

Used Fuel Disposition Campaign

Summary of DOE-NE PA Modeling for Storage and Disposal of Used Nuclear Fuel (UNF), High-Level Radioactive Waste (HLW), and Low-Level Waste (LLW)

Geoff Freeze

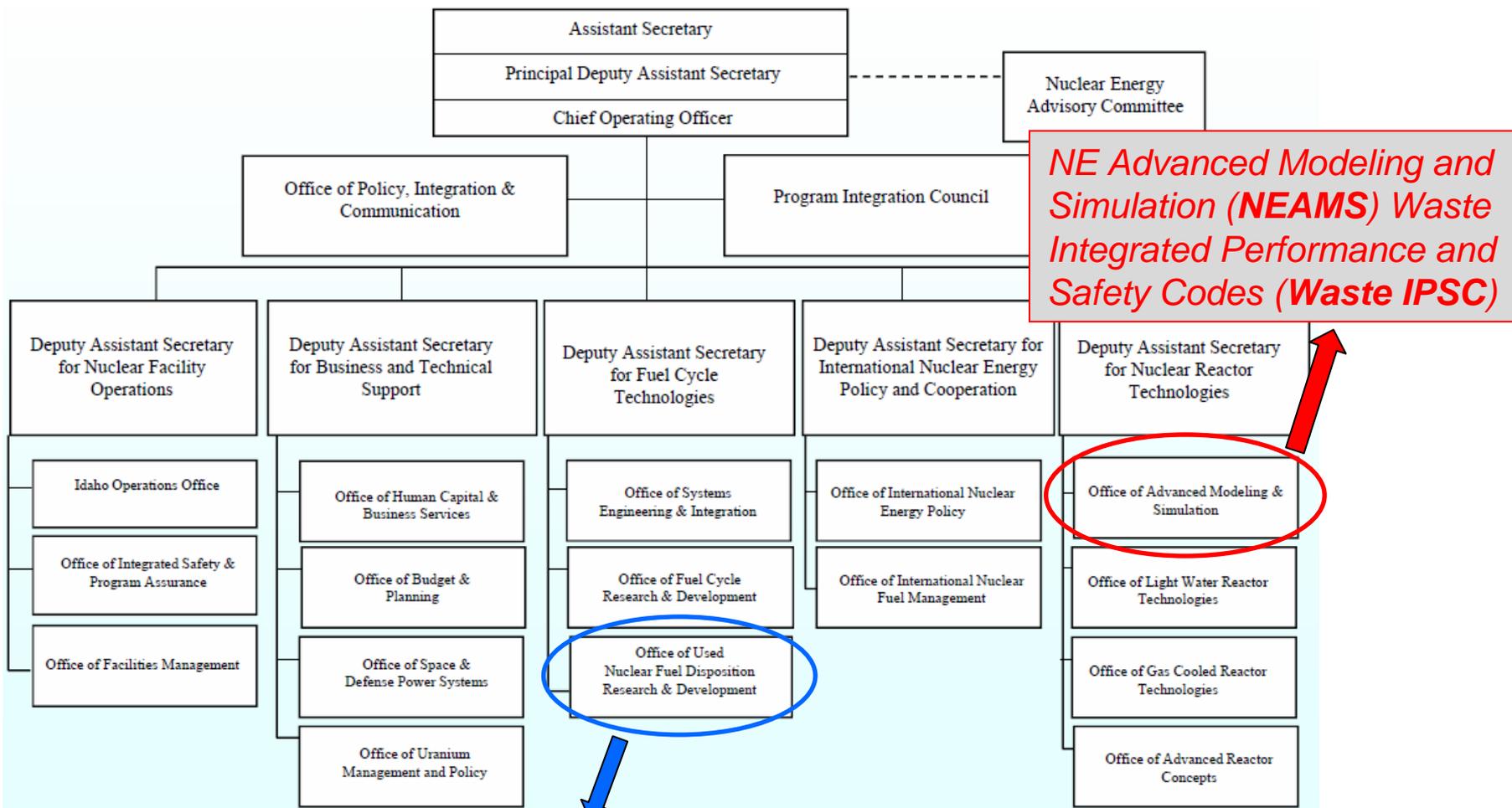
