

March 15, 2011

Mr. Thomas Gutmann, Director
Waste Disposition Programs Division
U.S. Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION JANUARY 27, 2011 ONSITE
OBSERVATION REPORT FOR THE SAVANNAH RIVER SITE SALTSTONE
FACILITY

Dear Mr. Gutmann:

The enclosed report describes the U.S. Nuclear Regulatory Commission's (NRC's) onsite observation activities on January 27, 2011, at the Savannah River Site (SRS) Saltstone Facility. This onsite observation was conducted in accordance with Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (Section 3116), which requires NRC to monitor disposal actions taken by the U.S. Department of Energy (DOE) for the purpose of assessing compliance with the performance objectives set out in 10 CFR Part 61, Subpart C. The activities conducted during the site visit were consistent with those described in the NRC's monitoring plan for salt waste disposal at SRS (dated May 3, 2007) and NRC's staff guidance for activities related to waste determinations (NUREG-1854, dated August 2007).

This onsite observation at SRS was focused on assessing compliance with three of the four performance objectives: (i) protection of the general population from releases of radioactivity (10 CFR 61.41), (ii) protection of individuals during operations (10 CFR 61.43), and (iii) stability of the disposal site after closure (10 CFR 61.44). Meeting these performance objectives is predicated on the performance of the disposal cells within the period of compliance.

NRC continues to conclude that there is reasonable assurance that the applicable criteria of Section 3116 can be met, if key assumptions made in DOE's waste determination analyses prove to be correct. In accordance with the requirements of Section 3116 and consistent with NRC's monitoring plan for the Saltstone Disposal Facility (SDF), NRC will continue to monitor DOE's disposal actions at SRS. The monitoring activities are expected to be an iterative process. Presently, three issues previously identified by the staff remain open: (1) the hydraulic and chemical properties of the saltstone grout, (2) the variability of saltstone from batch to batch, and (3) the reduction and retention of Technetium-99 within the saltstone waste form. Further onsite observation visits and technical reviews may be necessary in order to obtain the information needed to close all of the current open issues, as well as other issues that may be opened in the future. No discussions directly related to the three Open Issues took place during this observation.

T. Gutmann

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If you have any questions or need additional information regarding this report, please contact Nishka Devaser of my staff at (301) 415-5196.

Sincerely,

/RA by D. Diaz-Toro Acting for/

Andrew Persinko, 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

Enclosure:
NRC Observation Report

cc w /enclosure:
S. Wilson
Federal Facilities Liaison
Environmental Quality Control Administration
South Carolina Department of Health
and Environmental Control
2600 Bull Street
Columbia, SC 29201-1708

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U.S. NUCLEAR REGULATORY COMMISSION JANUARY 27, 2011 ONSITE OBSERVATION REPORT FOR THE SAVANNAH RIVER SITE SALTSTONE FACILITY

EXECUTIVE SUMMARY:

The U.S. Nuclear Regulatory Commission (NRC) staff conducted its tenth onsite observation visit, Observation 2011-01, to the Saltstone Facility at the Savannah River Site (SRS) on January 27, 2011. The purpose of this visit was to focus on compliance with three of the four performance objectives: (i) protection of the general population from releases of radioactivity (10 CFR 61.41), (ii) protection of individuals during operations (10 CFR 61.43), and (iii) stability of the disposal site after closure (10 CFR 61.44), by observing Vault 4 integrity and discussing saltstone production operations. This report provides a description of NRC onsite observation activities and identifies NRC observations made during the visit. Based on the results of the visit, the NRC continues to have reasonable assurance that the performance objectives of 10 CFR 61 can be met in the areas reviewed, as long as key assumptions made in the U.S. Department of Energy's (DOE's) waste determination analysis prove to be correct.

There are no new open issues resulting from this observation. The NRC staff received documentation pertaining to operations at the Saltstone Production Facility and pertaining to both the inventory of Vault 4 and the details about Cell A. Each of the documents received by the NRC staff during the observation are accessible via NRC's document repository, the Agencywide Documents Access and Management System (ADAMS), via the package accession number ML110670458.

A summary of the staff's observations and conclusions is provided below:

Vault 4 Integrity:

- DOE provided a tour of Vault 4 which included observations of the wall of Cell H and a video of some identified seepage spots on the south wall of Cell F. A representative of the DOE contractor, Savannah River Remediation (SRR) provided answers to staffs' questions during the tour and the video pertaining to the process of identifying seepage spots along the wall and the subsequent mitigative actions.

Saltstone Production Facility Operations:

- DOE provided an overview of saltstone production operations in calendar year 2010, which included details of operation (e.g., number of operating days, disposal volume, unusual work stoppages).

