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DEC 14 2012

Mr. Aby Mohseni, 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
U.S. Nuclear Regulatory Commission
11545 Rockville Pike, Mail Stop T8F5
Rockville, MD 20852-2738

Dear Mr. Mohseni:

SUBJECT: Modeling Activities for the Saltstone Disposal Facility at the Savannah River Site (SRS)

References:
1. Additional Response to *Technical Evaluation Report for Revised Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site, South Carolina* and Letter of Concern (Letter, Spears to Camper dated 7/26/12)
2. Letter of Concern (Type IV) Regarding US Department of Energy Disposal Activities at the Savannah River Site Saltstone Disposal Facility (Letter, Satorius to Gilbertson dated 4/30/12)
3. Technical Evaluation Report for the 2009 Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site (Letter, Camper to Gilbertson, dated 4/30/12)

As described in reference 1, DOE is planning on performing additional modeling to address the issues expressed in References 2 and 3. DOE requests technical discussions with NRC staff prior to performing the new modeling activities. Enclosure 1 is provided to support these technical discussions and identifies the modeling parameters being planned for an updated PORFLOW modeling run as compared to the base case and RAI PA-8 case analyses. The technical basis for the parameter values is identified in column 4 and consists of reports that have been previously provided to NRC.

Your staff's feedback related to the proposed modeling parameters described in Enclosure 1 would be much appreciated. DOE is available to support a public meeting on January 15, 2013 to discuss the proposed modeling. Please contact Sherri Ross of my staff to finalize arrangements related to the proposed public meeting. The courtesy of a written response by January 31, 2013 is respectfully requested to support DOE's planned modeling during fiscal year 2013.

Please contact Pat Suggs (803) 208-6804 or Sherri Ross (803) 208-6078 if you have questions regarding this letter.

Sincerely,

Kenneth P. Guay, Acting Director
Waste Disposition Programs Division

WDPD-13-21

Enclosure:
Model Parameter Changes from Base Case and PA-8

cc: w/encl
Nishka Devaser, NRC

Summary of FY13 Saltstone Disposal Facility Special Analysis (SA) Attributes Compared to Previous Cases

Modeling Attributes	PA Base Case (Case A) Attributes	PA-8 Case Attributes	FY13 SDF SA Attributes
Saltstone Physical Degradation	Saltstone saturated hydraulic conductivity and effective diffusion coefficient remained unchanged from their initial values.	Complete degradation occurred within 10,000 years with degraded saltstone having a saturated hydraulic conductivity of 1.0E-06 cm/sec and an effective diffusion coefficient of 5.0E-06 cm^2/sec. Final degradation values are representative of soil properties.	Degradation based on latest information from the CBP toolbox for acid attack, sulfate attack, and carbonation. SDU 1 and SDU 2 (i.e., all FDCs) clean cap and saltstone degrade via acid attack. SDU 4 clean cap and upper portion of saltstone degrades via carbonation-influenced steel corrosion. SDU 4 lower saltstone degrades via acid attack.
Moisture Characteristic Curves (MCCs)	MCCs for saltstone based on WSRC-STI-2007-00649 for SDU concrete and soil based on WSRC-STI-2006-00198.	MCCs were not used for cementitious material. Relative permeability and saturation were set equal to 1.0 for all suction levels for saltstone, clean cap, and SDU concrete (RAI SP-3).	Use latest MCC data for all cementitious materials. SRNL-STI-2011-00661 for saltstone and clean cap, other materials no change from PA Base Case.
Saturated hydraulic conductivity for intact saltstone	Initial (intact) saturated hydraulic conductivity = 2E-09 cm/sec (SRNL-STI-2008-00421)	Assumed to be 1.0E-08 cm/sec, largest value reported using simulants with a minimum of 90-day curing time and nominal curing temperature (RAI SP-5).	Initial value of 6.4E-09 cm/sec based on SRNL-STI-2012-00558 (average value of 24 samples, from both temperature profiles, within a w/pm ratio band of 0.59 and 0.64).
Effective diffusivity of saltstone	Initial (intact) effective diffusion coefficient = 1E-07 cm^2/sec (WSRC-STI-2006-00198 for ordinary concrete)	Initial value unchanged from the Base Case but increased to 5.0E-06 cm^2/sec as the saltstone and clean cap degrade within 10,000 years (RAI SP-6).	Initial value 1E-08 cm^2/sec based on latest SIMCO report, SRNL-STI-2010-00515. Increases to 5.3E-06 cm^2/sec based on saltstone degradation rate.
Reduction Capacity of cementitious materials	Saltstone – 0.822 meq e-/g SDU concrete – 0.240 meq e-/g (SRNS-STI-2008-00045)	Saltstone – 0.206 meq e-/g (based on scaling to slag weight percent) SDU concrete – 0.240 meq e-/g	Saltstone – 0.607 meq e-/g SDU concrete – 0.178 meq e-/g (SRNL-STI-2012-00596)

