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SAND2015-3248PE

Fuel Cycle Technologies

Used Fuel Disposition Campaign (UFDC) Generic Disposal System Analysis (GDSA)

Geoff Freeze
Sandia National Laboratories

JFCS-FCAWG Meeting
Jeju, Korea
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US – ROK Technical Engagement Task 1: Evaluation Tools for Repository Decisions

- **December, 2011 to June, 2014: Prior JFCS – FCAWG Workshops and Technical Exchanges**
  - US sent GDSA reports and GoldSim files for Generic Granite Model
  - US sent GDSA reports describing development and application of PFLOTRAN-based high-performance computing (HPC) performance assessment (PA) models
    - *Specific deliverable status provided by K. McMahon*

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GDSA Long-Term Objectives

- **Develop a PFLOTRAN-Based Performance Assessment (PA) modeling capability**
  - Explicit 3-D representation using state-of-the-art numerical methods
    - *Features of engineered barrier system (EBS) and natural barrier system (NBS)*
    - *Coupled processes (FEPs)*
  - Implementation of advanced uncertainty quantification (UQ) and verification and validation (V&V) methods
  - Designed for application on high-performance computing (HPC) systems
    - *Accommodates advances in HPC hardware and applications*
- **Apply advanced PA modeling capability to generic repository reference cases**
  - Salt
  - Granite / crystalline
  - Clay / shale / argillite
  - Deep borehole

