Used Fuel Disposition Campaign

Remaining Process Model Gaps for GDSA
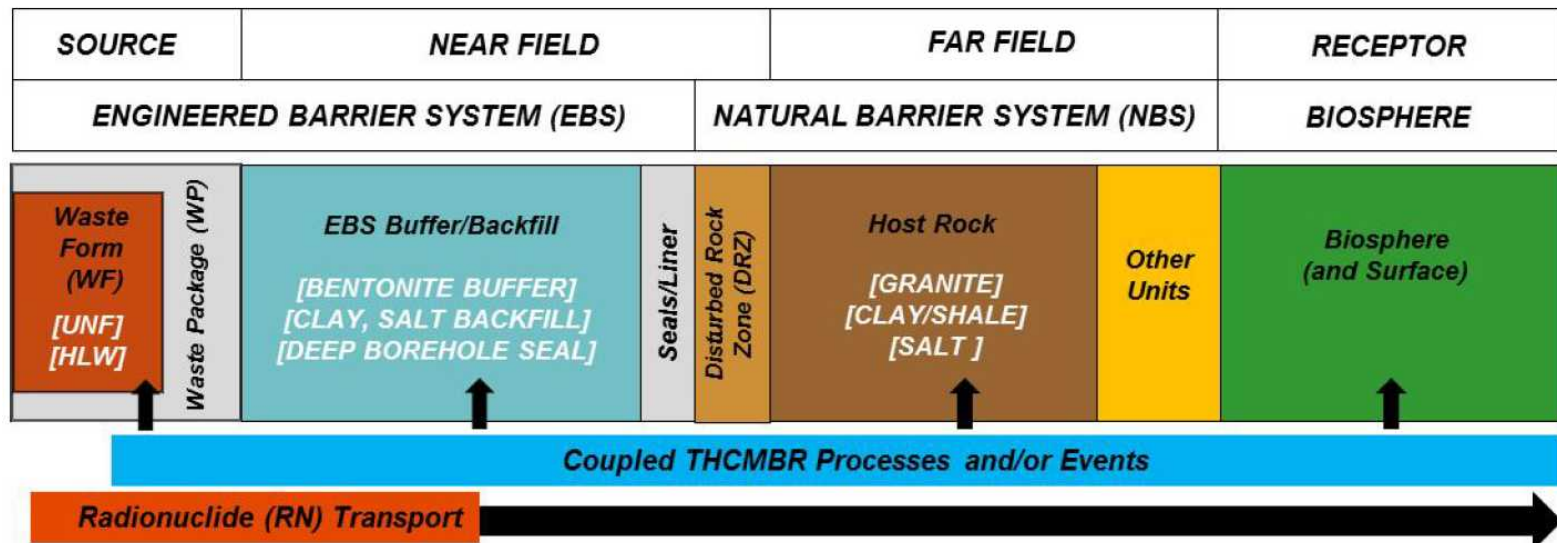
Paul Mariner

Sandia National Laboratories

2016 UFD Group Meeting

UNLV, Las Vegas, Nevada

June 8, 2016

Purpose of Talk

■ Purpose

- Share the list of process models we have identified as missing or in need of improvement (e.g., additional functionality, supporting data, improved computational efficiency, etc.)
- Seek additional input on this list
- Seek developers/partners to fill identified gaps

SOURCE	NEAR FIELD		FAR FIELD		RECEPTOR
ENGINEERED BARRIER SYSTEM (EBS)			NATURAL BARRIER SYSTEM (NBS)		BIOSPHERE

Waste Form (WF)

[UNF]
[HLW]

Waste Package (WP)

EBS Buffer/Backfill

[BENTONITE BUFFER]
[CLAY, SALT BACKFILL]
[DEEP BOREHOLE SEAL]

Seals/Liner

Disturbed Rock Zone (DRZ)

Host Rock

[GRANITE]
[CLAY/SHALE]
[SALT]

Other Units

Biosphere (and Surface)

Coupled THCMBR Processes and/or Events

Radionuclide (RN) Transport

Gap Identification

- **Informal gap analysis**
  - GDSA work
  - GDSA integration table
  - PA analyses from the literature
  - FEPs list
  - Internal discussions
  - Interactions (UFD campaign, conferences, etc.)
- **Identify and categorize process models**
  - Process model gaps (missing)
  - Improvements needed (or alternative process model(s) needed)

Process Model Gaps

- **Process model gaps**
  - Alteration* of seals, liners, EBS materials
  - **Canister degradation (mechanistic)**
    - *General corrosion, internal corrosion*
    - *Localized corrosion (pitting, MIC, etc.)*
    - *Stress corrosion cracking*
  - Disruptive events*, climate*, glaciation*
  - Early WP failure
  - Gas generation*
  - Microbial activity*
  - Neutron activation*
  - Non-Darcy flow*
  - Pitzer equations*
  - Reference biospheres
    - *Surface topography, hydrology, infiltration, and pumping for generic media models*
  - Solid solution model*
  - THM* for salt, clay, DRZ, buffer
  - WP performance after breach*
    - *WP internals, in-package chemistry, cladding, flow*

- **Improvements needed**
  - **Colloid stability and transport**
  - Comprehensive decay and ingrowth
  - **Discrete fracture network enhancements**
  - Dual or multi-continuum
  - HLW glass dissolution (mechanistic)
  - **Mesh refinement tools**
  - PA tools/methods
  - Representation of geosphere
    - *Heterogeneities*
  - **Sorption and solubility data and dependence**
  - **UNF dissolution (FMDM) enhancements**

Others??

* *Potentially excluded from primary PA simulations*