

May 24, 2013

MEMORANDUM TO: Aby S. Mohseni, Deputy Director
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

THRU: Janelle B. Jessie, Acting Chief */RA/*
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FROM: Nishka J. Devaser, Project Manager */RA/*
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SUBJECT: ONSITE OBSERVATION GUIDANCE FOR JUNE 26-27, 2013,
MONITORING VISIT TO THE SAVANNAH RIVER SITE, SALTSTONE
DISPOSAL FACILITY, DOCKET NO. PROJ0734

The U.S. Nuclear Regulatory Commission (NRC) staff is planning an onsite observation visit on June 26-27, 2013, to the U.S. Department of Energy Savannah River Site, Saltstone Disposal Facility to monitor activities related to the disposal of non-high-level waste, per the NRC responsibilities under the National Defense Authorization Act for Fiscal Year 2005. The onsite observation guidance is attached for your information.

Enclosure:
Onsite Observation Guidance

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ONSITE OBSERVATION GUIDANCE FOR JUNE 26-27, 2013, MONITORING VISIT AT THE SAVANNAH RIVER SITE SALTSTONE DISPOSAL FACILITY

PURPOSE:

The purpose of this document is to provide onsite observation guidance for a planned visit on June 26-27, 2013, to the U.S. Department of Energy (DOE) Savannah River Site (SRS) Saltstone Disposal Facility (SDF) to monitor activities related to the disposal of non-high-level waste, per the U.S. Nuclear Regulatory Commission (NRC) responsibilities under Section 3116(b) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA).

OBJECTIVE:

1. Observation of Saltstone Production Facility (SPF) during operation.
2. Discussion with SPF operations staff on details of the current processing cycle and future plans.
3. Update on DOE's Special Analysis for Saltstone and the DOE performance assessment (PA) maintenance plan.
4. Discussion of recent research with DOE technical staff.

BACKGROUND:

Section 3116(a) of the NDAA authorizes DOE, in consultation with the NRC, to determine whether certain radioactive waste related to the reprocessing of spent nuclear fuel is not high-level waste provided certain criteria are met. Section 3116(b) of the NDAA requires the NRC to monitor DOE disposal actions to assess compliance with Title 10 of the Code of Federal Regulations (10 CFR), Part 61, Subpart C, performance objectives for low-level waste. On March 31, 2005, DOE submitted to the NRC a draft waste determination titled, *Draft Section 3116 Determination, Salt Waste Disposal, Savannah River Site*. The purpose of the draft waste determination was to demonstrate compliance with the criteria in Section 3116(a) of the NDAA, including compliance with the performance objectives in 10 CFR Part 61, Subpart C.

In its consultation role under the NDAA, the NRC staff reviewed the draft waste determination. In December 2005, NRC staff documented the results of its review in a Technical Evaluation Report (TER), where the NRC concluded that there was reasonable assurance that the applicable criteria of the NDAA could be met, provided that certain assumptions made in the DOE analysis were verified during monitoring. DOE issued a final waste determination in January 2006 and took into consideration the assumptions, conclusions, and recommendations documented in the NRC TER.

Enclosure

In its monitoring role under the NDAA, the NRC finalized revision 0 of the monitoring plan for the SDF in May 2007. This onsite observation guidance was developed in accordance with the May 2007 monitoring plan to ensure consistency in NRC staff monitoring activities. The May 2007 monitoring plan is available in the NRC's Agency-wide Document Access and Management System (ADAMS) at accession number ML070730363.

In November 2009, DOE submitted its updated PA, the *2009 Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site* (2009 PA), for NRC staff review in accordance with the NRC monitoring responsibilities under Section 3116(b) of the NDAA. Following extensive discussions with DOE, the NRC staff completed its review and documented the NRC conclusions in a TER dated April 30, 2012 (ML121020140). In that TER, the NRC concluded that it did not have reasonable assurance that the performance objective in §61.41 would be met. However, the NRC concluded, that the §61.42, §61.43, and §61.44 performance objectives were met. Currently, the NRC is drafting a revised monitoring plan based on the 2012 TER. NRC staff expects the revised monitoring plan to be completed by the end of calendar year 2013. The NRC will continue to use the 2007 monitoring plan until the revised monitoring plan is completed.

OBSERVATION REQUIREMENTS:

The NRC onsite observation of the disposal actions taken by DOE focuses on the performance objectives set out in 10 CFR Part 61, Subpart C. Those performance objectives are:

(i) protection of the general population from releases of radioactivity (§61.41), (ii) protection of individuals against inadvertent intrusion (§61.42), (iii) protection of individuals during operations (§61.43), and (iv) stability of the disposal site after closure (§61.44). The NRC staff will use the following guidance to direct the observation while visiting the SRS facility.