Enclosure

1.0 BACKGROUND:

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

On March 31, 2005, DOE submitted a "Draft Section 3116 Determination Salt Waste Disposal Savannah River Site" to demonstrate compliance with the Section 3116 criteria including demonstration of compliance with the performance objectives in 10 CFR Part 61, Subpart C (DOE, 2005a). In its consultation role, the NRC staff reviewed the draft waste determination and concluded that there was reasonable assurance that the applicable criteria of Section 3116 could be met, provided certain assumptions made in DOE's analyses are verified via monitoring. NRC documented the results of its review in a Technical Evaluation Report issued in December 2005 (NRC, 2005). DOE issued a final waste determination in January 2006 taking into consideration the assumptions, conclusions, and recommendations documented in NRC's Technical Evaluation Report (DOE, 2006).

To carry out its monitoring responsibility under Section 3116, NRC plans to perform three types of activities: (i) technical reviews, (ii) onsite observations, and (iii) data reviews in coordination with the State of South Carolina site regulator, South Carolina Department of Health and Environmental Control (SC DHEC). These activities will focus on key assumptions – called "factors" – identified in the NRC monitoring plan for salt waste disposal at SRS (NRC, 2007). Technical reviews generally will focus on obtaining additional model support for assumptions DOE made in its PA that are considered important to DOE's compliance demonstration. Onsite observations generally will be performed to (i) observe the collection of data (e.g., observation of waste sampling used to generate radionuclide inventory data) and review the data to assess consistency with assumptions made in the waste determination, or (ii) observe key disposal (or closure) activities related to technical review areas (e.g., slag and other material storage, grout formulation and preparation, and grout placements). Data reviews will supplement technical reviews by focusing on monitoring data that may also indicate future system performance or by reviewing records or reports that can be used to directly assess compliance with performance objectives.

2.0 NRC ONSITE OBSERVATION ACTIVITIES:

The observation began with a short briefing presented by the DOE contractor, Savannah River Remediation (SRR) and attended by representatives from DOE, NRC, SC DHEC, and SRR. The briefing consisted of going through the observation agenda and reviewing standard safety considerations at the facility in preparation of a facility tour. After the briefing, Saltstone Production Facility (SPF) staff (employees of SRR) took the group on a tour of Vault 4 which consisted of observing the exterior wall of an empty vault cell, Cell H. SRR staff then moved the group into a conference room to discuss the operations at the SPF and to watch a short video of a seepage spot on Cell F.

2.1 SALTSTONE VAULT 4 WALL INTEGRITY:

2.1.1 Observation Scope:

The observation of DOE saltstone disposal operations pertains to Factor 1 – “Oxidation of Saltstone” and Factor 2 – “Hydraulic Isolation of Saltstone” identified in the NRC monitoring plan for the SRS SPF and SDF (NRC, 2007). The concrete vaults of the SDF are assumed to provide secondary containment for saltstone as well as limit wasteform exposure to aggressive chemical conditions. The objectives of the monitoring visit were to observe Vault 4 walls with respect to wasteform isolation, stability in the local environment, as well as gaining an understanding of the process SRR uses to identify seepage spots on the cell wall and the subsequent mitigative actions. Verifying the integrity of the Vault 4 walls is important to assessing the vaults ability to maintain hydraulic isolation of the saltstone waste form which relates directly to ensuring compliance with 10 CFR 61.41, “*protection of the general population from releases of radioactivity*”.

Section 3.1.3, “Hydraulic Isolation of Saltstone,” of the May 2007 monitoring plan (NRC, 2007) provides the basis for the staff’s intended review areas.

2.1.2 Observation Results:

The staff observed the exterior wall of the Vault 4, Cell H and SRR staff discussed earlier mitigative actions to limit the release of radiologically-contaminated water from the cells during disposal operations. Seepage has occurred at imperfections in the vault walls as liquid builds up in the gap between the saltstone and vault wall. DOE has applied sealant coatings, a rain shield, certified huts, and a drip pan on the exterior of the vault cells to reduce seepage of liquid to the environment.

The vaults are intended to provide secondary containment for the radioactive saltstone wasteform. SRR staff stated that Vault 4 was not designed to be watertight and the 2009 PA assumes a very high hydraulic conductivity of 0.17 cm/s. Although this value likely bounds the potential range of hydraulic conductivities of the fractured walls of Vault 4, the moisture characteristic curve implemented in the PA for fractured concrete significantly reduces the modeled flow rate through the walls. It is not clear that the flow through the walls of Vault 4, as modeled and assumed in the 2009 PA, is consistent with observations of seepage. NRC and DOE staff will further address this issue in an upcoming observation visit.

NRC staff inquired about the integrity of the roofs of the Vault 4 cells as this provides a degree of hydraulic isolation to the wasteform. SRR staff indicated that there are active efforts to reduce the infiltration of rainwater into the cells. NRC staff requested any documentation of repair work to the roofs of Vault 4 to ensure that the assumptions in the PA regarding the hydraulic properties of the roof are consistent with ongoing observations. DOE supplied images of the repair work to the roof of Cell A, Vault 4 (ML110620217).

