

# SALT R&D

## PRIORITIES DISCUSSION

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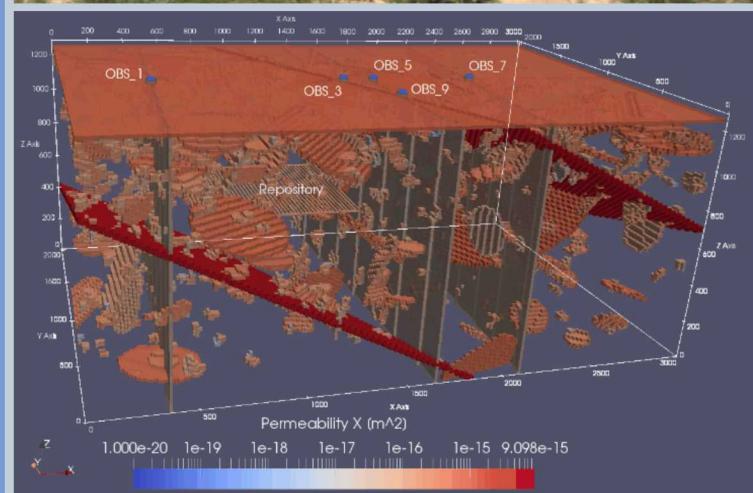
Sandia National Laboratories

# SFWD

## SPENT FUEL & WASTE DISPOSITION

*Annual Working Group Meeting*  
UNLV-SEB – Las Vegas, Nevada  
May 21-23, 2019

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# HIGH IMPACT PRIORITIES IN 2019 DISPOSAL R&D ROADMAP UPDATE

High Priority R&D Activities	
<b>A-08</b>	Evaluation of ordinary Portland cement (OPC)
<b>C-15</b>	Design improved backfill and seal materials
<b>C-16</b>	Development of new waste package concepts and models for evaluation of waste package performance for long-term disposal
<b>D-01</b>	Probabilistic post-closure DPC criticality consequence analyses Task 1 - Scoping Phase Task 2 - Preliminary Analysis Phase Task 3 - Development Phase
<b>D-03</b>	DPC filler and neutron absorber degradation testing and analysis
<b>D-04</b>	Coupled multi-physics simulation of DPC postclosure (chemical, mechanical, thermal-hydraulic) including processes external to the waste package.
<b>D-05</b>	Source term development with and without criticality
<b>E-09</b>	Cement plug/liner degradation
<b>E-11</b>	EBS High Temp experimental data collection- To evaluate high temperature mineralogy /geochemistry changes.
<b>E-14</b>	In-Package Chemistry
<b>E-17</b>	Buffer Material by Design
<b>I-04</b>	Experiment of bentonite EBS under high temperature, HotBENT
<b>I-06</b>	Mont Terri FS Fault Slip Experiment
<b>I-08</b>	DECOVALEX-2019 Task A: Advective gas flow in bentonite
<b>I-12</b>	TH and THM Processes in Salt: German-US Collaborations (WEIMOS)
<b>I-13</b>	TH and THM Processes in Salt: German-US Collaborations (BENVASIM)
<b>I-16</b>	New Activity: DECOVALEX Task on Salt Heater Test and Coupled Modeling
<b>I-18</b>	New Activity: Other potential DECOVALEX Tasks of Interest: Large-Scale Gas Transport
<b>P-12</b>	WP Degradation Model Framework
<b>S-01</b>	Salt Coupled THM processes, hydraulic properties from mechanical behavior (geomechanical)
<b>S-03</b>	Coupled THC advection and diffusion processes in Salt, multi-phase flow processes and material properties in Salt
<b>S-04</b>	Coupled THC processes in Salt, Dissolution and precipitation of salt near heat sources (heat pipes)
<b>S-05</b>	Borehole-based Field Testing in Salt

