

**U.S. NUCLEAR REGULATORY COMMISSION  
AUGUST 12, 2021, ONSITE OBSERVATION VISIT REPORT FOR  
THE SAVANNAH RIVER SITE SALTSTONE DISPOSAL FACILITY**

**EXECUTIVE SUMMARY:**

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its 22<sup>nd</sup> Onsite Observation Visit (OOV) to the Saltstone Disposal Facility (SDF) at the Savannah River Site (SRS) on August 12, 2021 (SDF Observation 2021-01). This is the first SDF OOV in Calendar Year 2021. On every OOV to SRS the NRC is focused on assessing the U.S. Department of Energy (DOE) compliance with performance objectives in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 61, Subpart C. The five 10 CFR Part 61 Subpart C performance objectives are: §61.40 (General Requirements); §61.41 (Protection of the General Population from Releases of Radioactivity); §61.42 (Protection of Individuals from Inadvertent Intrusion); §61.43 (Protection of Individuals during Operations); and §61.44 (Stability of the Disposal Site after Closure).

For this OOV, the NRC focused on the monitoring areas and monitoring factors in the NRC SDF Monitoring Plan, Rev. 1 dated September 2013 (available via the NRC Agencywide Documents Access and Management System [ADAMS] at Accession No. ML13100A113), as supplemented by the five NRC letters to the DOE (ADAMS Accession Nos. ML17097A351, ML18033A071, ML18107A161, ML18219B035, and ML19150A295). This is the eighth SDF OOV under the 2013 SDF Monitoring Plan. The South Carolina Department of Health and Environmental Control staff was invited to participate in this OOV but decided not to participate. The U.S. Environmental Protection Agency (EPA) Region 4 staff participated in this OOV because they were onsite already and, in the far future, they will be involved in the final closure of the SDF.

Consistent with the NRC Guidance for this OOV dated July 27, 2021, (ADAMS Accession No. ML21210A156), the main activities conducted during this OOV were: (1) discuss operating and disposal structure status; and (2) tour the construction of Saltstone Disposal Structure (SDS) 8 and SDS 9. The other activities described in the NRC Guidance were canceled due to the DOE SRS COVID restrictions that came out after the NRC Guidance was finalized. The NRC did not close any of the SDF MFs or change the overall conclusions from the NRC Technical Evaluation Report (TER) for the SDF dated April 2012 (ADAMS Accession No. ML121020140) as a result of this OOV.

**1.0 ONSITE OBSERVATION VISIT ACTIVITIES:**

On July 27, 2021, the NRC issued the OOV Guidance (ADAMS Accession No. ML21210A156) for the August 2021 SDF OOV, SDF Observation 2021-01. An OOV Guidance 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 OOV began with a short briefing on the agenda that was attended by representatives from the DOE (including the DOE contractors), the NRC, and the U.S. EPA. Afterwards, there were welcoming remarks and introductions. The rest of the OOV consisted of a technical discussion and a tour. The technical discussion was focused on the operating and disposal structure status. The tour was focused on the construction of SDS 8 and SDS 9.

## 1.1 Technical Discussion – Operating and Disposal Structure Status:

### 1.1.1 Observation Scope:

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

- Monitoring Area (MA) 1 (Inventory):
  - Monitoring Factor (MF) 1.01 (Inventory in Disposal Structures)
  - MF 1.02 (Methods Used to Assess Inventory)
- MA 3 (Waste Form Hydraulic Performance)
  - MF 3.03 (Applicability of Laboratory Data to Field-Emplaced Saltstone)
- MA 5 (Waste Form Chemical Degradation)
  - MF 5.01 (Radionuclide Release from Field-Emplaced Saltstone)
  - MF 5.04 (Certain Risk-Significant  $K_d$  values for Saltstone)
- MA 8 (Environmental Monitoring):
  - MF 8.01 (Leak Detection)
- MA 11 (Radiation Protection Program):
  - MF 11.01 (Dose to Individuals During Operations)

### 1.1.2 Observation Results:

The DOE presented an overview of the recent SDF operating and disposal structure status in the DOE presentation (SRR-CWDA-2021-00071, Rev. 1) (ADAMS Accession No. ML21242A296). The key points from the technical discussion were:

