Savannah River Site - Saltstone Disposal Facility Performance Assessment Update - 9240

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ABSTRACT

The Savannah River Site (SRS) Saltstone Facility is currently in the midst of a Performance Assessment revision to estimate the effect on human health and the environment of adding new disposal units to the current Saltstone Disposal Facility (SDF). These disposal units continue the ability to safely process the salt component of the radioactive liquid waste stored in the underground storage tanks at SRS, and is a crucial prerequisite for completion of the overall SRS waste disposition plan.

Removal and disposal of low activity salt waste from the SRS liquid waste system is required in order to empty tanks for future tank waste processing and closure operations. The Saltstone Production Facility (SPF) solidifies a low-activity salt stream into a grout matrix, known as saltstone, suitable for disposal at the SDF.

The ability to dispose of the low-activity salt stream in the SDF required a waste determination pursuant to Section 3116 of the Ronald Reagan National Defense Authorization Act of 2005 and was approved in January 2006. One of the requirements of Section 3116 of the NDAA is to demonstrate compliance with the performance objectives set out in Subpart C of Part 61 of Title 10, Code of Federal Regulations. The PA is the document that is used to ensure ongoing compliance.

INTRODUCTION

The Saltstone Facility (located in the Z-Area of SRS) consists of two facility segments:
The SPF, which receives and treats the salt solution to produce saltstone, and the SDF, which consists of disposal units used for the final disposal of the saltstone. The SPF is permitted as a wastewater treatment facility per South Carolina Department of Health and Environmental Control regulations. Construction of SPF and the first two disposal units of SDF were begun in February 1986. The Saltstone Facility started radioactive operations June 1990. Future disposal units will be constructed on a “just-in-time” basis in coordination with salt processing production rates.

The Performance Assessment now under way is being prepared to support the eventual closure of the Saltstone Disposal Facility (SDF) underground radioactive waste disposal cells. The Saltstone PA provides the technical basis and results to be used to demonstrate compliance with pertinent regulatory requirements. This PA incorporates lessons learned from other SRS PA work, including use of a hybrid groundwater modeling technique. This hybrid approach employs a combination of deterministic and probabilistic modeling to ensure meeting performance objectives while demonstrating an understanding of the manmade and natural barriers incorporated into the SDF.

Regulatory reviews will be conducted over the next year, with the final PA scheduled for completion in late CY09.

REGULATORY BACKGROUND

The regulatory process to complete closure of the SDF requires the development of multiple detailed technical documents with reviews and approvals by multiple state and federal agencies.