Medium-High Priority R&D Activities	
<b>A-04</b>	Argillite Coupled THM processes modeling including host rock, EBS, and EDZ (TOUGH-FLAC)
<b>C-01</b>	Discrete Fracture Network (DFN) Model
<b>C-06</b>	Buffer Erosion (is this a gap in our program?) is it too site specific for generic R&D
<b>C-08</b>	Interaction of Buffer w/ Crystalline Rock
<b>C-11</b>	Investigation of fluid flow and transport in low permeability media (clay materials).
<b>C-13</b>	Evaluation and upscaling of the effects of spatial heterogeneity on radionuclide transport
<b>C-14</b>	Radionuclide sorption and incorporation by natural and engineered materials: Beyond a simple Kd approach
<b>C-17</b>	Model DFN evolution due to changes in stress field
<b>E-02</b>	SNF Degradation testing activities
<b>E-03</b>	THC processes in EBS
<b>E-04</b>	Waste Package Degradation Model (mechanistic)
<b>E-06</b>	Waste Package Degradation Testing
<b>E-10</b>	High-Temperature Behavior
<b>E-20</b>	Colloid source terms
<b>I-02</b>	FEBEX-DP Modeling: Dismantling phase of the long-term FEBEX heater test - Modeling
<b>I-03</b>	FEBEX-DP Experimental Work: Dismantling phase of the long-term FEBEX heater test
<b>I-07</b>	DECOVALEX-2019 Task E: Upscaling of modeling results from small scale to one-to-one scale based in heater test data in Callovo-Oxfordian claystone (COx) at MHW underground research laboratory in France.
<b>I-09</b>	DECOVALEX-2019 Task C: GREET (Groundwater REcovery Experiment in Tunnel) at Mizunami URL, Japan
<b>I-14</b>	TH and THM Processes in Reconsolidating Salt: German-US Collaborations (KOMPASS)
<b>I-21</b>	New Activity: SKB Task 10 Validation of DFN Modeling
<b>O-02</b>	GDSA Geologic Modeling
<b>O-03</b>	Web Visualization of Geologic Conceptual Framework for GDSA Geologic Modeling
<b>P-01</b>	CSNF repository argillite reference case
<b>P-02</b>	CSNF repository crystalline reference case
<b>P-04</b>	CSNF repository unsaturated zone (alluvium) reference case
<b>P-11</b>	Pitzer model
<b>P-13</b>	Full Representation of Chemical processes in PA
<b>P-14</b>	Generic Capability Development for PFLOTRAN
<b>P-17</b>	Multi-Component Gas Transport
<b>S-02</b>	Salt Coupled THM processes, creep closure of excavations
<b>S-07</b>	Brine Origin, Chemistry, and Composition in Salt (in support of field test S-5)
<b>S-08</b>	Evolution of run-of-mine salt backfill
<b>S-11</b>	THMC effects of anhydrites, clays, and other non-salt components

# HIGH IMPACT PRIORITIES IN 2019 DISPOSAL R&D ROADMAP UPDATE

High Impact R&D Topics	High-Priority R&D Activities	Medium-High-Priority R&D Activities
High Temperature Impacts	D-1, D-4, I-4, I-6, I-16, E-11, <b>S-5</b>	I-2, I-3, I-7, E-10
Buffer and Seal Studies	I-4, E-9, E-17, A-8, C-15	I-2, I-3, I-7, A-4, C-6, C-8, C-11
Coupled Processes (Salt)	<b>S-1, S-3, S-4, I-12, I-13</b>	<b>I-14, S-2, S-7, S-8, S-11</b>
Gas Flow in the EBS	I-6, I-8, I-18	I-9, P-17
Criticality	D-1, D-3, D-4, D-5	
Waste Package Degradation	C-16, P-12	E-4, E-6
In-Package Chemistry	E-14	E-2, E-20
Generic PA Models		P-1, P-2, P-4, <b>P-11</b> , P-13, P-14
Radionuclide Transport		C-11, C-13, C-14
DFN Issues		I-21, C-1, C-17
GDSA Geologic Modeling		O-2, O-3
THC Processes in EBS		E-3

Maroon color denotes salt-related activities.

# DISCUSSION RE: R&D PRIORITIES

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## ■ Discussion (20 minutes):

### For each High or Medium-High R&D Activity:

- Do we agree with the “R&D Needed” text in our database? If not, how should we change it?
- How can we translate the Activity into an input to GDSA? If we cannot, then which component of the safety case does the activity support?
- Are the Activity and the GDSA reference case consistent with each other? If not, how can we make them consistent?
- Tentatively schedule sit-down meeting among the project staff who need to integrate on a particular Activity and identify the primary topics for discussion

considerations  
f. Integration with storage facilities

facility  
e. Waste acceptance criteria  
f. Impact of pre-closure activities on post-closure

• Durability/technical basis  
d. Shafts/seals technical basis  
e. UQ (aleatory, epistemic)

• Basis  
c. Aquifer/other geologic units technical basis  
d. UQ (aleatory, epistemic)

• Surface environment  
- Flora & fauna  
- Human behavior

## 4. Disposal System Safety Evaluation

### 4.1 Pre-closure Safety Analysis

- a. Surface facilities and packaging
- b. Mining and drilling
- c. Underground transfer and handling
- d. Emplacement operations
- e. Design basis events & probabilities
- f. Pre-closure model/software validation
- g. Criticality analyses
- h. Dose/consequence analyses

### 4.2 Post-closure Safety Assessment

- a. FEPs analysis/screening
- b. Scenario construction/screening
- c. PA model/software validation
- d. Barrier/safety function analyses and subsystem analyses
- e. PA and Process Model Analyses/Results
- f. Uncertainty characterization and analysis
- g. Sensitivity analyses

### 4.3 Confidence Enhancement

- a. R&D prioritization
- b. Natural/anthropogenic analogues
- c. URL & large-scale demonstrations
- d. Monitoring and performance confirmation
- e. International consensus & peer review
- f. Verification, validation, transparency
- g. Qualitative and robustness arguments

## 5. Synthesis & Conclusions

- a. Key findings and statement(s) of confidence
- b. Discussion/disposition of remaining uncertainties
- c. Path forward