- Regarding the Saltstone Production Facility:
  - in Fiscal Year 2019, the DOE processed 703,300 gallons of salt solution from Tank 50
  - in May 2019, the DOE discontinued the Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit (ARP/MCU) operations
  - As a result of ARP/MCU being shut down, there was no salt solution processed by the DOE in Fiscal Year 2020
- Regarding the Salt Waste Processing Facility (SWPF):
  - the first transfer from the SWPF to Tank 50 was on October 21, 2020
  - the SWPF started full operations on January 18, 2021
  - the SWPF has gone through both hot commissioning and operations in the last 10 months
  - from October 1, 2020, through July 31, 2021, the DOE processed 2,527,935 gallons of salt solution from Tank 50
  - the DOE plans to increase the frequency of Tank 50 sampling, as needed, due to the increased salt waste processing rate in order to ensure sampling of each salt waste batch

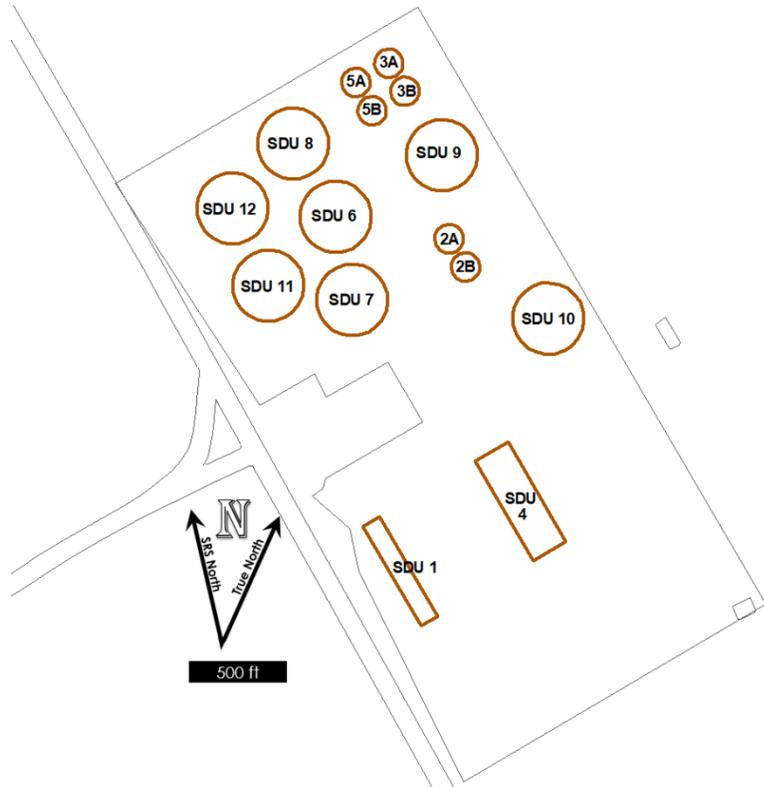
Regarding the SDF, as of July 31, 2021:

- since August 2018, all saltstone that was produced was placed in SDS 6
- the DOE added SDS 7 to the existing list (i.e., SDS 1, SDS 4, SDS 2A, SDS 2B, SDS 3A, SDS 3B, SDS 5A, SDS 5B, SDS 6) of the DOE operational disposal structures
- ~170,000 gallons of salt solution was available for processing from Tank 50
- the level of saltstone in the non-rectangular disposal structures is the following:
  - in SDS 2A = ~21.25 feet
  - in SDS 2B = ~21.25 feet
  - in SDS 3A = ~5.5 feet
  - in SDS 3B = ~0.0 feet
  - in SDS 5A = ~21.25 feet
  - in SDS 5B = ~21.25 feet
  - in SDS 6 = ~10.5 feet
  - in SDS 7 = ~0.0 feet
- see below for a picture of the SDF, as of June 10, 2021:



- Regarding using the new cement-free saltstone:
  - new dry mix formula is 60 percent (%) slag and 40% fly ash
  - in July 2021, the DOE performed a cement-free trial run:
    - ~120,000 gallons processed
    - no processing issues encountered
    - processing evaluation in-progress
  - the DOE identified benefits of using cement-free saltstone were:
    - use of all four silos
    - fewer dry feeds components/vendors
    - reduces dry feeds delivery frequency
    - potential for offsite mixing by vendor
  - effect of using cement-free saltstone:
    - emplaced saltstone in SDS 6 through SDS 12 will differ from saltstone cores used in previous DOE hydraulic property testing and dynamic leaching procedures
  - the NRC staff will review the DOE references that provided information about the physical and chemical properties of the cement-free saltstone, including any effects on pouring and curing to assess impacts on long-term performance