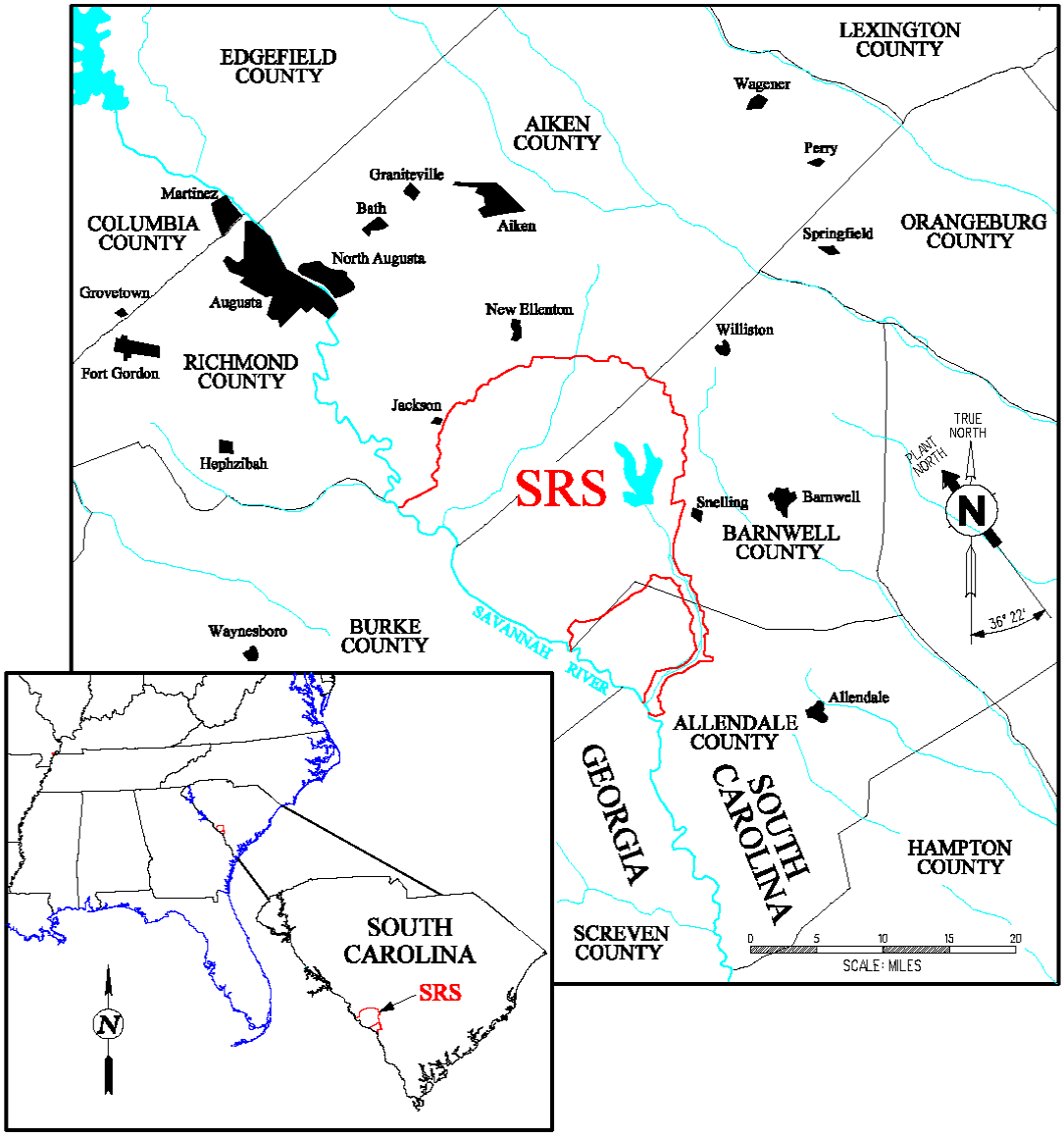
The documents involved include an SDF Section 3116 Basis Document, which will be used to demonstrate compliance with the NDAA Section 3116 criteria. The SDF Section 3116 Basis Document is reviewed and approved by the DOE, in consultation with the United States Nuclear Regulatory Commission (NRC). Approval of a Section 3116 Waste Determination by the Secretary of Energy is then required to determine that the solidified saltstone waste can be classified as non-high level waste for purposes of onsite disposition. The Section 3116 criteria include Part 10 of the Code of Federal Regulations Section 61, Subpart C. The SDF PA provides the technical basis that will be used to demonstrate compliance with 10 CFR 61.41 and 61.42 performance objectives in the FTF Section 3116 Basis Document. These performance objectives are used in lieu of the comparable performance objectives from DOE O 435.1. Compliance with the South Carolina Department of Health and Environmental Control (SCDHEC) requirements will be demonstrated in the SDF Closure Plan, which will establish the general protocols, requirements, and processes for closure of SDF. The SDF Closure Plan is reviewed and approved by DOE, SCDHEC, and the United States Environmental Protection Agency (EPA).

The SDF Section 3116 Basis Document will specify the point of compliance to be used for 10 CFR 61.41 and the SDF Closure Plan will specify the point of compliance to be used for applicable SCDHEC and EPA requirements. The SDF PA provides groundwater radionuclide concentrations at 1m, 100m and exposure points at the nearest stream. The groundwater concentrations are provided for each of the three aquifers as applicable as a part of the SDF groundwater modeling. The SDF PA also provides groundwater concentrations for chemical contaminants at 1m, 100m and the two seeplines. In addition, the SDF PA provides intruder doses consistent with the requirements for 10 CFR 61.42, as well as analyses for the air pathways and radon ground surface flux.