Summary of FY13 Saltstone Disposal Facility Special Analysis (SA) Attributes Compared to Previous Cases

Modeling Attributes	PA Base Case (Case A) Attributes	PA-8 Case Attributes	FY13 SDF SA Attributes
Pore volumes required to initiate E_h and pH transitions	Saltstone transitions: E_h – 2,806 pore volumes pH – 10,422 pore volumes SDU Concrete: E_h – 3,230 pore volumes pH – 4,206 pore volumes (SRNL-TR-2008-00283)	Saltstone transitions: E_h – 505 pore volumes pH – 7,608 pore volumes Based on lowered reduction capacity and porosity correction (RAI PA-8 and SP-8 for E_h transition). No change for SDU concrete.	Based on RAI SP-8 porosity correction, with latest recommended reduction capacity. Saltstone: E_h – 1,220 pore volumes pH – 11,213 pore volumes SDU Concrete: E_h – 3,673 pore volumes pH – 6,446 pore volumes
Technetium release model for saltstone and SDU concrete	Shrinking core model developed to simulate that the reduction capacity of the cementitious material would gradually be consumed by oxygen, releasing the technetium that had been held within the cementitious material once it is oxidized. This gradual consumption of the reducing capacity is modeled as a "pseudo K_d value" which is dependent on the reduction capacity in each local cell block within the saltstone and SDU concrete matrix.	An "average K_d " model based on the ISBN: 1-55899-189-1 approach; and using a semi-log fracture growth relationship with a final fracture spacing of 10 centimeters. Pertinent parameters (RAI SP-13) for saltstone are: • Constant diffusion coefficient of intact matrix of 1.0E-07 cm^2/sec • Reduction capacity of 0.206 meq e-/g (0.25 of Base Case value) • Dissolved oxygen concentration at each fracture face is 1.06 meq e-/L	Based on two recent studies, PNNL-21723 and SRNL-STI-2012-00596, technetium release in saltstone and concrete is solubility controlled in reduced regions and K_d controlled in oxidized regions. A report supporting the values to be used in the FY13 SDF SA will be issued. Technetium release dependent on flow through the system using the shrinking core model.
Drainage layer performance	Drainage layer degrades (decreasing hydraulic conductivity) from silt buildup. Complete degradation occurs 19,013 years after closure	No Change in modeling properties. (RAI IEC-8) Steady-state time periods refined to capture significant changes to model parameters (RAI C-22)	Same as used for PA-8 Case.