- Regarding future disposal structures:
  - SDS 8: construction is in-progress
  - SDS 9: construction is in-progress and completed installation of Lower Mud Mat (LMM), Geosynthetic Clay Liner with High Density Polyethylene (GCL with HDPE), and Upper Mud Mat (UMM)
  - SDS 10, SDS 11, and SDS 12: completed both Geotech and Geotech lab testing
  - see below for a DOE drawing of the SDF layout, including future disposal structures (*note: the DOE uses the term Saltstone Disposal Unit (SDU)*):



- Regarding the SDF worker doses:
  - the SDF worker doses continue to meet the §61.43 performance objective

### 1.1.3 Conclusions and Follow-Up Action Items (FUAs):

The NRC staff will continue to monitor the DOE SDF activities. The following FUAs resulted from the technical discussion:

- The DOE will provide the NRC with electronic copies of the Cement-Free down select reports [SRR-CWDA-2019-00003 and SRR-CWDA-2020-00008] and the Special Analysis [SRR-CWDA-2020-00064] – if not included in those reports, then the DOE will also provide the NRC with photos of pouring grout with the new formula into the disposal structures

- The NRC will update *Table 1-1, List of Periodic DOE Documents used in NRC Monitoring* in the NRC Monitoring Plan for the SDF (as supplemented) to:
  - *remove* the note regarding Salt Batch Qualification Reports
  - *change* the frequency of the DOE providing the NRC with Tank 50 Waste Acceptance Criteria sample analyses from “quarterly” to “as available”
  - *add* the previous NRC request for photos of future disposal structure construction under MA 6 (i.e., under MFs 6.03 through 6.05):
    - one or two photos of the ground on which the concrete LMM will be poured
    - several photos of different scale of the top of the concrete LMM after it has been poured – one or two photos as the LMM is being poured
    - several photos of different scale of the top of the GCL after it has been fitted on top of the concrete LMM (i.e., this would probably only be possible if it is not attached to the bottom of the HDPE)
    - several photos of different scale of the top of the HDPE layer after it has been fitted on top of the concrete LMM and after it has been seam-welded at several different distances/scales (i.e., images showing the seam welds, undulations in the HDPE closer up, undulations in the HDPE across the entire mud mat) – one or two photos as HDPE is being installed and one or two photos as the HDPE is being seam-welded
    - several photos at different scales of the HDPE ends embedded in the concrete Floor
    - several photos at different scales of the top of the concrete UMM after it has been poured
    - several photos at different scales of the top of the concrete Floor, including one or two photos of the Bearing Pad and Construction Joints after the floor has been poured – one or two photos as the floor is being poured
    - several photos at different scales of the two-foot concrete Round Column,
    - several photos at different scales of the concrete Wall before after the wall has been constructed and after the concrete Wall has been treated/painted/insulated – one or two photos of the concrete Wall as it is being placed on top of the Bearing Pad
    - several photos at different scales of the bottom of the concrete Roof, including one or two of the Bearing Pad before and after the roof has been fitted onto the concrete wall – one or two photos as the concrete Roof as it is being placed on top of the Bearing Pad
    - several photos at different scales of the top of the concrete Roof, including one or two of the Construction Joints after the roof has been fitted

## 1.2 Tour – Construction of SDS 8 and SDS 9:

### 1.2.1 Observation Scope:

The tour supported the NRC monitoring of the DOE disposal actions to assess compliance with §61.41 and §61.42. The tour was most relevant to the following monitoring areas and monitoring factors in the SDF Monitoring Plan, Rev. 1, as supplemented by the NRC letters to the DOE:

- MA 6 (Disposal Structure Performance):
  - MF 6.03 (Performance of Disposal Structure Roofs and HDPE/GCL Layers)
  - MF 6.04 (Disposal Structure Concrete Fracturing):
  - MF 6.05 (Integrity of Non-Cementitious Materials)
- MA 8 (Environmental Monitoring):
  - MF 8.02 (Groundwater Monitoring)

### 1.2.2 Observation Results:

The tour consisted of observing the construction of SDS 8 and SDS 9. The key points from the tour were:

- Before the tour, brief instructions were provided within a construction trailer and pictures were taken of a small model showing the cross-section of the intersection of a disposal structure floor and a wall lined with 3.0 millimeter (0.12 inch) thick epoxy-bonded rubber pieces
- The NRC staff observed many features of the construction at SDS 8 and SDS 9, and, as requested by the NRC staff, the DOE took pictures of key features of construction of SDS 8 and SDS 9:
  - location of future HDPE welds to join HDPE between mud mats to outer surfaces of walls in SDS 8
  - use of semi-permeable fabric to implement wet-curing technique for SDS 9 floor
  - plastic layer between UMM and floor to reduce friction caused by floor shrinkage during curing in SDS 9
  - water-stop placement between floor segments and between wall and outer floor perimeter of SDS 9
  - emplaced rebar for floor of SDS 9
  - perforated tubing for epoxy fill along water-stops and between floor segments of SDS 9
  - floor drains in SDS 9
  - cracks in newly poured UMM of SDS 9
- During the tour, a construction manager provided information on the various phases of the construction and construction features, including answering the NRC staff questions