SRS SITE DESCRIPTION

SRS, one of the facilities in the DOE complex, was constructed starting in the early 1950s to produce nuclear materials (such as Pu-239 and tritium). The site covers approximately 800 km^2 (310 mi^2) in South Carolina and borders the Savannah River. The site is approximately 20 km (12 mi) south of Aiken, South Carolina, and 25 km (15 mi) southeast of Augusta, Georgia, as shown in Figure 1.

Figure 1: Physical Location of Savannah River Site



SFD SITE DESCRIPTION

The SDF is in Z-Area, which is located in the central region of the SRS. Z-Area was chosen for the SDF site based on considerations of depth to the water table, distance to surface water and the public, available surface area, surface topography, and its proximity to the wastewater generated on site. Z-Area consists of approximately 640,000 m² (~150 acres).

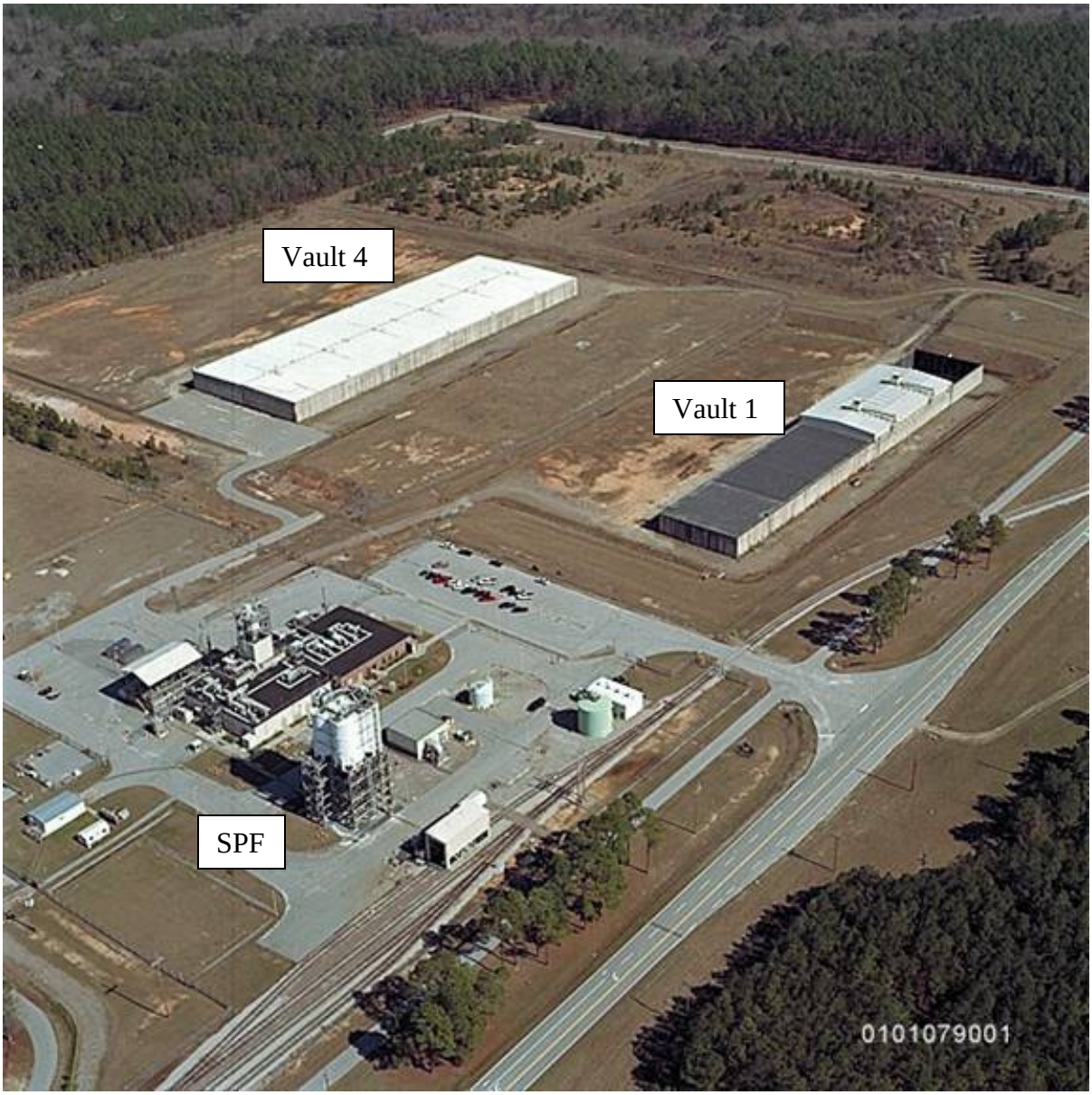
HYDROGEOLOGY

An understanding of the hydrogeology of the SDF is required in order for an estimate of the fate and transport of the residual SDF contaminants to be modeled. Characterization and monitoring data in the SRS General Separations Area is extensive and provides a clear understanding of hydrogeology containing the SDF.

PRINCIPAL FACILITY DESIGN FEATURES

The Saltstone Facility consists of two facility segments: the Saltstone Processing Facility (SPF), which receives and treats the salt solution to produce saltstone grout, and the SDF, which consists of vaults used for the final disposal of the saltstone grout. Both the SPF and the SDF are located in Z-Area. Construction of SPF and the first two vaults of SDF were completed between February 1986 and July 1988 and radioactive operations began in June 1990. Future vaults are called Future Disposal Cells (FDCs) and will be constructed on a "just-in-time" basis in coordination with salt processing production rates and will be constructed in pairs or four packs. Photo 1 is an aerial view of the existing vaults (called Vault 1 and Vault 4) at SDF.

Vaults 1 and 4 Aerial View



Future Disposal Cells