Observation of Saltstone Production Facility during Operation

NRC staff monitors salt waste processing, including qualification of salt batches. Salt waste processing and quality assurance are critical to grout quality. A discussion of grout quality includes the qualification of salt batches and grout production at the SPF. Batch qualification ensures that the feed material is within tolerances acceptable to production, and production variables such as water to premix ratio, dry feeds variability, and curing conditions, impact the performance of the waste form. Worker doses during salt waste grout processing and saltstone disposal structure¹ operation are directly related to the performance objective for protection of individuals during operations (i.e., §61.43). Section 3.2.2, "Waste Sampling", Section 3.2.3, "Vault Construction"², Section 3.2.4, "Grout Formulation and Placement", and Section 5, "Monitoring to Assess Compliance with §61.43 – Protection During Operations" of the May 2007 monitoring plan (NRC, 2007a) provide details of the basis for NRC staff review areas.

¹ A saltstone disposal structure (SDS) is a self-enclosed engineered barrier that is designed to limit the release of saltstone to the environment. A disposal structure may include one or more cells. The term "disposal structure" refers to DOE "Vault 1", "Vault 4", and "future disposal cells." The term "disposal structure" could also be used to refer to potential new DOE designs for structures to contain saltstone. The DOE term "Saltstone Disposal Unit" typically denotes a set of disposal structures (e.g., Saltstone Disposal Unit 2 includes SDS 2A and 2B).

² "Vault" is a historical DOE term for a type of disposal structure.

Discussions with Operations Staff

The objectives of this monitoring activity include observing the saltstone grout production process in operation, and engaging in discussions with operations staff at SRS on the following topics:

- General information on operations in current run³, thus far (e.g., number of operating days, aggregate disposed inventory [volume, concentrations, and activity]),
- Unusual facility behavior in current run, thus far, if any (e.g., unusual work stoppages, their causes and length, abnormal worker exposure),
- Any changes in salt waste composition, processing conditions, curing conditions, or emplacement procedures that could affect the physical, hydraulic, or chemical properties of emplaced saltstone, and
- Planned disposal actions for the remainder of the current run and the next run (e.g., run-rate, intended feed volume).

Update on DOE's Special Analysis for Saltstone and the DOE PA Maintenance Plan

The objective of this monitoring activity is for DOE to provide NRC staff with an update on recent activities related to the Saltstone Special Analysis and the implementation plan for DOE's PA Maintenance Plan.

Discussions of Recent Research with DOE Technical Staff

On April 30, 2013, NRC and DOE technical staff held a technical phone call to discuss a recent DOE research report *Solubility of Technetium Dioxides (TcO_2-c , $TcO_2 \cdot 1.6H_2O$ and $TcO_2 \cdot 2H_2O$) in Reducing Cementitious Material Leachates: A Thermodynamic Calculation* (SRNL-STI-2012-00769). Part of the stated purpose of the report is to generate recommendations for values of saltstone solubility and sorption coefficients to be used in PA for the SDF. Therefore, the NRC staff had questions about how the values recommended in the report (SRNL-STI-2012-00769) would be used in future PAs, in addition to questions related to the text and figures of the report itself and how they were developed from its supporting references. A summary of the phone call is currently being prepared and will be publicly available when completed. One of the objectives of this monitoring visit is to continue the discussion of that research paper (SRNL-STI-2012-00769). In particular, the NRC staff has remaining questions about the following topics:

- The basis for the recommended solubility of Tc in moderately-aged, chemically reduced cementitious material,
- Potential effects of high ionic strength on Tc solubility,

³ A saltstone "run" represents a period of operation of the saltstone production facility between outages.

- Uncertainty attributable to limiting the geochemical modeling to the selected potential Tc solid species,
- The significance of re-reduction of Tc shown in (Figure 3.7 of PNNL-21723) and reasons for the differences in re-reduction between different exposures to oxygen,
- Comparison of the oxidation of Tc shown in PNNL-21723 with the fraction of Tc oxidized by the continuous presence of 30-60 ppm of oxygen in SRNL-STI-2010-00667,
- Which of the values in Table 11 will be used in the PA,
- Calculation of transition times, including pH cut-off values for transitions,
- Use of probabilistic distributions for Tc solubility,
- Uncertainty attributable to relying on database values derived from experiments conducted under young cement conditions and applying them to moderate-aged cement conditions, and
- Representation of reduced sulfur in saltstone by various mineral phases.

On May 6, 2013, DOE provided the report, *Degradation of Cementitious Materials Associated with Saltstone Disposal Units* (SRNL-STI-2013-00118). This report evaluates the degradation of cementitious materials due to sulfate attack, carbonation, and decalcification, which DOE expects to be the primary chemical degradation phenomena under SDF exposure conditions. The NRC staff would like to discuss this report at the Onsite Observation Visit. In particular, the NRC staff would discuss the following issues from this report:

- The basis for excluding other degradation mechanisms from consideration
 - How DOE considered saltstone thermal loading when assessing the potential for fracture formation,
 - How DOE considered the high water-to-cement ratio on long-term saltstone durability and potential to fracture,
 - How DOE considered the effects of settlement in light of elevated and variable water-to-cement ratios in saltstone, and
 - How DOE considered the unique saltstone formulation (e.g., high pozzolanic replacement, high salt content, admixtures), which may produce chemical reactions that are not well characterized or incorporated into cementitious models.
- The potential effects of fracturing on the diffusion lengths considered in the report (SRNL-STI-2013-00118).
- How DOE intends to implement the results of this report in the PA (e.g., how will partial degradation be incorporated in the PA).