	
Gregory Suber			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.

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**DETAILED TECHNICAL INFORMATION FROM  
U.S. NUCLEAR REGULATORY COMMISSION  
JANUARY 25, 2017, ONSITE OBSERVATION VISIT TO  
THE SAVANNAH RIVER SITE SALTSTONE DISPOSAL FACILITY**

Tours – Walk-downs of Portions of the Upper Three Runs and McQueens Branch Adjacent to Z-Area that Focused on Hydrogeology and Erosion

During the safety briefing that preceded the walk-down tours, the DOE provided the NRC with a geomorphology handout entitled “Z-Area Geomorphology Trip 1/25/2017” (DOE document SRNS-STI-2017-00034, Rev. 0). That handout consisted of: (1) topographic information for the portions of Upper Three Runs and McQueens Branch areas that the DOE and the NRC would walk-down; and (2) select geological cross-section diagrams for the SRS Z-Area, which were referred to as “Geomorphology Area A” and “Geomorphology Area B.” After the OOV, the NRC received the electronic of that handout from the DOE [ADAMS Accession No. ML17044A217].

Based on criteria provided in advance by the NRC to the DOE, the tours were conducted as walk-downs of locations that had previously been scouted and marked by the DOE. During the tours, the DOE provided descriptions of locations to the NRC.

The tours occurred under ideal conditions: (1) good visibility due to a cloudless sky and leafless vegetation; (2) unfrozen soils due to moderate temperatures; and (3) a precipitation event consisting of several inches of rainwater a few days before the tour, which increased the chance of seeing ephemeral contact springs flow due to the increased recharge. Some of the pictures taken during this OOV are included as figures below. All the pictures taken during this OOV are in the updated DOE Presentation (SRR-CWDA-2017-00007, Rev. 1) for this OOV [ADAMS Accession No. ML17034A540].

Geomorphology Area A was toured first. A ravine was observed within Geomorphology Area A that held a small amount of green-tinted water within a depression (see Figure 1 below).

ATTACHMENT



**Figure 1: Green-Tinted Water in Ravine (p. 13 in SRR-CWDA-2017-00007, Rev. 1)**

The green-tinted water could be observed in the ravine at a point that the DOE indicated was above the Tan Clay Confining Zone (TCCZ) (see both Figure 2 and Figure 3 below); although it was difficult for the NRC to confirm that due to the depth of the topsoil. The DOE indicated that the green-tinted water originated from the recent leak test of Saltstone Disposal Structure 6 (SDS 6). After the SDS 6 leak test was completed, the dyed water was released (i.e., pumped out) under controlled conditions and it flowed down the ravine. That release occurred about one week prior to this OOV. Erosion barriers had been set in place along the old logging road near the release point and the upper part of the ravine and had prevented active erosion. It is not clear to the NRC staff why the dye used in the SDS 6 leak test was still visible in one of the ravine branches despite the relatively larger rainfall that had taken place a few days prior to this OOV. One possibility was that a small amount of green-tinted water remained in surface depressions and, though diluted by the rainfall event, was not completely washed away. A second possibility was that the green-tinted water indicated that the water seeping out of the ground was still under the influence from the water that was used in the SDS 6 leak test that was subsequently discharged into the ravine. A third possibility was that the dye used in the SDS 6 leak test adsorbed to soil and was being slowly released from the soil by natural water seeping.