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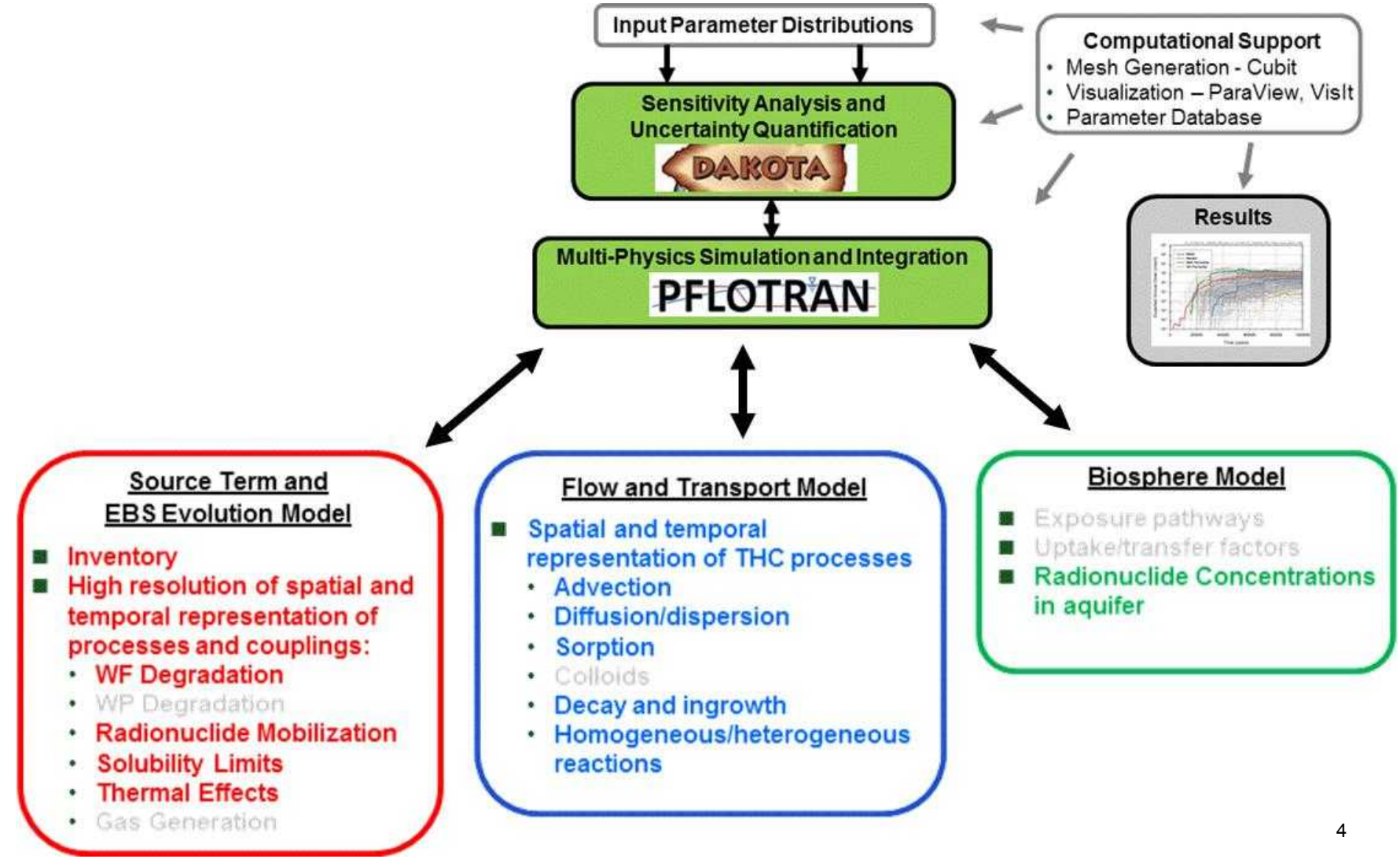
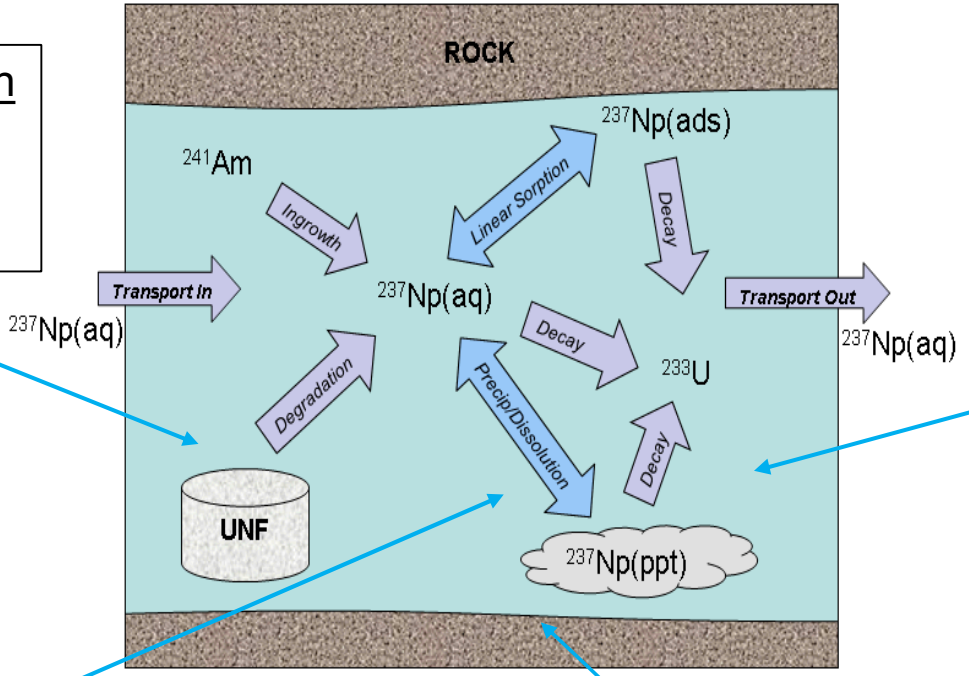
GDSA Current Code Capabilities



GDSA FY2015 Scope

- **Integrate updated conceptual models and capabilities into the PFLOTRAN-based system model architecture**
  - Refine source term and EBS evolution model

Waste Form Degradation
Couple Fuel Matrix Degradation Model (FMDM)



