Savannah River Site Saltstone Disposal Facility Performance Assessment

NRC’s Saltstone Monitoring and Technical Evaluation Report

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Location of the SDF

- The SDF is located in Z-Area within the “General Separations Area.”
- SDF sits approximately six miles from the closest SRS site boundary and approximately ten miles from the Savannah River.
- The reported peak annual doses are at 100 meters from SDF.
Saltstone Disposal Facility
Robust Disposal Unit Design

New Disposal Unit Design Features:

• Cylindrical 150’ diameter, 24’ high
• 2.9 million gallon grout capacity
• High quality Class III sulfate resistant concrete
• Minimum 8” walls, 12” floor, 8” roof
• Interior epoxy coating
• Interior drain water collection system
• Significant design improvement over the existing rectangular disposal units
• Hydrotesting of disposal cells
2009 SDF PA Development

- Development of the “new” PA began in earnest in 2007
  - Built upon Scoping Meetings held on F-Tank Farm PA with SCDHEC, NRC and EPA
- Used extensive new material testing data and enhanced computer modeling - both deterministic and probabilistic
- LFRG recommended release for public review in 10/2009 following implementation of their key recommendations
- Formally issued to SCDHEC and NRC on 11/23/2009
NRC TER on the SDF PA

NRC’s decision on not currently having “reasonable assurance” is associated with the timing and magnitude of peak annual doses between 8,000 and 15,000 years following SDF closure.
Putting Issue Into Perspective

- Average Background Dose in Denver, CO is >1,000 mrem/yr
- 500 mrem/yr Performance Objective inside the 100-meters
- 100 mrem/yr Public Dose Limit
- 25 mrem/yr Performance Objective
- 2,000 mrem/yr DOE Administrative Control Limit for Workers
- 620 mrem/yr Average Dose to US Citizen in 2007
- 320 mrem/yr Average Background Dose in South Carolina
Key Points

• NRC’s review confirmed that DOE will meet its DOE Manual 435.1-1 performance objective for the member of the public during the DOE 1,000-year compliance period
  - Identified the peak dose could occur within 10,000 years following closure of SDF
  - Seeking reduction in uncertainty of the projections 8,000 to 15,000 years into the distant future
  - Acknowledged that distant future risk is low - peak annual doses are <100 mrem
Due to the large uncertainties in projecting doses 100’s to 1,000’s of years into the future, DOE considers a myriad of cases and scenarios in reaching a determination of “reasonable expectation” that a performance objective will be met.

DOE further considers the risks to current workers and members of the public from delaying activities.

DOE also recognizes that, if new information is discovered, design changes or remedial actions can be taken to ensure performance objectives are met.
DOE PA Maintenance Process

• All DOE PAs are required to have maintenance plans, reviewed annually, to address uncertainties or gaps in existing data
• The 2012 SDF PA Plan consists, in part, of the following activities:
  • Technetium $K_d$ sorption testing and column testing
  • Property testing of saltstone produced under varying conditions
  • Verification of Disposal Cell hydraulic & physical properties
  • Degradation of saltstone and similar cementitious materials
  • Oxidation rate analytical method development
  • Long-term radiological lysimeter program
• The 2013 SDF PA Plan update will consider NRC’s TER monitoring factors and prioritization, availability of funds, risk mitigation and program impacts
DOE Responses to NRC TER/Concern

• Letter dated June 13, 2012  
  • Transmitted 6 documents to NRC including updated stochastic model (all pre-dated the NRC TER)

• Letter dated July 12, 2012  
  • Addresses risk associated with near term disposal at SDF (Vaults 1, 4 and SDU 2, 3, 5)

• Letter dated July 26, 2012  
  • Identifies the path forward to address the identified risk for all planned SDF operations
July 12, 2012 Transmittal

- Projected Tc-99 inventory in SDUs 2, 3, and 5 to be about 20% of the current modeled inventory of 540 curies.

- Performed a Sensitivity Analysis using the updated stochastic model to evaluate dose results for Cases K and K1 using the current Vault 1 and 4 inventories and the updated projected SDU 2, 3, and 5 Tc-99 inventories (all other radionuclides remained unchanged from RAI PA-8 response).
Sensitivity Analysis Case K

- **100 mrem/yr** Public Dose Limit (10 CFR 835.208 and 10 CFR 20.1301)
- **Tc Kd values for cementitious materials:**
  - Sensitivity Case 1:
    - Reducing Region II (all) - 1,000 mL/g
    - Oxidizing Region II (saltstone) - 10 mL/g
    - Oxidizing Region II (concrete) - 0.8 mL/g

Inventory:
- V1: current inventory (×2)
- V4: current inventory SDUs 2, 3 and 5:
  - Tc-99: 119 curies per cell
- Other radionuclides: PA Section 3.3 and Response to RAI PA-8

- **1,000 year DOE M 435.1-1 Compliance Period**
- **10,000 year NRC Performance Period**
- **25 mrem/yr** Performance Objective (DOE M 435.1-1 and 10 CFR 61.41)

- **Years after Closure**
  - Sector I, dominated by SDUs 3 and 5
  - Sector B, dominated by Vault 4
Sensitivity Analysis Case K1

**Inventory:**
- V1: current inventory (×2)
- V4: current inventory
- SDUs 2, 3 and 5:
  - Tc-99: 119 curies per cell
  - Other radionuclides: PA Section 3.3 and Response to RAI PA-8

**Dose to MOP, mrem/yr**
- 100 mrem/yr Public Dose Limit (10 CFR 835.208 and 10 CFR 20.1301)
- 1,000 year DOE M 435.1-1 Compliance Period
- 25 mrem/yr Performance Objective (DOE M 435.1-1 and 10 CFR 61.41)
- 10,000 year NRC Performance Period

**Tc Kd values for cementitious materials:**
- Sensitivity Case 2:
  - Reducing Region II (all) - 500 mL/g
  - Oxidizing Region II (all) - 0.8 mL/g

**Years after Closure**
- Sector I, dominated by SDUs 3 and 5
- Sector B, dominated by Vault 4
• Attachment 1 and 2 identifies DOE’s approach to address each NRC TER item identified in Table A-1 and Table A-2, respectively.
  • Fold into DOE’s PA maintenance program
• DOE proposes to perform new modeling to address the identified Tc-99 risk for all planned SDF operations.
  • Consider NRC’s TER when performing new modeling
  • Incorporate new information, as available
  • Engage in technical discussions with NRC prior to performing the new modeling
Path Forward

• DOE looks forward to continuing to work with NRC to:
  - Support NRC and SCDHEC’s monitoring role
  - Answer questions related to responses submitted to date
  - Schedule technical discussions related to planned additional modeling efforts