Summary of FY13 Saltstone Disposal Facility Special Analysis (SA) Attributes Compared to Previous Cases

Modeling Attributes	PA Base Case (Case A) Attributes	PA-8 Case Attributes	FY13 SDF SA Attributes
Degradation of disposal unit concrete	Concrete degradation based on sulfate attack. Results from simulations conducted by SIMCO, Inc. using their STADIUM® computer code (SRNS-STI-2008-00050) were used to develop a degradation model dependent on sulfate concentration and concrete thickness (SRNL-STI-2009-00115). No significant degradation as modeled by no significant change in the hydraulic conductivity prior to 20,000 years. Walls of Vault 1 and Vault 4 had large saturated hydraulic conductivity with "fractured concrete" MCCs.	Concrete fully degrades to representative soil properties with a saturated hydraulic conductivity of 1.0E-06 cm/sec and an effective diffusion coefficient of 5.0E-06 cm^2/sec • Initially for walls of Vaults 1 and 4 (RAI VP-6) • Within 3,500 years for the roof of Vault 4 • Within 10,000 years for other disposal unit concrete (RAIs VP-2 and VP-3)	Using the CBP toolbox for acid and sulfate attack, and carbonation attack; degradation times based on these mechanisms will be developed. Credit for the HDPE-GCL above the SDU 2 (i.e., all FDCs) roof and below the SDU 2 UMM and for the HDPE covering the SDU 2 wall will also be considered as a delaying mechanism prior to degradation. The walls of SDU 1 and 4 are assumed to initially exhibit soil-type hydraulic properties.
Flow fractures in concrete and saltstone	None	None	Roof support columns in SDU 4 and SDU 2 (i.e., all FDCs) will degrade based on the CBP toolbox for acid and sulfate attack, and carbonation attack; degradation times based on these mechanisms will be developed. Floor joints in SDU 1 and 4 and bearing pad in SDU 2 (i.e., all FDCs) are initially modeled as fast flow zones with gravel properties and $K_d = 0$.
Dose to the chronic intruder in vicinity of disposal units	Dose estimated based on a water source located 1 meter from the SDF boundary at closure.	Dose estimated based on water concentrations below SDU 4 and an SDU 2 (RAI II-2)	Same as done for PA-8 analysis.
Radionuclides analyzed	All radionuclides identified in PA Section 3.3	No change from the Base Case	No change from the Base Case

Summary of FY13 Saltstone Disposal Facility Special Analysis (SA) Attributes Compared to Previous Cases

Modeling Attributes	PA Base Case (Case A) Attributes	PA-8 Case Attributes	FY13 SDF SA Attributes
Inventory	Provided in SDF PA: SDU 1 – Table 3.3-1 SDU 4 – Table 3.3-3 SDU 2 (i.e., all FDCs) – Table 3.3-5	SDU 4 inventory reduced from the PA Table 3.3-3 for Pu-238, Ra-226, Th-230, and U-234. SDU 2 (i.e., all FDCs) inventory reduced from the PA Table 3.3-5 for Ra-226 and Th-230 (RAI IN-5).	Same as used in PA-8
K_d values for soil and cementitious materials (saltstone, SDU concrete)	Values provided in SDF-PA: Soil – Table 4.2-15 Cementitious material – Table 4.2-18	Values updated based on latest issued reports (RAIs SP-10, SP-14, SP-15, FFT-2, and FFT-3 with summary tables provided in RAI PA-8)	Same as PA-8 except as noted: K_d value for Pu in sandy soil is to be changed from 290 to 650 mL/g based on SRNL-STI-2011-00672. K_d value for Se in oxidized Region III concrete should be 150 mL/g. A value of 30 mL/g was used in the PA-8 analysis. The K_d values for Tc in oxidizing conditions same as used in the PA Base Case (i.e., 0.8 mL/g for Region II and 0.5 mL/g for Region III).
Dose methodology	Biotic transfer factors provided in SDF PA Tables 4.6-1 through 4.6-4. One-half year buildup of radionuclides in irrigated soil.	Biotic transfer factors updated based on latest information (RAI B-2) Inclusion of chicken and egg pathway (RAI B-2) Updated ingestion dose conversion factors (RAI B-2) 25-year buildup of radionuclides in irrigated soil (RAI B-3) Inclusion of leafy portion in plant transfer factor (RAI B-4)	No change from the parameters used in the PA-8 analysis; correction applied to the identified error in the leaching factor.