Sandia National Laboratories

PA Community of Practice Technical Exchange

May 25-26, 2011

Used Fuel Disposition

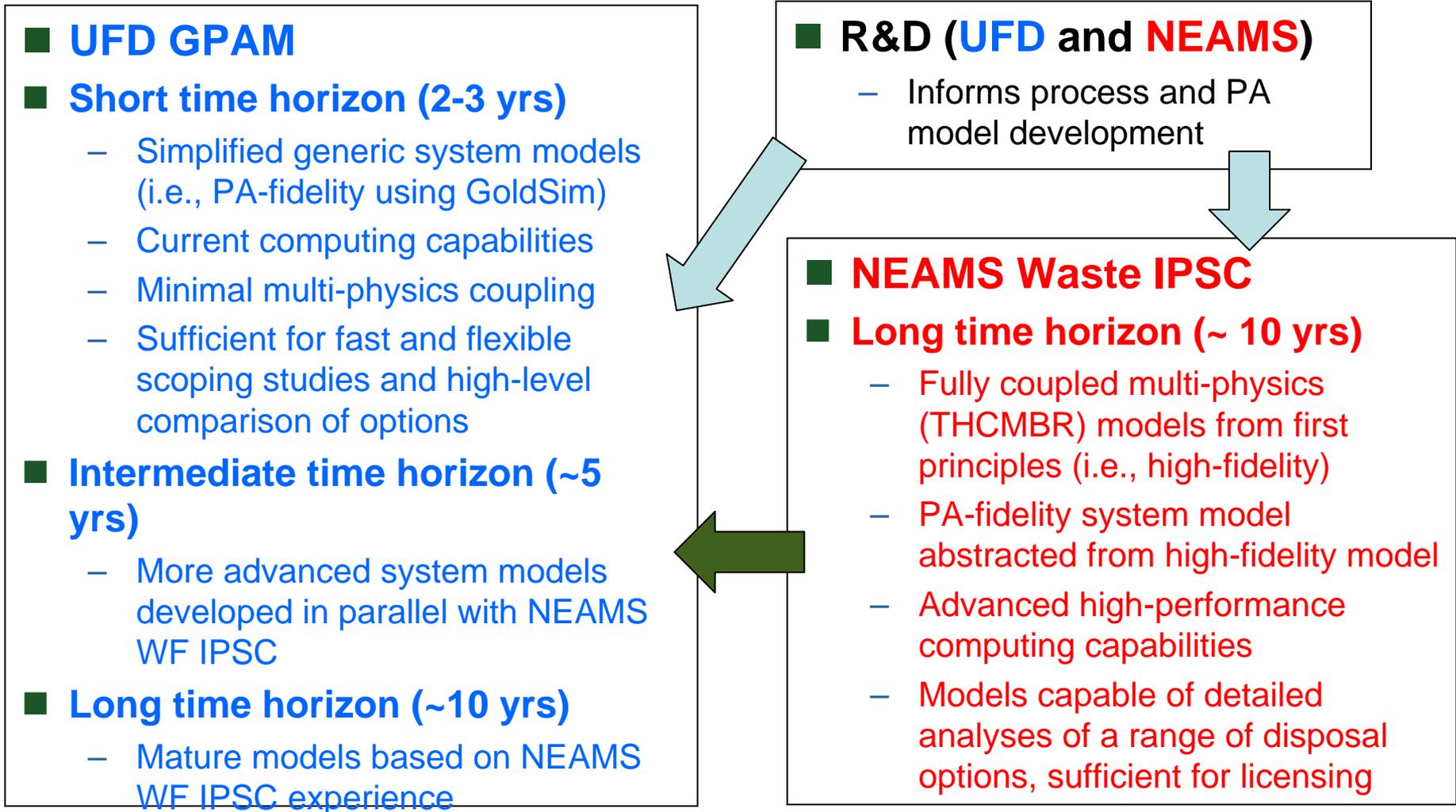
DOE-Nuclear Energy (NE) – PA Modeling Activities