Decay
Adjust for secondary phases

Solubility
Adjust for isotope fractions

Waste Package Degradation
Corrosion and gas generation rates

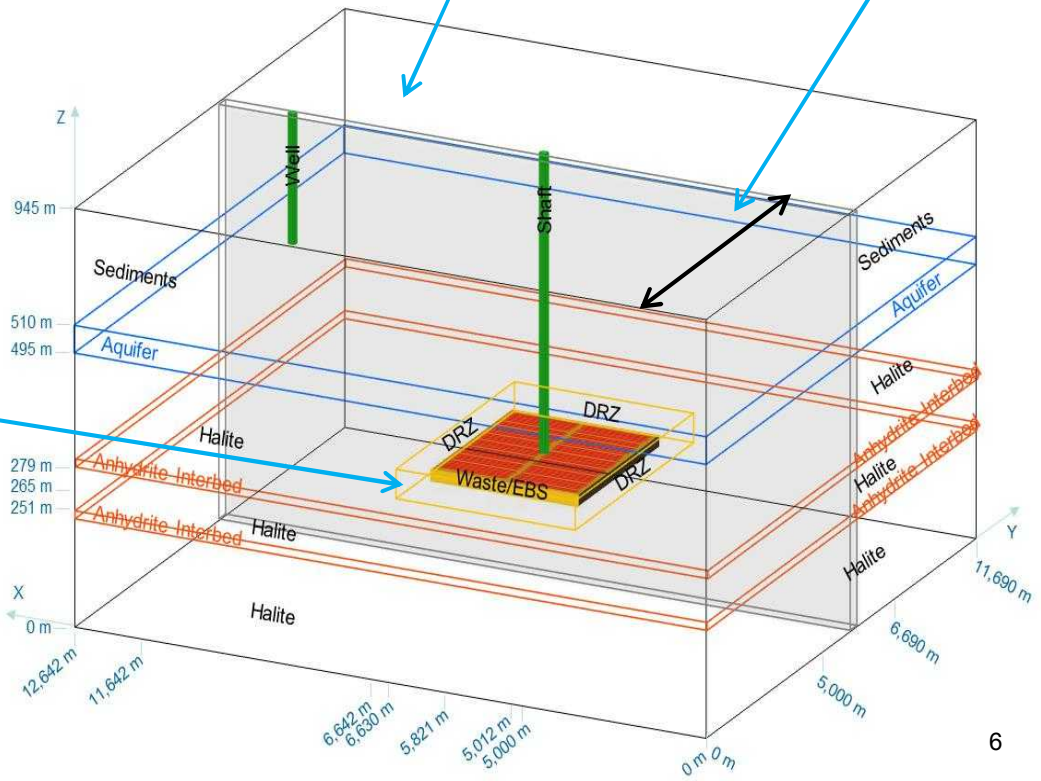
GDSA FY2015 Scope (cont.)

- **Update simulations of selected reference cases**
  - Demonstrate simulation and sensitivity analysis capabilities
    - *FY2014 – Salt*
    - *FY2015 – Clay, Deep Borehole*
    - *FY2016? – Granite*
  - Inform R&D planning