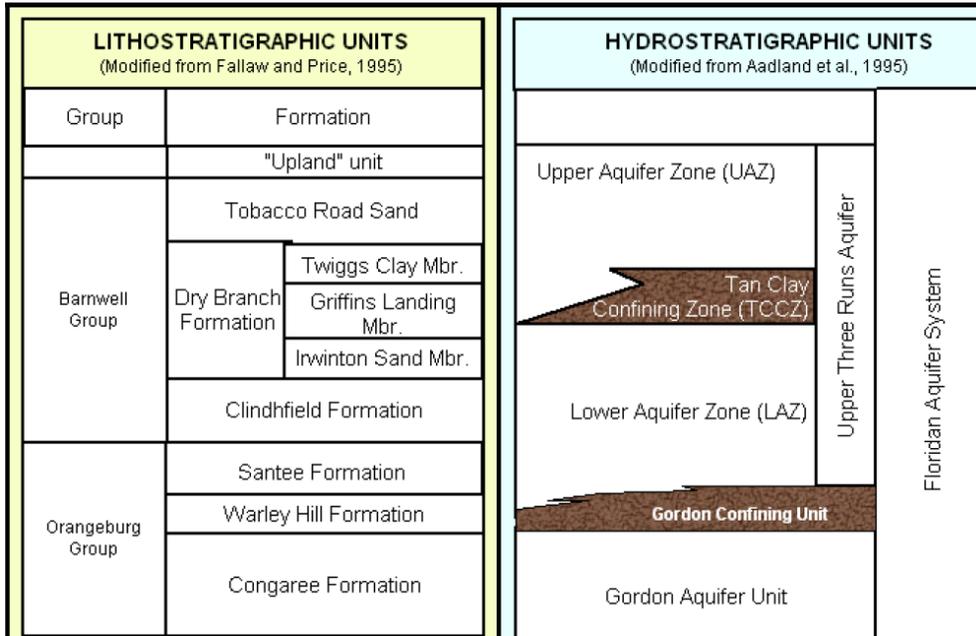


Figure 2: Geological and Hydrogeological Units in SRS Z-Area (modified from Figure 3.1-15 in SRR-CWDA-2009-00017, Rev. 0)

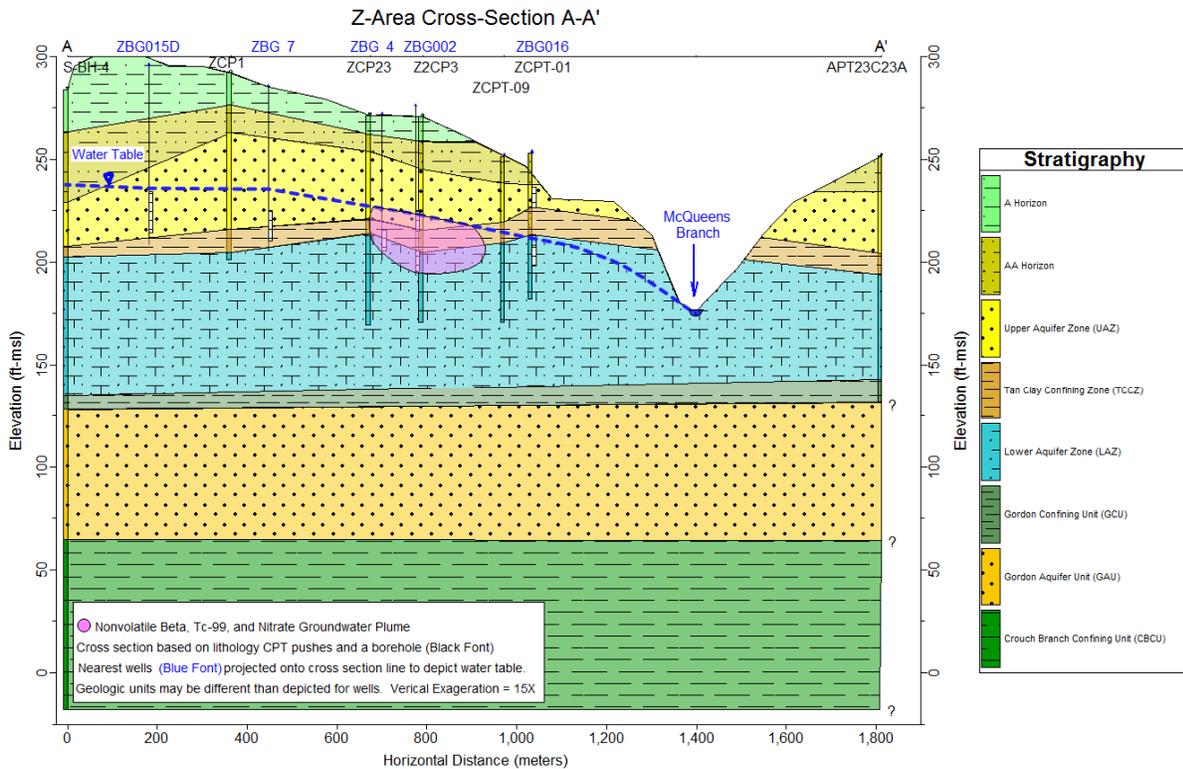


Figure 3: SRS Z-Area Cross Section (Figure 5 in SRNS-TR-2015-00300, Rev. 0)

Outside of that ravine area, no contact spring or seep was evident. Further down the ravine, clayey soil could be more readily identified; however, it was at an elevation that was too low for it to have been the TCCZ. Below that layer, still within the Lower Aquifer Zone (LAZ), but above the Green Clay Confining Zone, was a layer that the DOE identified as the Santee Formation (see Figure 4 below). From what could be observed, that layer appeared to be about one foot thick and consisted of a light-colored sand with a relatively low calcareous composition although the sand was interspersed with small, high-spined sea snail shells. A 1989 report from the U.S. Geological Society indicated that, in the case of surface exposures, carbonate was probably removed during weathering of the bluff along Upper Three Runs Creek.



