

September 24, 2008

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

SUBJECT: NUCLEAR REGULATORY COMMISSION ONSITE OBSERVATION REPORT  
FOR THE SAVANNAH RIVER SITE SALTSTONE PRODUCTION AND  
DISPOSAL FACILITIES, JULY 31, 2008

Dear Ms. Ridley:

The enclosed report describes the U.S. Nuclear Regulatory Commission's (NRC's) onsite observation activities on July 31, 2008, at the Savannah River National Laboratory (SRNL) at the Savannah River Site (SRS). This onsite observation was conducted in accordance with the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA), which requires NRC to monitor disposal actions taken by 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 primarily focused on the performance objective in 10 CFR 61.41, *protection of the general population from releases of radioactivity*. Since saltstone grout production operations could impact the long-term stability of the disposal facility after its closure, this observation also partially assessed the performance objective in 10 CFR 61.44, *stability of the disposal site after closure*.

During the previous onsite observation visit in March 2008, DOE presented plans for additional studies, including laboratory experiments. These experiments, when completed, are designed to provide information DOE needs to address open issues identified by NRC during an observation visit in October 2007 as well as to provide additional model support for the Saltstone Performance Assessment. The open issues identified by the NRC pertain to: (1) the need for additional information to support the physical characteristics of the saltstone grout assumed in the DOE waste determination; and (2) the need for additional information which quantifies the impact of grout component intrabatch variability, flush water additions, and additives, on final saltstone grout physical and chemical properties.

In July 2008, DOE-Savannah River (DOE-SR) informed NRC that DOE contractor staff at SRNL planned to complete three experiments on vault and saltstone grout materials by mid-August 2008. NRC staff visited SRNL on July 31, 2008 in order to observe ongoing experiments that will address the first open issue described above, before they were completed. No new open issues were identified relating to these observations, and no open issues were closed, as

the data from these experiments, data assessments, and updated performance assessments are not yet available.

Based on NRC staff observations, NRC staff continues to conclude that there is reasonable assurance that the applicable criteria of the NDAA can be met if key assumptions made in DOE's waste determination analyses prove to be correct. In accordance with the requirements of the NDAA and consistent with NRC's monitoring plan for the salt waste disposal facility, NRC will continue to monitor DOE's disposal actions at SRS. The monitoring activities are expected to be an iterative process and several onsite observation visits, and technical reviews of various reports, studies, etc., may be necessary in order to obtain the information needed to close all of the current open issues, as well as issues that may be opened in the future.

If you have any questions or need additional information regarding this report, please contact David Brown at (301) 415-6116.

Sincerely,

**/RA/**

Patrice Bubar, Deputy Director  
Division of Waste Management  
and Environmental Protection  
Office of Federal and State Materials  
and Environmental Management Programs

Enclosure:  
NRC Observation Report

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

the data from these experiments, data assessments, and updated performance assessments are not yet available.

Based on NRC staff observations, NRC staff continues to conclude that there is reasonable assurance that the applicable criteria of the NDAA can be met if key assumptions made in DOE's waste determination analyses prove to be correct. In accordance with the requirements of the NDAA and consistent with NRC's monitoring plan for the salt waste disposal facility, NRC will continue to monitor DOE's disposal actions at SRS. The monitoring activities are expected to be an iterative process and several onsite observation visits, and technical reviews of various reports, studies, etc., may be necessary in order to obtain the information needed to close all of the current open issues, as well as issues that may be opened in the future.

If you have any questions or need additional information regarding this report, please contact David Brown at (301) 415-6116.

Sincerely,

*/RA/*

Patrice Bubar, Deputy Director  
Division of Waste Management  
and Environmental Protection  
Office of Federal and State Materials  
and Environmental Management Programs

Enclosure:  
NRC Observation Report

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

DISTRIBUTION:

RidsOpaMail                      RidsOgcMailCenter                      RidsOcaMailCenter

**ML082530057**

OFC	FSME/DWMEP	DWMEP/LA	FSME/DWMEP	FSME/DWMEP	FSME/DWMEP
NAME	D.Brown	AWalker-Smith	A.Kock	A.Bradford	D.Brown
DATE	9/11/08	9/17/08	9/19/08	9/22/08	9/24/08

**OFFICIAL RECORD COPY**

SAVANNAH RIVER SITE SALTSTONE PRODUCTION AND DISPOSAL FACILITIES  
U. S. NUCLEAR REGULATORY COMMISSION ONSITE OBSERVATION REPORT  
JULY 31, 2008

