Saltstone Disposal Facility Performance Assessment Overview

Presentation to the Savannah River Site Citizens Advisory Board

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• What is **Saltstone**

• What is a **Disposal Cell** (a.k.a., Vault)

• What is a **Performance Assessment**

• Description of the Saltstone Disposal Facility Performance Assessment

• Conclusions
SRS Waste Systems

SRS Waste Systems

- SRS Fuel
- Target Materials
- H-Canyon
- H Tank Farm
- Sludge Processing
- DWPF
- Saltstone
- Federal Repository
- GWSB
- Disposal Cells

DWPF - Defense Waste Processing Facility
GWSB - Glass Waste Storage Building
Saltstone is a cementitious, non-hazardous waste form engineered for low-level salt waste disposal at SRS.
Saltstone Disposal Facility (SDF)

We do the right thing.

Saltstone Production Facility (SPF)

Vault 1
Previous Saltstone Disposal

Vault 4
Active Saltstone Disposal

Legend

FDC = Future Disposal Cell (surrounded by construction area)

Note: Not to Scale - Figure presents the anticipated FDC locations, numbered disposal units are per existing construction & Geotechnical Investigation Report K-ESR-Z-00002
Existing Disposal Units

Vault 1
Six 100’x100’ cells
Approximately 25’ high

Vault 4
Twelve 100’x100’ cells
Approximately 26’ high
Vault 2–Future Disposal Cells

11/20/2008
Site Prep

5/15/2009
Wall Panels

7/23/2009
Roof Form

10/14/2009
Cell Interior
Vault 2–Future Disposal Cells

150’ diameter tank approximately 22’ high

11/9/2009
**PA = Performance Assessment**

Performance Assessment = a key **risk assessment tool** used to inform closure and disposal decisions

- Models **fate and transport** of materials over long periods of time to determine potential consequences
- Utilizes informed assumptions
- Provides **most likely consequences** of planned actions
PA provides best estimation of what the dose consequences will be, both chemical and radiological, over time

- Focused on determining “peak dose” - worst one-year period – or “peak concentration”
- Reflects potential variation in parameters and identifies key parameters for which the model has the greatest sensitivity (i.e., importance)
• SRS initiated a PA revision in October 2007 per DOE O 435.1

• Revised PA accounts for:
  – New disposal cell design,
  – New research data since 2005, and
  – New information related to the NRC Technical Evaluation Report (ML053010225)

• Revision A was submitted for review by a DOE-SR appointed team in March 2009
• Revision B was submitted for review by a DOE Low Level Waste Federal Review Group (LFRG) appointed team in June 2009

• The LFRG on-site review was conducted August 10-14, 2009 and NRC staff were observers
  - NRC issued observation report (ML092710477)

• Revision 0 was submitted to NRC and SCDHEC in November 2009
• Eleven Chapters and twelve appendices
  – Including disposal facility characteristics, performance analysis, analysis results, inadvertent intruder analysis, and results interpretation

• More than 290 figures and 170 tables of information in the main body of PA

• Volume 1 of the Revised PA (663 pages) and the appendices comprise over 2000 total pages
Modeling for the PA utilizes a “hybrid approach”

– Deterministic approach selects a “best value” for each input and provides a discrete dose value

– Probabilistic approach looks at a range of values for inputs and provides information on uncertainties and specific parameter sensitivities
Conceptual Model
Model Example: Closure Cap

Individual Vault/Cell (FDC) Closure System (Vaults 1 and 4 do not include HDPE/GCL layers)

Topsoil (6")
Upper Backfill (30")
Erosion Barrier (12")
Geotextile Fabric
Middle Backfill (12” min)
Geotextile Filter Fabric (0.1” min)
Upper Lateral Drainage Layer (12")
Geotextile Fabric
HDPE Geomembrane (0.06")
Geosynthetic Clay Liner (0.2")
Foundation Layer (12")
Lower Backfill Layer (12” min)
Geotextile Filter Fabric
Lower Drainage Layer (24")
Geotextile Fabric
HDPE Geomembrane (0.1")
Geosynthetic Clay Liner (0.2")

Note: Vegetative Layer not shown [NOT TO SCALE]
Far-Field Flow Pathlines

Traces reach Gordon Aquifer which has a NW flow.
• The PA development process is regulated by DOE Order 435.1

• Disposal requirements are based on:
  - DOE Order 435.1
Peak dose significantly less than 25 mrem/yr performance objective

1.4 mrem
SDF All-Pathways Peak Dose for 20,000 Years

Peak dose within 20,000 years still well below performance objective of 25 mrem/year
## Conclusions

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Limit</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOE O 435.1-1</td>
<td>All-Pathways Dose</td>
<td>25 mrem/yr</td>
</tr>
<tr>
<td>DOE O 435.1-1</td>
<td>Intruder Dose</td>
<td>500 mrem acute 100 mrem/yr chronic</td>
</tr>
<tr>
<td>DOE O 435.1-1</td>
<td>Air Pathways Dose</td>
<td>10 mrem/yr</td>
</tr>
<tr>
<td>DOE O 435.1-1</td>
<td>Radon Flux</td>
<td>20 pCi/m²/s At ground surface</td>
</tr>
<tr>
<td>Safe Drinking Water Act and DOE O 435.1-1</td>
<td>Groundwater Protection - Maximum Contaminant Levels</td>
<td>Total β/γ 4 mrem/yr Total α 15 pCi/L Total U 30 mg/L Total Ra 5 pCi/L</td>
</tr>
<tr>
<td>10 CFR 61.41</td>
<td>All-Pathways Dose</td>
<td>25 mrem/yr</td>
</tr>
<tr>
<td>10 CFR 61.42</td>
<td>Intruder Dose</td>
<td>500 mrem/yr</td>
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</tbody>
</table>

**Total**

- \( \beta/\gamma \): 4 mrem/yr
- Total α: 15 pCi/L
- Total U: 30 mg/L
- Total Ra: 5 pCi/L

**Groundwater Protection - Maximum Contaminant Levels**

- Safe Drinking Water Act and DOE O 435.1-1
  - Total β/γ: 4 mrem/yr
  - Total α: 15 pCi/L
  - Total U: 30 mg/L
  - Total Ra: 5 pCi/L
• It is anticipated that the peak annual dose from all SDF disposal units will be \(< 2 \text{ mrem}\) during the 10,000-year Compliance Period.

• Per NCRP-160, the average dose to a person in the United States in 2006 was \(620 \text{ mrem}\):
  – Approximately 310 mrem from naturally occurring background.
  – Approximately 300 mrem from medical procedures.
  – Up from 360 mrem in the 1980’s due mainly to increases in medical procedures.

• A person receives approximately 0.5 mrem/hr for a jet airliner flight:
  – Roundtrip flight to the West Coast results in \(~5 \text{ mrem}\) dose.
  – Dream vacation to Europe yields a dose of \(~10 \text{ mrem}\).

• If a person lived in a wood house in Columbia, South Carolina and moved to brick house in Denver, Colorado, his annual dose from background radiation would increase by \(~80 \text{ mrem}\).
Annual doses from background radiation varies significantly across the United States. Would you decide not to visit or move to the western states knowing that your annual exposure increases by tens of mrem per year?
• SDF PA has been completed and is currently undergoing external review

• SDF disposal activities are **safe** and **protective** of human health and the environment