NE Advanced Modeling and Simulation (NEAMS) Waste Integrated Performance and Safety Codes (Waste IPSC)

Used Fuel Disposition (UFD) Generic Performance Assessment Model (GPAM)

***** Initial modeling focus in both campaigns in on UNF/HLW disposal**

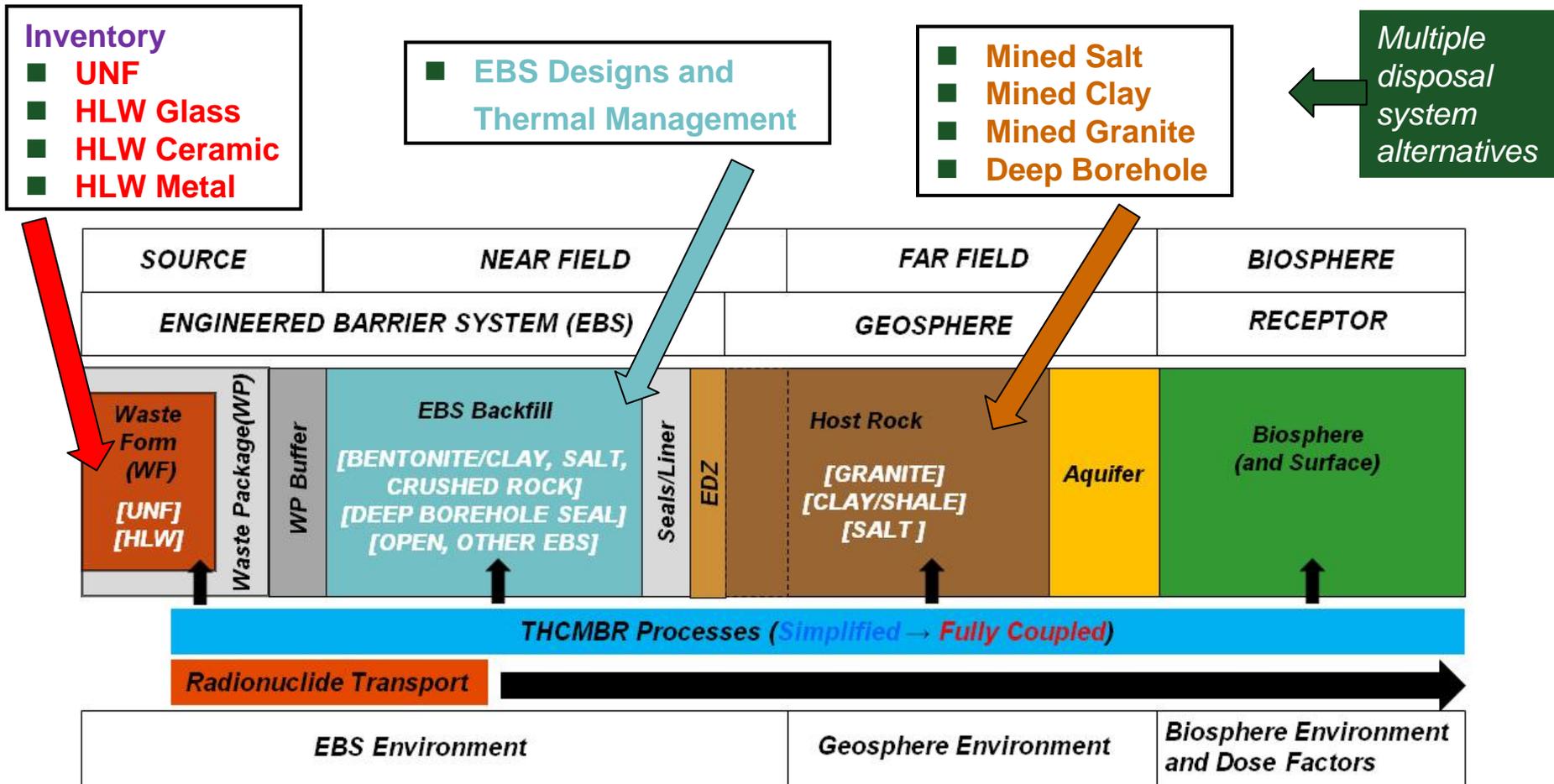


Used Fuel Disposition

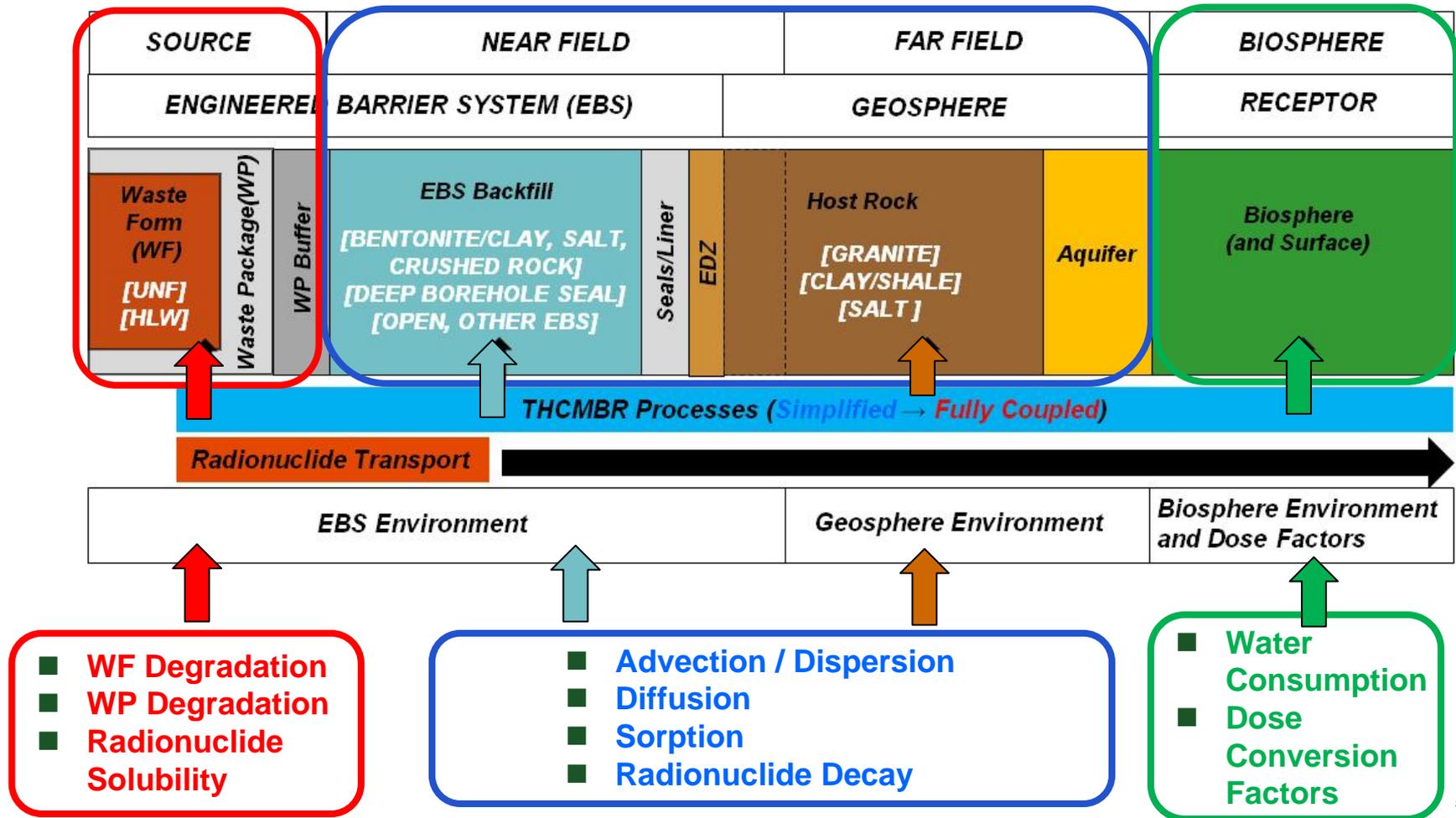
DOE-Nuclear Energy (NE) – PA Modeling UNF/HLW Disposal Scope

