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

June 29, 2018

Ms. Elizabeth Connell, Director
Regulatory, Intergovernmental,
and Stakeholder Engagement
Office of Environmental Mgmt.
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585

SUBJECT: SUPPLEMENT TO THE 2013 U.S. NUCLEAR REGULATORY COMMISSION SALTSTONE DISPOSAL FACILITY MONITORING PLAN BASED ON RECOMMENDATIONS IN THE TECHNICAL REVIEW REPORT ISSUED ON JANUARY 31, 2018

Dear Ms. Connell:

The purpose of this letter is to inform both the U.S. Department of Energy (DOE) and the South Carolina Department of Health and Environmental Control (SCDHEC) that the U.S. Nuclear Regulatory Commission (NRC) has decided to supplement the 2013 NRC Monitoring Plan for the Savannah River Site (SRS) Saltstone Disposal Facility (SDF), which is available via the NRC's Agencywide Documents Access and Management System (ADAMS) at Accession No. ML13100A113. As required by Section 3116(b) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA), the NRC, in coordination with the SCDHEC, monitors the DOE disposal actions at the SRS SDF.

On January 31, 2018, the NRC issued *Technical Review Report: Hydraulic Performance and Erosion Control of the Planned Saltstone Disposal Facility Closure Cap and Adjacent Area* (ADAMS Accession No. ML18002A545). In the NRC Technical Review Report (TRR), the technical staff recommended to:

- increase the priority of Monitoring Factor (MF) 2.01 (Hydraulic Performance of Closure Cap) from low-priority to medium-priority;

- modify MF 2.02 (Erosion Protection) to clarify that areas adjacent to the future SDF closure cap will be under the NDAA monitoring activities at the SDF; and

- add a new MF 10.14 (Scenario Development and Defensibility) under Monitoring Area 10 (Performance Assessment Model Revisions) as a medium-priority monitoring factor.

The NRC is implementing those recommendations. The changes in the 2013 NRC SDF Monitoring Plan that are described in more detail in the enclosure are effective immediately and will be included in Revision 2 of the NRC SDF Monitoring Plan. The NRC expects to issue Revision 2 of the NRC SDF Monitoring Plan after the NRC reviews the next revision of the DOE SDF Performance Assessment (PA), which is expected to be after 2020.

The table below provides the number of open and closed monitoring factors for the SRS after the NRC implements the recommendations in the January 31, 2018, NRC TRR:

Number of Open and Closed Monitoring Factors for both SRS SDF and SRS Tank Farms

	SRS SDF	*SRS Tank Farms*
Open Monitoring Factors	38	26
Closed Monitoring Factors	3	0

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

Sincerely,

/RA M Sampson for/

John R. Tappert, Director
Division of Decommissioning, Uranium Recovery
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket No. PROJ0734

Enclosure:
Details Supplementing the
2013 NRC SDF Monitoring Plan

cc: J. Folk, DOE
S. Wilson, SCDHEC
WIR Service List
WIR ListServ

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DATE June 29, 2018

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Details Supplementing the 2013 NRC SDF Monitoring Plan

The details of the immediately effective changes in the 2013 U.S. Nuclear Regulatory Commission (NRC) Saltstone Disposal Facility Monitoring Plan based on the recommendations in the January 31, 2018, NRC technical review report (TRR) are described below.

Based on the January 31, 2018, NRC TRR, the NRC will increase the priority of Monitoring Factor (MF) 2.01 (Hydraulic Performance of Closure Cap) from low-priority to medium-priority under both Title 10, *Code of Federal Regulations* (10 CFR) Part 61 Performance Objective (PO) §61.41 (Protection of the General Population from Releases of Radiation) and PO §61.42 (Protection of Individuals from Inadvertent Intrusion). The reasons for this change are: (1) the relative importance of the rate of infiltrating water through the wasteform; and (2) the NRC staff concerns about the hydraulic performance of and minimizing infiltration through, the closure cap, as described in the TRR.

Based on the January 31, 2018, NRC TRR, the NRC will modify MF 2.02 (Erosion Protection) to clarify that areas adjacent to the future SDF closure cap will be under the NRC monitoring activities at the SDF under both 10 CFR Part 61 PO §61.41 and PO §61.42. The reason for this change is the importance of controlling erosion in the area surrounding the SDF, which had not been addressed previously.

Specifically, the NRC will revise the title of MF 2.02 from "Erosion Protection" to "Erosion Control of the SDF Engineered Surface Cover and Adjacent Area."

