HLWYM HEmails

From: Keith Compton
Sent: Monday, May 22, 2006 8:07 AM
To: Jude Mcmurry; Paul Bertetti; Allen Fetter; Christopher Grossman; Jin-Ping Gwo; Randall Fedors; Eugene Peters
Cc: Alexander Sun; Andy Campbell; Marissa Bailey; Jack Guttmann; Bret Leslie; James Rubenstone; Timothy McCartin
Subject: UZ3 TSPA barrier analysis session summary

Attached please find a bulleted summary of the UZ3 barrier session that we held on Thursday May 11. I tried to capture the key questions/issues in the fourth item, based on the discussions and on a review of the IIRSR, but please take a look and see if I got it right. If anyone has any questions of comments please let me know...

1) Scope of UZ3
The following TSPA components are likely to be within the purview of UZ3:
UZ Transport Abstraction (FEHM)
UZ Sorption and Retardation GoldSim
EBS_UZ Boundary Model (ENG4 lead)
EBS Invert Transport Model (ENG4 lead)
NOTE: The treatment of the EBS/UZ interface will need to be closely coordinated between ENG4 and UZ3. The relevant components are currently assigned to ENG4, as they are integrated with the EBS release model implemented in GoldSim; however, UZ3 may need to provide technical input on the implementation of transport in the invert and in the upper 17 m of UZ.
Connectivity of UZ3 components with other elements
Inputs: Timing of Climate state (UZ1); Infiltration scenario (UZ1); Flow fields (UZ2); Percolation flux (UZ2); Liquid saturation (UZ2); Number of waste packages failed (ENG1); Mass flux (ENG4); Fraction of radionuclide flux into UZ fractures and UZ matrix (ENG4); elevation of water table under different climate states (SZ1)
Outputs: Mass flux into saturated zone (SZ2); Invert distribution coefficients (ENG4)

2) Barrier Identification
DOE Barriers likely to be relevent to UZ3 (adapted from EBS RTA, Table 6.7-1)
1) Barrier: Unsaturated rock layers overlying the repository and host unit
Capability: In the physical and chemical environment in the unsaturated zone at Yucca Mountain (mildly oxidizing, pH near neutral), the vast majority of radionuclides are present in thermodynamically stable forms (metal oxides or ceramics) that are not geochemically mobile, and therefore are unlikely to move
2) Barrier: Unsaturated Rock layers below the repository
Capabilities:
- Delay radionuclide movement and decrease radionuclide concentrations in the groundwater aquifer because of water residence time
- Delay radionuclide movement and decrease radionuclide concentrations in the groundwater aquifer because of matrix diffusion - Delay radionuclide movement and decrease radionuclide concentrations in the groundwater aquifer because of sorption
- Delay radionuclide movement and decrease radionuclide concentrations in the groundwater aquifer because of precipitation
- Delay radionuclide movement and decrease radionuclide concentrations in the groundwater aquifer because of dispersion NRC Risk Insights for UZ3 Retardation in the Calico Hills Non-Welded Vitric Unit (Medium) Matrix Diffusion in the Unsaturated Zone (Medium) Effect of Colloids on Transport in the Unsaturated Zone (Medium)

3) Information to support an understanding of barrier performance General Information Recall that the EBS transport abstraction has one source term domain and three transport domains: waste form, corrosion product, and invert. The radionuclide mass can be in the following locations:
EBS GoldSim Model: Source Term Domain, Waste Form Domain, Corrosion Product Domain, Invert Domain
Geosphere: Unsaturated Zone, Saturated Zone, Biosphere Each of these locations is potentially associated with a barrier. A mass balance that accounted for all of these locations would yield information on where

activity was retained within the system. Identifying where the mass is located in the system may provide an indication of the effectiveness of the associated barrier. Mass balances and mass fluxes are saved in the TSPA results section, and these mass balances may therefore provide an indication of the effectiveness of the different barriers for different nuclides.
Specific information
Comparison of mass fluxes into and out of the UZ (from TSPA) Mass balances showing radionuclide accumulation in the UZ (from TSPA mass balance container?) Breakthrough curves for UZ transport (synthesized from FEHM output; available in an AMR?) Plots showing mass distribution in UZ as a function of time (synthesized from FEHM output; available in an AMR?)

4) Key Questions/Issues for UZ3
1) Implementation of matrix diffusion
2) Derivation of transport properties for FEHM transport cells
3) Impact of colloids on transport in the saturated zone, i.e., net barrier due to retardation of colloids with irreversiibly sorbed nuclides or permanant removal by filtration; or net barrier bypass due to elimination of potential sorption credit for dissolved radionuclides?
4) Upscaling of laboratory measurements of model parameters to model scale
5) Effect of drift shadow, if such a process is included in the LA
6) Consistency of Cl36 data with active fracture model
7) Hydraulic and geochemical effects of fault zones on transport

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