## 1.0 INTRODUCTION

On July 31, 2008, NRC staff conducted its third onsite observation visit of the Savannah River Site (SRS) Saltstone Facilities. The purpose of this one-day visit was to observe ongoing experiments at the Savannah River National Laboratory (SRNL) at the Savannah River Site. This visit focused on the performance objective in 10 CFR 61.41, "*protection of the general population from releases of radioactivity*," by reviewing ongoing laboratory experiments designed to collect data on the physical and chemical properties of the SRS Saltstone Disposal Facility (SDF) vault and saltstone grout materials. Because the saltstone grout production operations could impact the long-term stability of the disposal facility after its closure, this observation also was intended to partially assess compliance with the performance objective in 10 CFR 61.44, "*stability of the disposal site after closure*." This report provides a description of NRC onsite observation activities and identifies NRC observations from 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.

## 2.0 NRC ONSITE OBSERVATION ACTIVITIES

At the beginning of the visit, DOE contractor staff provided briefings to staff from NRC and the South Carolina Department of Health and Environmental Control (SCDHEC) on: (1) the ongoing experiments at SRNL that are designed to collect data on physical and chemical parameters of the SDF vault and saltstone grout; and (2) the current status of salt waste processing. DOE briefing slides are included in Attachments 1 and 2. With regard to the experiments, DOE contractor staff explained that there are three main types of experiments at different stages of completion. These experiments include: (1) batch studies of absorption and desorption rates of key radionuclides from a pulverized simulated concrete and grout, which are 75% complete, and which DOE estimates will be complete in September 2008; (2) studies of technetium-99 oxidation and release rates from crushed samples of laboratory-prepared saltstone grout, which DOE estimates are about 50% complete; and (3) studies of the reduction capacity of saltstone, grout, which are complete.

With regard to the batch studies of absorption and desorption rates of key radionuclides from a pulverized simulated vault concrete and saltstone grout, DOE contractor staff explained that three saltstone grout mixtures are being studied that are representative of three liquid waste processing streams: (1) deliquification, dissolution, and adjustment (DDA); (2) actinide removal process / modular caustic side solvent extraction unit (ARP/MCU); and (3) the Salt Waste Processing Facility (SWPF). The data collected in these experiments is used to calculate distribution coefficients, or  $K_d$  values, which are key parameter values in the DOE performance assessment. DOE explained that the current experiments are not testing the effects of grout additives such as anti-foaming agents or set-retardant. However, DOE may conduct such experiments in the future, subject to prioritization of research needs and available funds.

Enclosure

The experiments to collect data on the reducing capacity of saltstone grout are using a colorimetric titration technique to oxidation endpoints measured using a spectrophotometer. The indicator is based on the reduction-oxidation couples of cerium and chromium .

The experiments on the oxidation of saltstone grout and desorption rates of technetium-99 in saltstone grout are batch experiments. In these experiments, crushed laboratory-prepared saltstone grout is added to small, sealed serum bottles with simulated, highly-buffered saltstone grout pore water. The grout and water mixture is equilibrated by tumbling or shaker table, which requires several days. Equilibrium is indicated by stable pH measurements, at which time the technetium-99 spike is added to the mixture. Aqueous technetium-99 concentrations are measured at regular time intervals throughout the experiment. Aqueous phase technetium-99 is determined after filtration of the leachate through 100 nanometer pore filters. Early results indicate that equilibrium technetium-99 adsorption is reached within 5 hours. After one week, air is sparged into the serum bottles, and technetium-99 aqueous phase concentrations continue to be measured at regular time intervals.

NRC staff did not review preliminary results for any of the experiments, as data validation and data assessment for all laboratory experiments is pending. As a result, the two open issues pertaining to saltstone characterization that are summarized in the NRC's observation report for the March 24-28, 2008, observation visit remain open. These open issues pertain to: (1) the need for additional information to support the physical characteristics of the saltstone grout assumed in the DOE waste determination; and (2) the need for additional information which quantifies the impact of grout component intrabatch variability, flush water additions, and additives, on final saltstone grout physical and chemical properties. In addition, NRC staff expects to review the results of these experiments as part of the monitoring of Factor 3: Model Support described in Section 3.1.4 of NRC's Monitoring Plan for Salt Waste Disposal at SRS.