### 1.2.3 Conclusions and FUAIs:

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

- The DOE will provide the NRC with an electronic copy of the photographs from the SDS 8 and SDS 9 tour
- The DOE will provide the NRC with a report (or reports) that describe the procedures for and results of the SDS 7 hydrotest
- The DOE will provide the NRC with information on the piping material and quantity of the floor drains being installed in SDS 9 and the other 375-ft. disposal structures

- The DOE will provide the NRC with information on the change in thickness of the HDPE layer between the LMM and the UMM from 100 mil and the reason for that change
- The DOE will provide the NRC with schedule updates regarding timing for the HDPE/GCL installation between the LMM and UMM, and the UMM placement on future disposal structures (e.g., SDS 10, SDS 11, SDS 12)

## 2.0 **OVERALL CONCLUSIONS**

### 2.1 Overall Conclusions:

The information gathered during SDF Observation 2021-01 will be used for multiple NRC Technical Review Reports and future OOVs, based on the topics discussed. There is no change to the overall conclusions from the NRC 2012 SDF TER regarding compliance of DOE disposal actions with the 10 CFR Part 61 performance objectives. Background information can be found in the most recent NRC-issued Waste Incidental to Reprocessing (WIR) Periodic Monitoring Report (ADAMS Accession No. ML19058A272) dated October 21, 2019. Please go to the NRC Public Website DOE WIR Location webpage for the SDF (<https://www.nrc.gov/waste/incidental-waste/wir-process/wir-locations/saltstone.html>) to see the current status of the NRC Monitoring of the SDF. The NRC expects that that the DOE will take into consideration the NRC staff information that was provided during the OOV.

### 2.1 Status of Open FUAIs from either Previous SDF OOVs or Calls:

All FUAIs from previous SDF OOVs were closed prior to SDF Observation 2021-01. All FUAIs from previous calls were closed prior to SDF Observation 2021-01.

### 2.2 Summary of FUAIs Opened During this Onsite Observation Visit:

After the OOV, the NRC received the updated DOE OOV presentation (SRR-CWDA-2021-00071, Rev. 1) (ADAMS Accession No. ML21242A296) pertaining to the activities during this OOV. The table below contains the FUAIs that were opened during SDF Observation 2021-01, including a unique NRC identifier for each FUAI:

Unique Identifier	FUAI
SDF-CY21-01-001	The DOE will provide the NRC with electronic copies of the Cement-Free down select reports [SRR-CWDA-2019-00003 and SRR-CWDA-2020-00008] and the Special Analysis [SRR-CWDA-2020-00064] – if not included in those reports, then the DOE to also provide the NRC with photos of pouring grout with the new formula into the disposal structures
SDF-CY21-01-002	The NRC will update <i>Table 1-1, List of Periodic DOE Documents used in NRC Monitoring</i> in the NRC Monitoring Plan for the SDF (as supplemented) to: <ul style="list-style-type: none"> <li>• <i>remove</i> the note regarding Salt Batch Qualification Reports</li> <li>• <i>change</i> the frequency of the DOE providing the NRC with Tank 50 Waste Acceptance Criteria sample analyses from “quarterly” to “as available”</li> </ul>