Add infiltration and pumping well

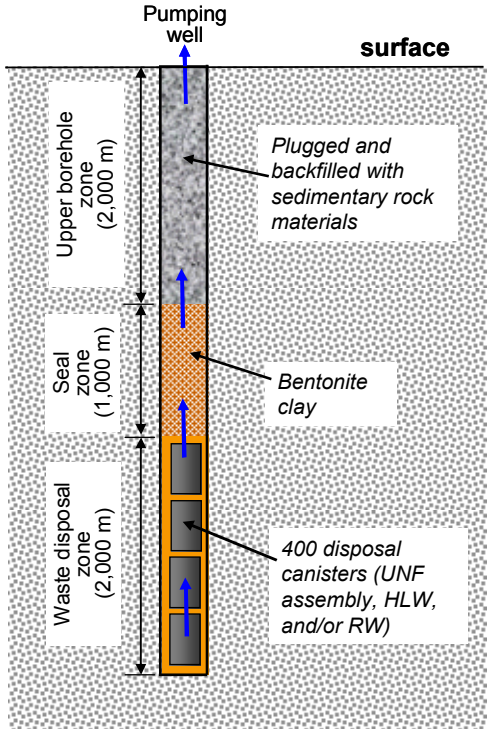
Broaden simulated domain

Develop refined EBS discretization

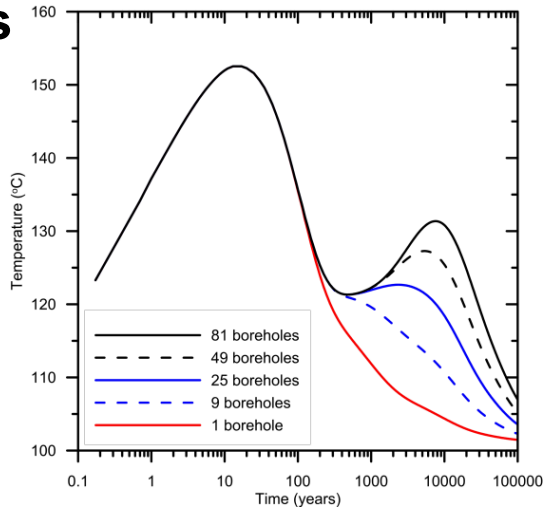


GDSA Deep Borehole Model (FY2015)

- **Update simulations of selected reference cases**
  - Deep borehole disposal model

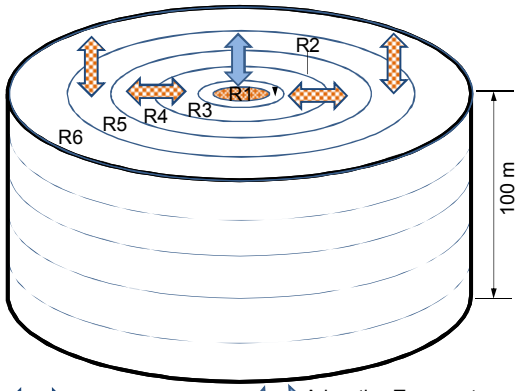


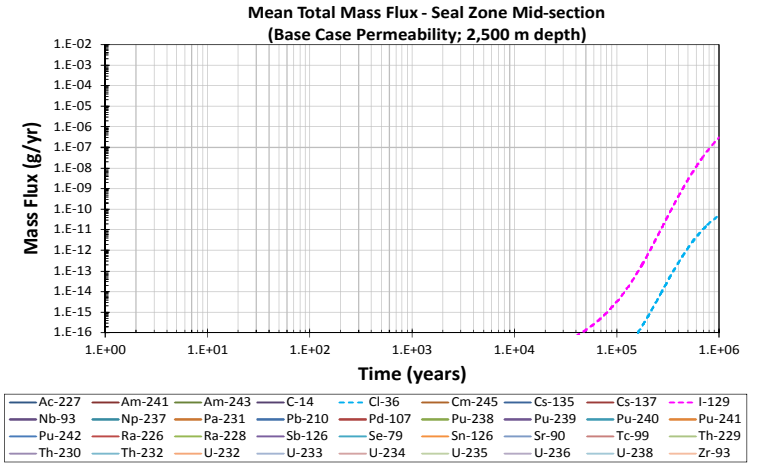
Thermal-hydrology (TH)



