

June 2, 2008

MEMORANDUM TO: Scott Flanders, 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

THRU: Anna Bradford, Chief **/RA/**
Low-Level Waste Branch
Environmental Protection and Performance
Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

FROM: David D. Brown, Senior Project Manager **/RA/**
Low-Level Waste Branch
Environmental Protection and Performance
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SUBJECT: MAY 15, 2008, MEETING SUMMARY: INTERAGENCY
MEETING BETWEEN THE SOUTH CAROLINA DEPARTMENT
OF HEALTH AND ENVIRONMENTAL CONTROL, U.S.
DEPARTMENT OF ENERGY AND U.S. NUCLEAR
REGULATORY COMMISSION ON THE SAVANNAH RIVER SITE
SALTSTONE FACILITY VAULT 2 DESIGN

On May 15, 2008, U.S. Nuclear Regulatory Commission (NRC) staff participated in a meeting hosted by the South Carolina Department of Health and Environmental Control in Columbia, SC. The purpose of the meeting was to discuss with the Department of Energy its design for Vault 2 of the Saltstone Disposal Facility at the Savannah River Site. I am enclosing the meeting summary for your use.

Enclosure: NRC Meeting Summary of a Meeting Hosted by the South Carolina Department of Health and Environmental Control on DOE's Vault 2 design

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(301) 415-6116

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OFFICE	LLWB	LLWB
NAME	DDBrown	AHBradford
DATE	6/2/08	6/2/08

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Summary of the May 15, 2008, Meeting Hosted by the South Carolina Department of Health and Environmental Control on DOE's Vault 2 Design

Date: May 15, 2008

Place: South Carolina Department of Health and Environmental Control
8911 Farrow Road
Columbia, SC 29203

Attendees: See Enclosure 2

Purpose: The purpose of the meeting was for U.S. Nuclear Regulatory Commission (NRC) staff to provide its insights and perspectives to the South Carolina Department of Health and Environmental Control (SCDHEC) on the design for the Saltstone Facility Vault 2 at the Department of Energy's (DOE's) Savannah River Site.

Discussion: An agenda for the meeting is provided as Enclosure 1.

NRC staff noted during opening remarks that while this is SCDHEC's meeting regarding a DOE application for a solid waste disposal permit that is before SCDHEC, the proposed revision of the saltstone disposal vault design is also a DOE disposal action that is subject to NRC monitoring, pursuant to Section 3116(b) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA). Therefore, NRC staff explained that it planned to prepare a publicly-available summary of the meeting to document this NRC monitoring activity.

Following other opening remarks and further introductions, DOE contractor staff described the objectives for their presentation. DOE contractor staff also described the systems and facilities at SRS that are relying on the timely approval of the permit application before SCDHEC. These SRS facilities and processes include the Defense Waste Processing Facility, the Effluent Treatment Facility, and high-enriched uranium processing at the H-area canyon. DOE contractor staff also provided reasons why DOE has advanced its schedule for additional saltstone disposal vaults from early 2012 to July 2010. Among these were: Initial indications of good performance of the actinide removal process modular caustic side solvent extraction unit (ARP/MCU) during startup and initial operation, including low organic carryover, which allows higher feed rates for waste to the Saltstone Facility; and shortened feed qualification cycles for waste being prepared for the Saltstone Facility. DOE noted that subsequent vault designs may be revised based on lessons-learned from Vault 2. SCDHEC stated that this permit applies only to Vault 2; any future vault modifications would require a new or amended permit.

DOE contractor staff next provided an overview of the proposed Vault 2 design features. The proposed Vault 2 disposal vault is two pre-stressed water storage tanks that are available from the Crom Corporation, as modified by SRS. Although the Vault 2 design is modified from the normal commercial and industrial applications for which Crom has previously built tanks, all SRS design specifications are within the ranges available from Crom Corporation, and Crom

Corporation has no objection to providing the vault as specified. The Crom Corporation has built water storage tanks since 1952. Characteristics of the proposed Vault 2 design include two separate, right cylindrical 11,000,000 liter (3,000,000 gallon) tanks (i.e., cells), that are approximately 46 meters (150 feet) in diameter, and about 6.7 meters (22 feet) high. The first cell would be below-grade and would have soil placed around it to provide radiation shielding. DOE contractor staff described the modifications to the commercial off-the-shelf design, including the use of 2.54 millimeter (100 mil) high-density polyethylene (HDPE) liners, and geosynthetic clay liners for additional protection from tank leakage and water intrusion. Other modifications include a 20 centimeter (8 inch) thick Class III concrete core wall and roof, and the use of radiation-resistant epoxy coating on interior surfaces of the vault. The roof would be supported by 48 vertical reinforced concrete supports. All service penetrations will be through the tank roof. There will be no side-wall or floor penetrations. During construction, each cell would be pre-stressed in excess of anticipated hydraulic and thermal loads, such that no movement of the tank is expected during grout filling and curing.