■ Disposal System Model Components (UFD GPAM or NEAMS Waste IPSC)

– Based on Features, Events, and Processes (FEPs) Analysis

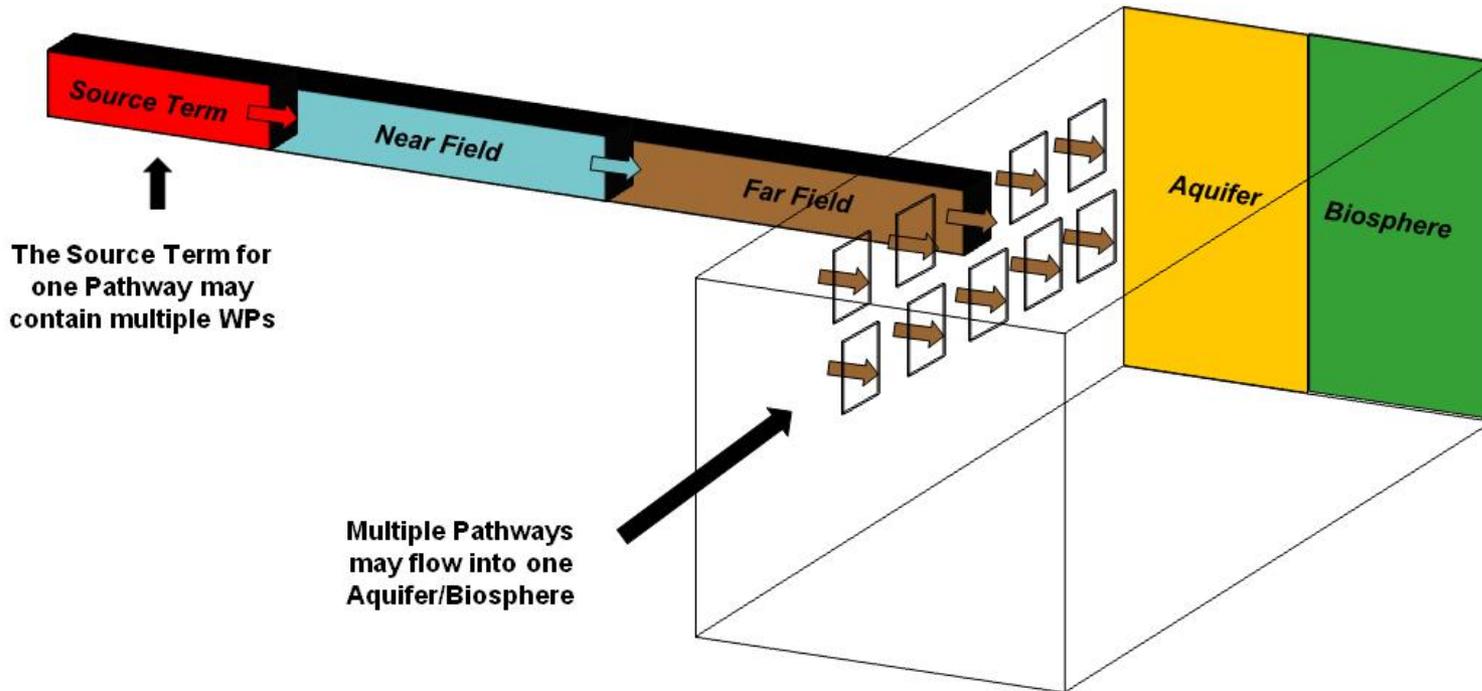


- Disposal System Model Phenomena (**UFD GPAM** or **NEAMS Waste IPSC**)
 - Thermal-Hydrologic-Chemical-Mechanical-Biological-Radiological (THCMBR)