Unique Identifier	FUAI
	<ul style="list-style-type: none"> <li>• <i>add</i> the previous NRC request for photos of future disposal structure construction under MA 6 (i.e., under MFs 6.03 through 6.05): <ul style="list-style-type: none"> <li>○ one or two photos of the ground on which the concrete LMM will be poured</li> <li>○ several photos of different scale of the top of the concrete LMM after it has been poured – one or two photos as the LMM is being poured</li> <li>○ several photos of different scale of the top of the GCL after it has been fitted on top of the concrete LMM (i.e., this would probably only be possible if it is not attached to the bottom of the HDPE)</li> <li>○ several photos of different scale of the top of the HDPE layer after it has been fitted on top of the concrete LMM and after it has been seam-welded at several different distances/scales (i.e., images showing the seam welds, undulations in the HDPE closer up, undulations in the HDPE across the entire mud mat) – one or two photos as HDPE is being installed and one or two photos as the HDPE is being seam-welded</li> <li>○ several photos at different scales of the HDPE ends embedded in the concrete Floor</li> <li>○ several photos at different scales of the top of the concrete UMM after it has been poured</li> <li>○ several photos at different scales of the top of the concrete Floor, including one or two photos of the Bearing Pad and Construction Joints after the floor has been poured – one or two photos as the floor is being poured</li> <li>○ several photos at different scales of the two-foot concrete Round Column</li> <li>○ several photos at different scales of the concrete Wall before after the wall has been constructed and after the concrete Wall has been treated/painted/insulated – one or two photos of the concrete Wall as it is being placed on top of the Bearing Pad</li> <li>○ several photos at different scales of the bottom of the concrete Roof, including one or two of the Bearing Pad before and after the roof has been fitted onto the concrete wall – one or two photos as the concrete Roof as it is being placed on top of the Bearing Pad</li> <li>○ several photos at different scales of the top of the concrete Roof, including one or two of the Construction Joints after the roof has been fitted</li> </ul> </li> </ul>
SDF-CY21-01-003	The DOE will provide the NRC with an electronic copy of the photographs from the SDS 8 and SDS 9 tour
SDF-CY21-01-004	The DOE will provide the NRC with a report (or reports) that describe the procedures for and results of the SDS 7 hydrotest

<b>Unique Identifier</b>	<b>FUAI</b>
SDF-CY21-01-005	The DOE will provide the NRC with information on the piping material and quantity of the floor drains being installed in SDS 9 and the other 375-ft. disposal structures
SDF-CY21-01-006	The DOE will provide the NRC with information on the change in thickness of the High-Density Polyethylene layer between the LMM and the UMM from 100 mil and the reason for that change
SDF-CY21-01-007	The DOE will provide the NRC with schedule updates regarding timing for the High-Density Polyethylene/Geosynthetic Clay Liner installation between the LMM and UMM, and the UMM placement on future disposal structures (e.g., SDS 10, SDS 11, SDS 12)

### **3.0 PARTICIPANTS:**

<b>U.S. NRC</b>	<b>U.S. DOE</b>	<b>U.S. EPA</b>
Hans Artt	Sheri Ross	Jon Richards
Christopher McKenney	Pat Suggs	
A. Christianne Ridge		
	<b>U.S. DOE Contractors</b>	
	Larry Romanowski	
	Kent Rosenberger	

### **4.0 REFERENCES:**

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 3, "Radioactive Waste Management Manual," January 2021. ML21035A232

\_\_\_\_ DOE Order 435.1, Change 2, "Radioactive Waste Management," January 2021. ML21035A224

\_\_\_\_ 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

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

\_\_\_\_ SRR-CWDA-2019-00071, Rev. 1, "Presentation for NRC Saltstone Disposal Facility Onsite Observation Visit on August 12, 2021," August 2021. ML21242A296

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

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

\_\_\_\_\_ "Technical Evaluation Report for the Revised Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site, South Carolina," April 2012. ML121020140

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

\_\_\_\_\_ NUREG-2175, "Guidance for Conducting Technical Analyses for 10 CFR Part 61 – Draft Report for Comment," March 2015. ML15056A516

\_\_\_\_\_ "Closure of Monitoring Factors in the 2013 NRC Saltstone Disposal Facility Monitoring Plan," June 2017. ML17097A351

\_\_\_\_\_ "Clarification of the Number of Monitoring Factors in Both the NRC's 2013 SDF Monitoring Plan and the 2015 TFs Monitoring Plan," March 2018. ML18033A071

\_\_\_\_\_ "Supplement to the 2013 NRC SDF Monitoring Plan Based on Recommendations in the Technical Review Report Issued on January 31, 2018," June 2018. ML18107A161

\_\_\_\_\_ "Supplement to the 2013 NRC SDF Monitoring Plan," October 2018. ML18219B035

\_\_\_\_\_ "Supplement to the 2013 NRC SDF Monitoring Plan," August 2019. ML19150A295

\_\_\_\_\_ "Periodic Monitoring Report for the DOE Non-High-Level Waste Disposal Actions for Calendar Year 2014 through Calendar Year 2018 (Revision 6)," October 2019. ML19058A272

\_\_\_\_\_ "Guidance for the August 12, 2021 Monitoring Onsite Observation Visit to the Savannah River Site, Saltstone Disposal Facility," August 2021. ML21210A156