Following the design overview, the DOE contractor staff described the factors that are influencing the update of the performance assessment (PA) for the Saltstone Facility. These factors include the new Vault 2 design, new vault and grout testing information, emergent facility conditions, and areas of uncertainty identified by NRC staff during its review of the Saltstone Facility waste determination pursuant to Section 3116 of the NDAA. Specific considerations include the physical and hydraulic properties of the emplaced grout (compressive strength, moisture retention, porosity, heat of hydration, etc.), the linear sorption coefficient (K_d) values for radionuclides in the grout, the reducing capacity of emplaced grout, technetium oxidation rates in the emplaced grout, and concrete degradation mechanisms, including both sulfate and aluminate attack.

DOE contractor staff then described how the PA-related insights were used to inform the Vault 2 design process. Specifications for the composition and thickness of the concrete panels were described, along with the chemical-resistant and radiation-resistant properties of the multiple layers of different moisture barriers that will be used, including epoxy sealant, high-density polyethylene, and geosynthetic clay liners. Throughout the presentation, DOE and DOE contractor staff answered questions from both SCDHEC and NRC staff on such matters as the ingredients of the concrete, methods for joining or welding HDPE, adherence of the HDPE to vertical surfaces and timing of the HDPE installation, and geosynthetic clay layer test results.

DOE contractor staff also described the results of initial PA-type calculations for the Saltstone Facility, which included consideration of Vaults 1 and 4, and 64 additional disposal cells of the type planned for Vault 2. These initial calculations were performed for selenium-79, technetium-99, iodine-129, and nitrate. Several defense-in-depth features of the new integrated Saltstone Disposal Facility design were described by DOE contractor staff. These features include the low permeability and reducing capacity of the saltstone grout and the elimination of diffusional fluxes of nitrate and soluble radionuclides, and minimization of advective flow, in the Vault 2 design. DOE contractor staff also described the defense-in-depth offered by the different degradation mechanisms and rates of

degradation of the high density polyethylene, geosynthetic clay layers, and concrete. The minimum water infiltration and drainage features of the closure cap, and the cap erosion barriers were also cited as providing additional defense-in-depth.

At the end of the DOE contractor staff presentation, NRC staff offered PA-type observations for further consideration by SCDHEC and DOE as SCDHEC completes its deliberations on the solid waste disposal permit application. These were put forth as areas where NRC staff would pay particular attention in its future review of any PA update for the Saltstone Facility. Specifically, NRC staff offered the following observations:

- 1) There appear to be significant differences between a typical application of this design (i.e., water storage tank) and the design application being considered by DOE. The effect of multiple design changes is a higher level of design complexity that, for example, exceeds that of the existing Vault 4 design. In general, a performance assessment perspective calls for reducing design complexity in order to remove uncertainty in long-term performance;
- 2) A problem observed at Vault 4 was inadequate construction quality. A more complex design, as put forth for the proposed Vault 2, offers continuing challenges to DOE to ensure that the quality of construction meets its expectations;
- 3) Also related to design complexity, the proposed Vault 2 design introduces a larger number, and different types of, joints than are present in the Vault 4 design, since multiple pre-stressed concrete panels are joined to form each cylindrical cell. NRC noted that some issues that could arise from this design complexity appears to be potentially offset by the use of tensioning, backfilling, and interior coatings;
- 4) Staff noted that the expected shrinkage gaps between the cured saltstone grout and the Vault 2 cell walls and 48 interior columns provide a path for water intrusion and hydrostatic leakage, which may not, by itself, be an improvement over the Vault 4 design;
- 5) The PA-related importance of the new design features introduced in Vault 2 depend to a large extent on the information DOE obtains regarding the physical and chemical properties of the emplaced saltstone grout. If the saltstone grout does not have the physical and chemical properties relied upon in the PA, then the additional features introduced in the Vault 2 proposed design will be more important to meeting the 10 CFR Part 61, Subpart C performance objectives; and
- 6) There is uncertainty associated with the performance of novel components in the Vault 2 design, as a result of a lack of information on long-term performance of novel components (e.g., epoxy, HDPE, and neoprene seals). DOE may need to review its experience base with these materials in similar facilities, or, for example, perform accelerated testing to obtain long-term performance data.