There are planned for 64 Type 2 disposal cells in the future at SDF. These cells are ~45 m (150 ft) diameter by ~7 m (22 ft) high, cylindrical, reinforced concrete tanks

Each tank consists of the following:

- Controlled compacted backfill soil base
- ~10 cm (4 in) thick lower mud-mat of concrete
- Geosynthetic Clay Liner (GCL) consisting of sodium bentonite and a 100 mil High Density Polyethylene (HDPE) liner above the lower mud-mat
- ~10 cm (4 inch) thick upper mud-mat of Type V Class III sulfate resistant concrete

- Minimum ~20 cm (8 inch) thick cast-in-place reinforced concrete floor slab of Type V Class III sulfate resistant concrete
- Minimum ~20 cm (8 inch) thick pre-cast reinforced concrete walls of Type V Class III sulfate resistant
- The exterior side of the walls covered with a 100 mil HDPE geomembrane
- Maximum 6 m (20 ft) of saltstone poured into the tank through a roof penetration
- Minimum 61 cm (2 ft) clean non-radioactive grout cap to fill between the saltstone and roof poured into the tank through roof penetrations
- Minimum 20 cm (8 in) thick reinforced concrete roof of Type V Class III sulfate resistant at a minimum 2% slope - in place prior to the saltstone pour
- Roof penetrations will exist to pour saltstone, to pour the clean grout cap, for ventilation, for monitoring (temperature and cameras), and personnel access.

SDF CLOSURE CAP

The SDF closure cap is primarily intended to provide physical stabilization of the site, minimize infiltration, and provide an intruder deterrent. Two closure caps are anticipated to be constructed over the SDF disposal cells at the end of the operational period (planned for 2030). After installation of the closure cap, a 100-year institutional control period is assumed to begin, during which active SDF facility maintenance will be conducted sufficient to prevent pine forest succession and to repair any significant erosion. After the institutional control period, a 10,000-year post-closure compliance period is assumed to begin, during which no active SDF facility maintenance is assumed. Degradation of the closure cap is assumed to accelerate once active SDF facility maintenance has ceased.