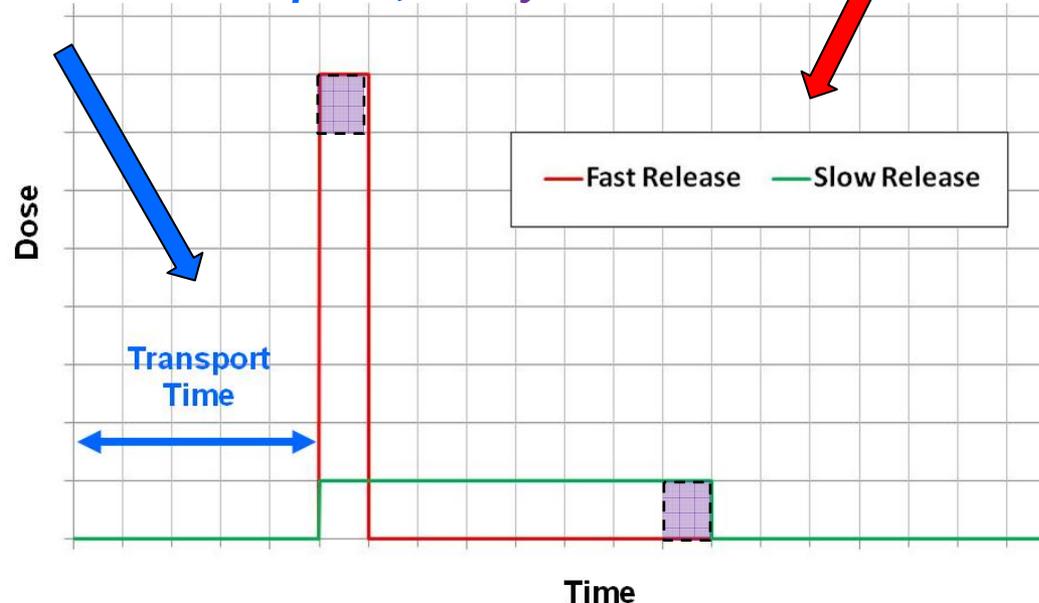


■ Disposal System Model Configuration and Dimensionality

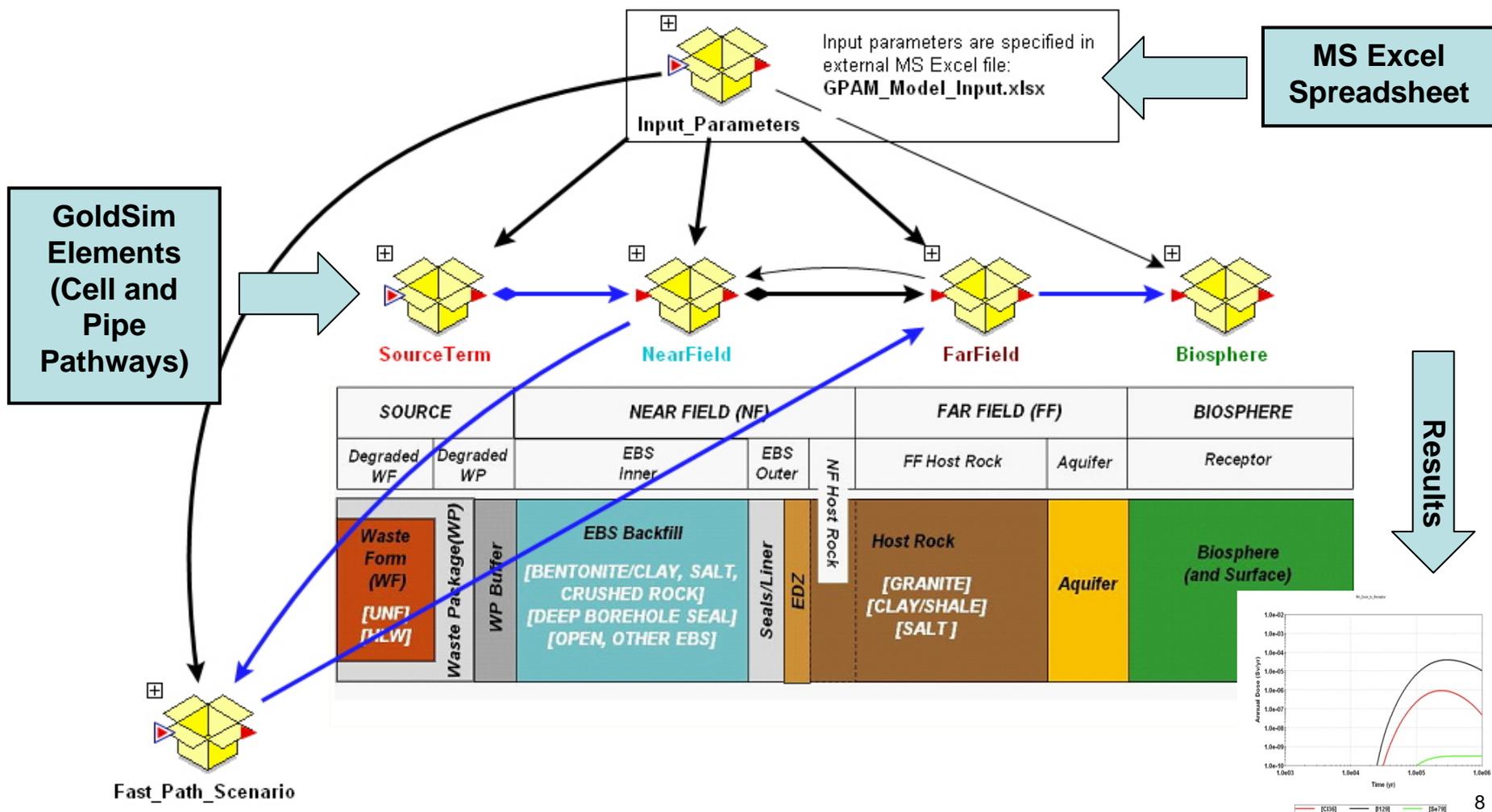
- Horizontal (e.g., mined repository) or vertical (e.g., deep borehole)
- Quasi 3-D, duplicate pathways ([UFD GPAM](#))
- Fully 3-D, independent coupled pathways ([NEAMS Waste IPSC](#))
- Modular structure for added complexity/THCMBR coupling as needed