In addition, the NRC will revise the text of MF 2.02 in Section 3.2.2 under §61.41 to the following:

> "**3.2.2. MF 2.02: Erosion Control of the SDF Engineered Surface Cover and Adjacent Area**
>
> The ability of the engineered surface cover to resist erosion is important in maintaining the barriers to infiltration within the closure cap and the layers below. The closure cap entails that part of the engineered surface cover that is simulated using the code Hydrologic Evaluation of Landfill Performance (HELP) and provides the upper boundary condition for the PORFLOW SDF vadose zone flow model. The engineered surface cover includes the closure cap and additional layers underneath, including the lower backfill layer above the natural soils and those engineered cover layers found only above each saltstone disposal structure. The erosion protection design is important in maintaining a minimum of three (3) meters (10 feet) of clean material above the disposal structures to deter inadvertent intrusion. The NRC will monitor or evaluate the DOE: (i) erosion protection designs (i.e., design changes, implementation, rock source); (ii) calculations of soil loss rates due to erosion; (iii) information related to the physical stability of the vegetative and topsoil layers; (iv) information related to the ability of the cover layers to withstand the effects of high frequency/low intensity rainfall events, which can dominate long-term erosion; and (v) projected impacts of degradation (e.g., due to fire or drought) on the stability of the vegetative cover. Due to the possibility of undermining the stability of the engineered cover, potential erosion in the adjacent area surrounding the future cover will be evaluated by the NRC staff. For more information about erosion control and engineered covers, see the NRC TRR on "Hydraulic

Performance and Erosion Control of the Planned Saltstone Disposal Facility Closure Cap and Adjacent Area" (ADAMS Accession No. ML18002A545).

The NRC expects to close MF 2.02 (Erosion Control of the SDF Engineered Surface Cover and Adjacent Area) under PO §61.41 after the NRC determines that the projected physical stability of the final engineered surface cover and the adjacent area is adequate (i.e., the projected level of erosional degradation is not expected to significantly impede the performance of the disposal facility). Given the importance of construction activities on the performance of the final engineered surface cover, MF 2.02 will not be closed prior to construction of the cover."

Also, the NRC will revise the text of MF 2.02 in Section 4.2.2 under PO §61.42 to the following:

"**4.2.2. MF 2.02: Erosion Control of the SDF Engineered Surface Cover and Adjacent Area**

The DOE needs more model support to demonstrate that the physical stability of the final engineered surface cover is consistent with the assumed performance of the closure cap in the DOE 2009 PA. The NRC staff will evaluate preliminary erosion protection designs, any significant changes to the design before construction, construction quality, rock source for riprap, calculations of soil loss rates due to erosion, and information related to the physical stability of the vegetative and topsoil layers. For more information about how the closure cap relates to erosion control, see Section 3.2.2.

The NRC expects to close MF 2.02 (Erosion Control of the SDF Engineered Surface Cover and Adjacent Area) under PO §61.42 after the NRC determines that the projected physical stability of the final engineered surface cover and the adjacent area is adequate (i.e., the projected level of erosional degradation is not expected to significantly impede the performance of the disposal facility). Given the importance of construction activities on the performance of the final engineered surface cover, MF 2.02 will not be closed prior to construction of the cover."

Finally, the NRC will revise the text of the Technical Notes for MF 2.02 to the following:

"**Technical Notes for MF 2.02: Erosion Control of the SDF Engineered Surface Cover and Adjacent Area**

The erosion barrier is important in maintaining the physical stability of the closure cap, which protects the waste from exposure due to erosion, and maintaining adequate cover depth to discourage inadvertent intrusion. When the NRC staff reviewed a similar closure cap design for the SRS F-Tank Farm, the NRC staff recommended that a preliminary evaluation of rock sources be conducted to provide confidence that an acceptable rock source is available (ADAMS Accession No. ML1090150222). In response, the DOE indicated that the design information was sufficient for planning purposes and that rock sources will be evaluated in the final closure cap design (SRR-CWDA-2009-00054). The NRC staff remains concerned that if a rock source is not available that can adequately resist weathering, then modifications to the closure cap and/or assumptions regarding performance of the closure cap may be needed. Those modifications may be more easily accommodated earlier in the closure process. Accordingly, the NRC staff should review information related to the erosion barrier to verify that a rock source is available that is capable of resisting the anticipated weathering throughout the performance period.

Erosion of the upper layers of the cap (i.e., above the erosion barrier) also could degrade other aspects of cap performance. Specifically, long-term maintenance of the topsoil and vegetative cover is important to closure cap performance because the average evapotranspiration rate dominates the modeled water balance distribution for SRS precipitation. The DOE estimated the rate of erosion of the vegetative and topsoil layers using the Universal Soil Loss Equation assuming a mixed Bahia grass and pine tree cover during the post-institutional control period. The resistance of the topsoil portion of the cover to gully erosion was evaluated using the methodology in NUREG-1623 (ADAMS Accession No. ML022530043) based on a Probable Maximum Precipitation (PMP) event assuming Bahia grass cover. However, the DOE has not evaluated the potential cumulative effects from less significant; but, more frequent precipitation events on gully formation over long time periods. The NRC staff should verify the assumption that erosion based on the PMP for the vegetative and topsoil layers is conservative. In addition, the NRC staff should evaluate the stability of a degraded vegetative cover because the Bahia grass, bamboo, or pine forest could be degraded by fire or extended drought, which could adversely affect the ability of the vegetative and topsoil layers to resist erosion.