NRC and DOE contractor staff also discussed whether soil sampling and analysis results for samples taken in the vicinity of the Saltstone Disposal Facility (SDF) were available for NRC technical review. These sample were taken in the vicinity of weep sites in Vault 4. DOE contactor staff stated that sample analysis results were available, but that additional time is needed to complete a data assessment. NRC staff will follow up on the availability of this information for NRC technical review.

DOE contractor staff also provided an update to NRC and SCDHEC staff on salt processing. Of note, as described in the Attachment 2, DOE has started ARP/MCU processing under a Management Control Plan, which involves a heightened level of administrative controls on operations, including cross-checks, various process hold points for management review and approval, and higher sampling rates. The performance of the ARP/MCU processing is of interest to NRC staff because the amount of removal achieved during this process affects the inventory of radionuclides disposed of at the Saltstone Disposal Facility and consequently the dose that a receptor may receive.

DOE contractor staff explained that they have experienced some start-up challenges with MCU, including loading of a Decontaminated Salt Solution (DSS) coalescer. The accumulation of monosodium titanate solids on the coalescer media occurred more rapidly than anticipated, starting with the fifth of what was expected to be a series of 10 DSS batches under the Management Control Plan. The coalescer media in the crossflow filter protects contactors located downstream in the MCU process. DOE contractor staff explained that the rate of coalescer media loading does not present a process safety hazard. Lessons-learned on

equipment start-up are being shared with Parsons, which is designing the SWPF. DOE contractor staff explained that the ARP/MCU process is performing better than desired production goals. However, the process has been treating "startup simulant" from Tank 49, for which higher decontamination factors are expected. DOE will continue treating additional batches of ARP/MCU feed material, and expect that equilibrium processing rates and performance will be reached within ten batches following replacement of the coalescer media. DOE had processed a total of 13 batches at the time of the NRC observation visit. No radionuclide removal data was available for NRC technical review during the visit. However, DOE is preparing a technical report on the results of start-up operations under the Management Control Plan. In addition, the sampling protocol for the ARP/MCU process is being developed. NRC staff will follow up on the availability of these documents in the future.

Following discussion of the three types of experiments, and the update from DOE contractor staff on the status of salt processing, NRC and SC DHEC staff were provided a tour of ongoing experiments in the laboratory.

In the afternoon, NRC and DOE staff discussed which routine reports DOE and/or DOE contractor staff prepare for which NRC would like to be on distribution. NRC and DOE also discussed the schedule for the preparation of technical reports pertaining to the laboratory experiments observed during this visit, and other ongoing studies.

### 3.0 CONCLUSIONS

During this onsite observation visit, NRC and SC DHEC staff were afforded an opportunity to observe ongoing laboratory experiments, and ask clarifying questions on the design and scope of the experiments. NRC and SC DHEC staff also received a briefing on the status of salt waste processing operations, but did not request a tour of the Saltstone Facilities, or review onsite documentation pertaining to ongoing operations. Given the limited scope of the onsite observation, and the fact that experimental data and data assessments are not yet available, staff did not close open items that were described in the NRC's observation report for the March 24-28, 2008, observation visit.

Based on NRC staff observations, NRC staff continues to conclude that there is reasonable assurance that the applicable criteria of the NDAA can be met if key assumptions made in DOE's waste determination analyses prove to be correct. In accordance with the requirements of the NDAA and consistent with NRC's monitoring plan for the salt waste disposal facility, NRC will continue to monitor DOE's disposal actions at SRS. The monitoring activities are expected to be an iterative process and several onsite observation visits, and technical reviews of various reports, studies, etc., may be necessary in order to obtain the information needed to close all of the current open issues, as well as issues that may be opened in the future.

### 4.0 PARTICIPANTS

NRC and State of South Carolina Observation Team

Anna Bradford, NRC  
David Brown, NRC  
Karen Pinkston, NRC  
Jason Shirley, SC DHEC  
Ted Millings, SC DHEC

U.S. DOE and Contractor Representatives

Seaward Middleton, DOE-SR  
Howard Pope, DOE-SR  
Sherri Ross, DOE-SR  
Ginger Dickert, WSRC  
Dan Kaplan, WSRC

David Little, WSRC  
Jeff Newman, WSRC  
Larry Romanowski, WSRC  
Kent Rosenberger, WSRC  
F. Malcolm Smith, WSRC

Attachments:

1. "Batch Kd Measurement," Dan Kaplan, WSRC, undated
2. "Salt Processing Update," David Little, WSRC, dated July 31, 2008.