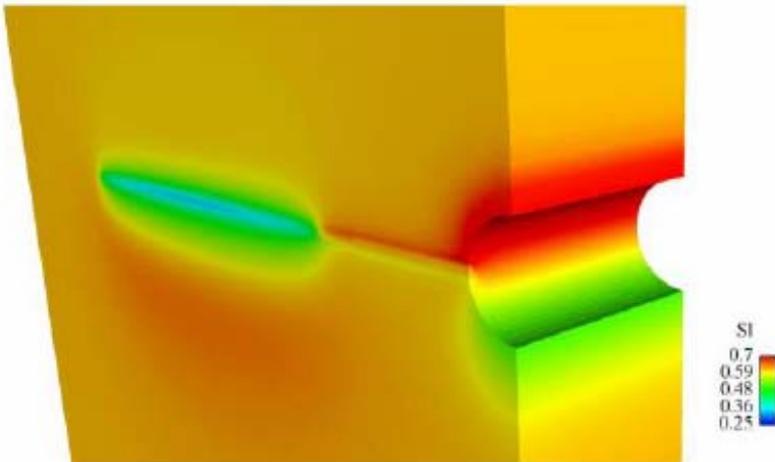
- Dose estimates in most long-term radioactive waste disposal PAs are controlled by a few key processes/parameters
 - Initial mass (inventory) of dose-contributing radionuclides (or parents)
 - Source Term duration (short-duration fast release vs. long-duration slow release)
 - *WF and WP degradation rates, radionuclide solubility*
 - NF and FF Transport processes/residence time
 - *Mass spreading: advection, dispersion, diffusion,*
 - *Mass retention/loss: sorption, decay*



- GPAM implemented in GoldSim for “generic” application

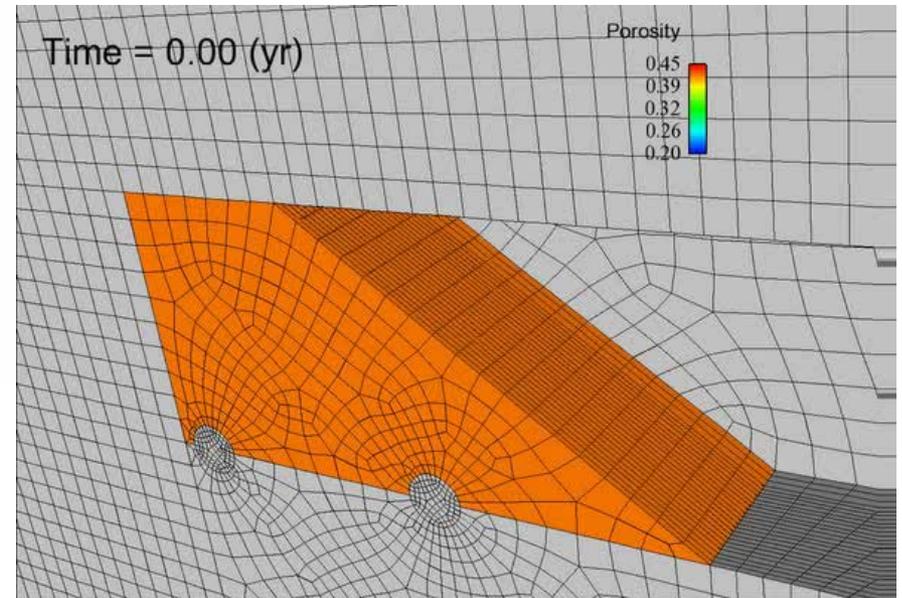


- **NEAMS Waste IPSC implemented in coupled continuum model (e.g., SIERRA)**



THM in a clay repository

TM in a salt repository



■ Interim Storage Systems

- Phenomena (FEPs) and failure mechanisms being identified and evaluated for very long term storage
- Integrated PA model development between **UFD** and **NEAMS Waste IPSC**

■ LLW Disposal Systems

- FEPs evaluation initiated
- Simple GoldSim PA model development to be initiated in **UFD**
 - *Near surface*
 - *Borehole*

■ UNF/HLW Disposal Systems

- Integrated PA model development between **UFD (simplified models)** and **NEAMS Waste IPSC (complex coupled models)** to evaluate a range of disposal alternatives
- Joint workshop with ASCEM in February 2011

■ Interim Storage and LLW Disposal Systems

- Just beginning PA model conceptualization and development