The NRC staff identified concerns related to the soil loss equation that the DOE used (see the NRC TRR on “Hydraulic Performance and Erosion Control of the Planned Saltstone Disposal Facility Closure Cap and Adjacent Area” (ADAMS Accession No. ML18002A545)). For example, the R value, or the rainfall erosion index used by the DOE, should be updated based on the newer Revised Universal Soil Loss Equation (RUSLE) equation and the value for unmanaged undergrowth should be used to obtain the C factor, or vegetative cover factor. In the NRC TRR, the NRC staff showed that potential differences in 10,000-year soil-loss results based on calculations using relatively small parameter value differences could add up to be more than 0.15 meters (0.5 feet), which is the entire thickness of the planned closure cap topsoil. Appropriate technical bases for the RUSLE parameters are needed because small changes in parameter values could cause relatively large changes in the erosion predictions. More recent publications may provide additional information as to an appropriate range of values.

The SDF and the future closure cap will be built in the current SRS Z-Area. The surrounding land consisting of unconsolidated soils and sediment sand will support the planned surface cover over the SDF from below (i.e., acting as a base or a foundation). Severe erosion and gully growth in the land surrounding the SRS Z-Area in the future could have the potential to disturb the engineered cover and possibly affect the isolation of the saltstone. Due to the importance of the erosion process in areas surrounding the SDF, the NRC staff will be monitoring those areas adjacent to the future engineered surface cover. Those areas of interest include: (i) land northeast of the asphalted service road; and (ii) land between the SRS Z-Area and portions of the Upper Three

Runs and McQueen Branch, especially those areas where the topography has a steeper incline.

For more information about erosion control and engineered covers, see Section 3.2.2 and Section 4.2.2."

Based on the January 31, 2018, NRC TRR, the NRC will add a new MF 10.14 (Scenario Development and Defensibility) under MA 10 (Performance Assessment Model Revisions) that will be under the NRC monitoring activities at the SDF under both 10 CFR Part 61 PO §61.41 and PO §61.42. The reason for this change is to more clearly distinguish between conceptual model uncertainty and future scenario uncertainty. The new MF 10.14 applies to both PO §61.41 and PO §61.42. The new MF 10.14 will be identified as medium-priority.

Specifically, the NRC will revise the summary paragraph of monitoring factors in MA 10 to include MF 10.14 as follows:

"Regarding MF 10.14, the DOE had previously developed an initial list of features, events, and processes (FEP) for the SDF PA. The DOE had previously screened those FEPs to obtain the final screening results (SRR-CWDA-2012-00011). However, the DOE had not used those final FEP results to investigate if plausible alternative scenarios of the future could be developed from the remaining FEPs. One of the NRC staff concerns in the *Technical Review Report: Hydraulic Performance and Erosion Control of the Planned Saltstone Disposal Facility Closure Cap and Adjacent Area* was that the DOE had not adequately considered future scenario uncertainty in the SDF PA. During monitoring, for clarification purposes and to distinguish more clearly between model uncertainty and future scenario uncertainty, the NRC identified the need for MF 10.14 (Scenario Development and Defensibility).

The NRC monitoring activities to assess DOE compliance with §61.42, "Protection of Individuals from Inadvertent Intrusion," will be based on a risk-informed review, including onsite observation visits, technical reviews, and data reviews, Most of the monitoring factors applicable to PO §61.41 are also applicable to PO §61.42. However, MF 10.10 through MF 10.13 do not apply to PO §61.42. MF 10.14 applies to both PO §61.41 and PO §61.42."