After a break, DOE, NRC and SCDHEC discussed a recent letter from SCDHEC to DOE regarding DOE's plans for leak detection beneath Vault 2 cells. DOE explained that no leak detection was planned for Vault 2, due to: 1) schedule constraints; 2) the short duration of fill time for the vault; and 3) the watertight features of the design, but that the Consent Order of Dismissal called for DOE to install leak detection on Cell 3A and every fifth cell constructed thereafter. Cell 3A is scheduled for construction and operation on a schedule which follows Vault 2 by about one year. DOE has not completed design of the Cell 3A leak detection system. NRC staff indicated that because Vault 2 will be below grade and thereby unavailable for visual inspections for integrity, DOE should consider how it will provide assurance that the vault remains free of leaks. NRC staff asked about other approaches that DOE may take to substantiate the intended performance of the Vault 2 design, including the use of scale models. DOE explained that no scale models of the Vault 2 design were planned. Other concepts that were discussed include hydrostatic testing of completed cells to provide additional assurance of water tightness in lieu of leak detection, and leak capture systems made of perforated drain pipe emplaced below the mud mat or further into the vadose zone under the cell base mat.

During NRC's closing remarks, NRC staff indicated that its views and observations were based only on the design information offered by DOE during the morning presentation, and the NRC staff could not, on the basis of the information provided, make a definitive assessment of the performance of the proposed Vault 2 design. NRC staff stated that its conclusions on the overall performance of the Saltstone Facility would need to be informed by an integrated review of the updated performance assessment and other supporting information, which DOE has not submitted for NRC to review. However, staff reiterated its observations stated above, and stated its view that the Saltstone Disposal Facility using the proposed Vault 2 design did not appear any less likely of meeting the 10 CFR Part 61, Subpart C, performance objectives than the Vault 4 design. NRC staff also noted that, given the long lead time to developing some of the types of information required to support a PA update, DOE should start as soon as possible.

SCDHEC staff caucused and provided concluding remarks. SCDHEC staff concluded that, in its view, no issues or concerns were raised during the meeting that should deter it from taking further action on DOE's permit application. SCDHEC stated its desire for continued NRC input on future deliberations. Following additional discussions regarding the schedule for issuance of a draft permit for public comment, the meeting was adjourned.

VAULT 2 DISPOSAL UNIT DESIGN DISCUSSION

May 15, 2008

Agenda

0800	Welcome/Opening Comments	S. Sherritt D. Brown L. Ling
0820	Introduction <ul style="list-style-type: none">- Presentation Objectives- SRS System Plan Drivers/Impacts- Agenda	G. Dickert
0840	Vault 2 Disposal Unit <ul style="list-style-type: none">- Design Features	K. Liner
0940	Break	
0950	PA-Informed Design <ul style="list-style-type: none">- SDF PA Revision Status- Vault 2 PA-Informed Design Features- Comparison to Vault 4 Performance	K. Rosenberger M. Phifer
1150	Summarize	G. Dickert
1200	Lunch / NRC Caucus	
1330	NRC Outbrief	D. Brown
1400	DHEC Caucus	
1445	Path Forward	S. Sherritt
1600	NRC Leave for Airport	

Meeting Hosted by the South Carolina Department of Health and Environmental Control on
DOE's Vault 2 design

May 15, 2008

South Carolina Department of Health and Environmental Control
8911 Farrow Road
Columbia, SC 29203

Attendees

Kent Coleman	SCDHEC
Keith Collinsworth	SCDHEC
Joan Litton	SCDHEC
John McCain	SCDHEC
Ted Millings	SCDHEC
Barry Mullinax	SCDHEC
Michael Plemmons	SCDHEC
Roger Schweitzer	SCDHEC
Shelly Sherritt	SCDHEC

Karen Guevara	DOE-HQ
David Hoel	DOE
Larry Ling	DOE
Chun Pang	DOE

Ginger Dickert	WSRC
Nick Kennedy	WSRC
Keith Liner	WSRC
David Little	WSRC
Mark Phifer	SRNL
Kent Rosenberger	WSRC
Steve Thomas	WSRC

Anna Bradford	NRC
David Brown	NRC
David Esh	NRC
Andrea Kock	NRC
Karen Pinkston	NRC
Roberto Pabalan	CNWRA