In addition to the tour, SRR staff presented a video of a seepage spot on the Vault 4, Cell F wall and discussed the use of disposal pads to mitigate the releases. SRR staff stated the plan is to dispose of the pads in Vault 1 or E Area. Toxicity Characteristic Leaching Procedure tests are conducted on the pads but a radionuclide-specific characterization of the pads has not been

conducted. Characterization of the radionuclides that are released may provide insight into the stability of the saltstone wasteform (e.g., whether or not Tc-99 is retained in the wasteform).

2.1.3 Conclusions and Follow-up Actions:

No issues or concerns were identified during the observation of Vault 4. With respect to the Vault 4 seepage, the corrective actions taken by DOE should be effective at significantly reducing or eliminating contamination from the vault from reaching the environment in the short term (NRC, 2008). NRC staff requested any documentation regarding repair work to the roofs of all Vault 4 cells and maintains an interest in the disposal and characterization of the absorbent pads. Based on the discussion that took place during the observation, the NRC continues to have reasonable assurance that the 10 CFR Part 61 performance objectives can be met.

2.2 SALTSTONE PRODUCTION FACILITY OPERATIONS:

2.2.1 Observation Scope:

The staff's interest in discussing operations at the SPF is to ensure that the production of saltstone grout at the SDF is consistent with the assumptions made in the 2009 PA. Verifying the suitability of the saltstone production process is important to assessing the sites' radiation protection program which relates directly to ensuring compliance with 10 CFR 61.43, "*protection of individuals during operations.*"

Section 5.2.1, "Radiation Protection Program," of the May 2007 monitoring plan (NRC, 2007) provides the basis for the staff's intended review areas.

2.2.2 Observation Results:

The NRC staff was not able to observe the saltstone grout in operation during the observation. In lieu of observing active operations, SRR staff provided a presentation explaining the current inventory being disposed of onsite, a short description of 2010 operational parameters (e.g., number of operating days, aggregate disposed inventory, quarterly run-rate), and an assessment of atypical operational parameters (e.g., unusual work stoppages, abnormal worker exposure).

In response to the NRC's request, DOE provided a chart with the details of Saltstone production during Calendar Year 2010 (ADAMS Acc No. ML110620205). The chart expresses cumulative production of Saltstone and identifies any interruptions in production during the year. Of note, the staff learned that approximately 2,630 kiloliters (694,000 gallons) and 1,481 TBq (40 kCi) of salt solution were disposed of in 2010 and that Vault 4 is expected to be at capacity sometime in early 2012. DOE is planning to dispose of 2 million gallons during 2011 and "several hundred thousand" gallons more in the beginning of 2012.

SRR staff stated the disposal of thorium-230 at the SDF is significantly below the assumed activity in the 2009 PA due to a very conservative estimation of Th-230 inventory in the PA. The 2009 PA assumes 7.5 Ci of Th-230 to be disposed of in Vault 4 and to date, DOE has disposed

of 0.028 Ci. NRC staff indicated that the inventory of Th-230 is not currently on DOE's website and requested the disposal history of this radionuclide into Vault 4. In addition, NRC staff inquired whether the predicted disposal of Tc-99 into Vault 4 is consistent with the assumed activity in the 2009 PA.

2.2.3 Conclusions and Follow-up Actions:

No issues or concerns were identified during the observation of the Saltstone Production Facility operations. NRC staff requested documentation of the Th-230 activity disposed of in Vault 4 to date and an updated prediction of the Tc-99 disposal activity for Vault 4. Documentation on the disposed Th-230 activity was provided by DOE (ML110620210). Based on the discussion that took place during the observation, the NRC continues to have reasonable assurance that the 10 CFR part 61 performance objectives can be met.

3.0 PARTICIPANTS:

U.S. NRC
George Alexander
Nishka Devaser
Gregory Suber

U.S. DOE-SR
Chun Pang
Patricia Suggs
Armanda Watson

SRR
Ginger Dickert
Edward Selden
F. Malcolm Smith
Aaron Staub
Steve Thomas

SC DHEC
Justin Koon
Jason Shirley
Scott Simons

U.S. DOE
Linda Suttora

4.0 REFERENCES:

U.S. Department of Energy (DOE). DOE-WD-2005-001, "Basis for Section 3116 Determination Salt Waste Disposal at the Savannah River Site." Washington, DC: DOE. March 2005a.

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———. "U.S. Nuclear Regulatory Commission Plan for Monitoring the U.S. Department of Energy Salt Waste Disposal at the Savannah River Site in Accordance with the National Defense Authorization Act for Fiscal Year 2005." Washington, DC: NRC. May 3, 2007. (ADAMS Accession No. ML070730363).

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Savannah River Remediation (SRR). SRR-CWDA-2009-00017, Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site, Savannah River Site, Aiken, SC, October 29, 2009 (ADAMS Accession No. ML101590008).