**Figure 4: Likely Exposure of Santee Formation (p. 16 in SRR-CWDA-2017-00007, Rev. 1)**

In a different branch of that ravine, a clayey material identified by the DOE as the TCCZ was observed along a small cliff face of the ravine. The clayey material consisted of a whitish-clayey material with rust-colored streaks mixed in (see Figure 5 below). Above the TCCZ within the ravine, a marshy plateau was bordered by the sides of the ravine and was the terminus of at least one gully. The marshy area was the beginning of a small creek with a very slow flow rate, and, although there had been significant rainfall in the days prior to the OOV, the stream flow rate was very low. On days with average rainfall, the stream flow would likely be further reduced. Lithified sand or pieces of sandstone were found by the DOE along the side walls of the gully; but, they appeared to be relatively uncommon. Vegetation, including mature trees, was growing in the gully. Despite the recent heavy rainfall, the bottom part of the gully was covered with leaf debris. No active gully erosion was evident and the gully formation appears to have occurred at an earlier time. Outside of that ravine area, no sheet or rill erosion was evident.



**Figure 5: TCCZ Exposure in Area A (p. 23 in SRR-CWDA-2017-00007, Rev. 1)**

Geomorphology Area B was toured second. As shown on pages 8 through 10 of SRNS-STI-2017-00034, Rev. 0 [ADAMS Accession No. ML17044A217], the DOE divided Geomorphology Area B into smaller areas labeled Geomorphology Areas B-1, B-2, and B-3.

The DOE and the NRC made numerous cuts with a shovel at the side of a road leading down to the McQueen Branch in an attempt to locate the TCCZ within Geomorphology Area B-1. Several locations of clayey material were dug into (see Figure 6 below). No contact springs or seeps were observed near the exposure of the contact between the Upper Aquifer Zone (UAZ) and the TCCZ along the hill slope. Seeps and a marshy area were found below the hill slope; therefore, below the TCCZ, at an elevation that would be slightly above that of the McQueen Branch.



**Figure 6: TCCZ Exposure in Area B (p. 29 in SRR-CWDA-2017-00007, Rev. 1)**

No sheet, rill, or gully erosion was observed, even at those locations with relatively steep slopes. The ground was covered with leaf litter and a relatively thick topsoil intertwined with fine roots can be seen in the photographs on pages 31-32 in SRR-CWDA-2017-00007, Rev. 1.

Due to the abundant leaf litter and thick topsoil, no colluvium could be positively identified. Therefore, any visible impact that material may have on erosion or on long-term landscape development was not observed and additional insights could not be gathered.

Manmade features were evident in this area, including: (1) a piece of concrete; (2) a major ditch, possibly having drained a previous Carolina Bay or marshy spot on the Z-Area plateau to the McQueen Branch; and (3) a remnant of a dam in the McQueen Branch, possibly made from sediments excavated from the manmade ditch.

The Z-Area Sedimentation Basin No. 4 is located near Geomorphology Area B-1. Due to the rainfall event prior to this OOV, the basin expansion portion of Sedimentation Basin No. 4, which was added in 2014, may have received storm water from the original portion of the basin for the first time since its construction. Water was visible in the basin expansion area.

A marshy area was observed within Geomorphology Area B-2 (see Figure 7 below) a short distance downslope from an established nature trail. The marshy area appeared to be above the TCCZ and, unlike Geomorphology Area A, was relatively close to the McQueen Branch in distance and elevation. Further marshy areas were discovered nearby. The McQueen Branch, which had a stream bed consisting of whitish colored sand in Geomorphology Area B-2, appeared to change to a more clayey type of sediment in Geomorphology Area B-3. With that change, numerous small seeps and fast pathway tunnels were observed along the sides of the

stream bed (see Figure 8 below), indicating recharge water was moving in a preferential lateral direction near the TCCZ.



**Figure 7: Marshy Area above TCCZ (p. 46 in SRR-CWDA-2017-00007, Rev. 1)**



**Figure 8: Seep alongside McQueen Branch (p. 60 in SRR-CWDA-2017-00007, Rev. 1)**