In addition, the NRC will add text for MF 10.14 in a new Section 3.10.14 under PO §61.41 as follows:

"**3.10.14. MF 10.14: Scenario Development and Defensibility**

Uncertainty about the future of the site is the result of inherent lack of knowledge about how the site will evolve over time. The future climatic, geologic, and population conditions that will prevail at a site are not known but, the PA process requires that an analyst consider possible future conditions. Scenario uncertainties are evaluated by incorporating the events or processes that may significantly influence projected doses to the receptor in the technical analysis. For example, climatic variation may significantly change groundwater flow pathways over time, necessitating changes to the groundwater flow model or the introduction of new parameters. Technical analyses may not be able to exclude the plausibility of both a future scenario involving no major climatic variations in which groundwater flow pathways remain unchanged (i.e., often identified as the central scenario) and of an alternative scenario involving future climate variations in which the groundwater flow pathways may change. In that case, the site would have two plausible scenarios (i.e., two potential routes of evolutionary development) that would need to be evaluated. The longer the analysis timeframe, the greater the likelihood of significant changes to the features and processes and of events occurring. Different scenarios may include improved or degraded performances due to changing features or due to the frequency of a process occurring (e.g., a future with a reduced rate of precipitation may enhance the waste isolation capabilities of the site in general; however, the vegetation may develop deeper root systems to obtain moisture and thereby degrade performance or sediments may consolidate due to the lower of a water table). If different evolutions of the area near the SDF are shown to be plausible, then the multiple scenarios should be evaluated and an appropriate technical description of the estimated future performance should be provided.

The NRC expects to close MF 10.14 (Scenario Development and Defensibility) under PO §61.41 after the DOE updates the PA and the NRC determines that future scenario uncertainty has been accounted for adequately."

Also, the NRC will add text for MF 10.14 in a new Section 4.10.14 under PO §61.42 as follows:

"**4.10.14. MF 10.14: Scenario Development and Defensibility**

The information in Section 4.10.14 (MF 10.14 – Scenario Development and Defensibility) for §61.42 is the same as the information in Section 3.10.14 (MF 10.14 – Scenario Development and Defensibility) for §61.41.

The NRC expects to close MF 10.14 (Scenario Development and Defensibility) under PO §61.42 after the DOE updates the PA and the NRC determines that future scenario uncertainty has been accounted for adequately."

Finally, the NRC will revise the text of the Technical Notes in Section A.10 to the following:

"A.10 Monitoring Area 10 – Performance Assessment Model Revisions

There are no Technical Notes for MFs 10.01 through 10.13.

<u>Technical Notes for MF 10.14: Scenario Development and Defensibility</u>

The DOE had previously developed an initial list of features, events, and processes (FEPs) for the SDF PA. The DOE had previously screened those FEPs to obtain the final screening results (SRR-CWDA-2012-00011). However, the DOE had not used the final FEP results to investigate if plausible alternative scenarios of the future could be developed from the remaining FEPs. Different potential future changes to vegetation, infiltration, and erosion could impact future facility performance differently. The concern raised by the NRC staff as it pertains to future erosion rates for land surrounding the SDF and the future closure cap under different, yet plausible, climate states remains.

That NRC staff concern is closely related to the uncertainty associated with the future evolution of the SDF or scenario uncertainty. For example, although there is no evidence of significant erosion in the area surrounding the SDF, only current conditions representative of the present and the near past could be observed during the SDF Observation 2017-01. The Report for SDF Observation 2017-01 is in ADAMS as Accession No. ML17054C453. Additional DOE analyses could reduce scenario and conceptual model uncertainty. If the DOE can demonstrate that different evolutions of the SDF are plausible, then evaluating multiple scenarios may provide an appropriately comprehensive technical description of the estimated performance in the future. The most plausible future scenario of a disposal site (i.e., central scenario) usually will not include disruptive events (e.g., earthquake, flood) because the disposal usually will not have been selected at a site where that is probable. Alternative scenarios that are less likely; but, still plausible descriptions of future evolutions of the disposal site, can and sometimes do include disruptive events.

An example of how an alternative scenario involving climate could change the groundwater flow system near the SDF can be shown using recent data from wells in the SRS Z-Area. The history of Salstone Disposal Structure 4 (SDS 4) included release of contaminants into the surrounding soils and the vadose zone. Well ZBG-4 is located next to SDS 4 while the old Well ZBG-2 was located some distance downgradient. Well ZBG-4 is located below the Tan Clay Confining Zone (TCCZ), while the open screen interval for Well ZBG-2 was located above the TCCZ. Although Well ZBG-4 is closer to the possible source (i.e., near SDS 4) than Well ZBG-2, contaminants were detected at Well ZBG-2 before they were detected at Well ZBG-4. A scenario with a very humid climate would plausibly produce a conceptual model where water from near SDS 4 would flow along the top of the TCCZ and towards Well ZBG-2. That is, given sufficient recharge to raise the water table above the TCCZ, water will flow in a predominately lateral direction, possibly flowing in troughs on the surface of the TCCZ. However, if a plausible scenario existed with a less humid long-term climate, then a conceptual model is plausible where the water table is below the TCCZ and recharge water follows a downward, yet slower path, through the TCCZ. Once through the TCCZ, water and any constituents within may flow in a different direction than water flowing in troughs on the surface of the TCCZ. The possibility then exists that the two hypothetical scenarios could produce different locations for the points of maximum exposure."