Simulated Temperature at 4 km Depth Near the Central Borehole

Radionuclide transport





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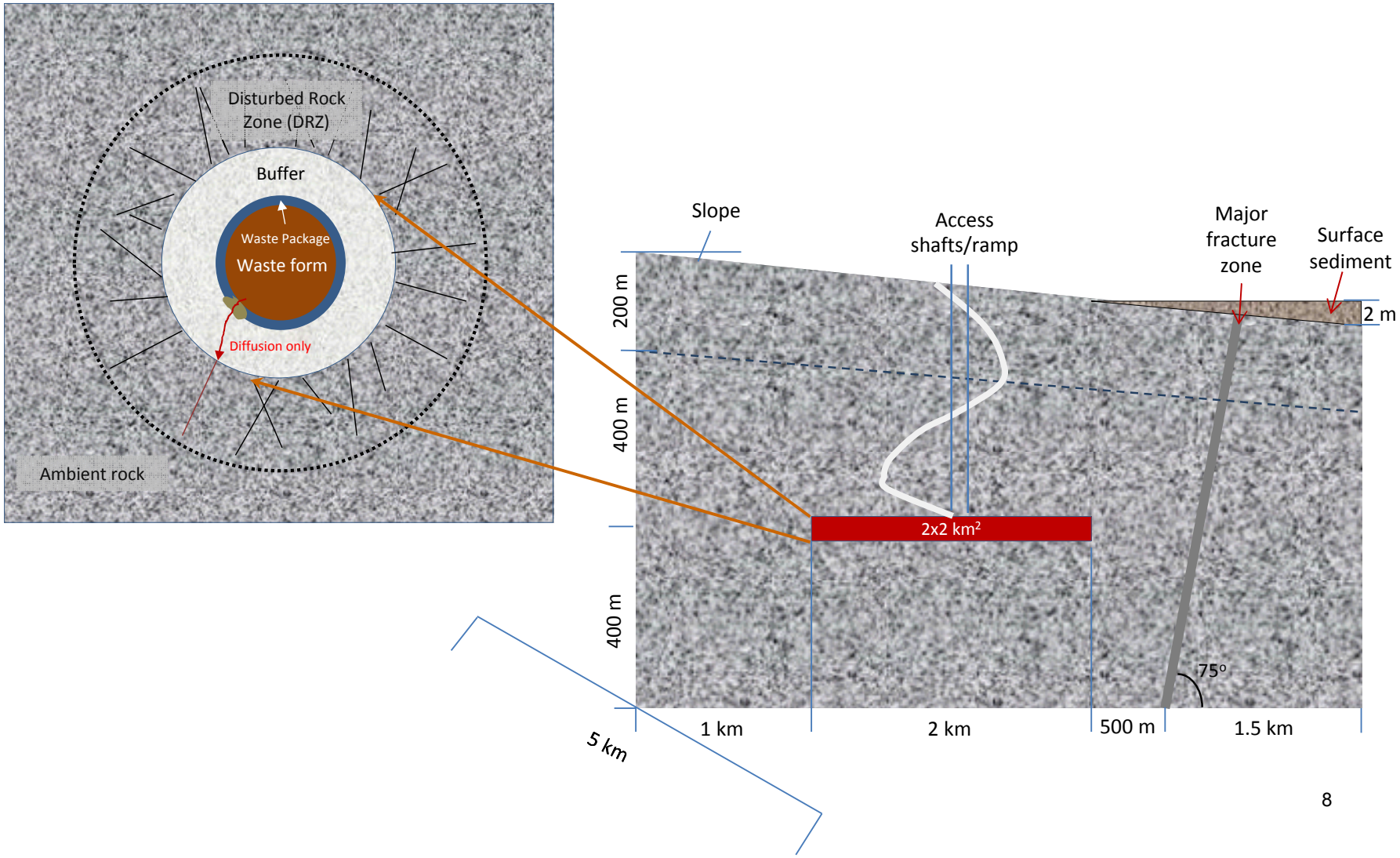
GDSA Granite Model (FY2016?)



GDSA FY2015 Technical Milestones

- **September, 2015: Application of Generic Disposal System Models (M2FT-15SN0808011)**
  - Updated Source Term Model (WF degradation, WP degradation, solubility)
  - Updated PA Model Implementation (clay, deep borehole)

Backup Slides

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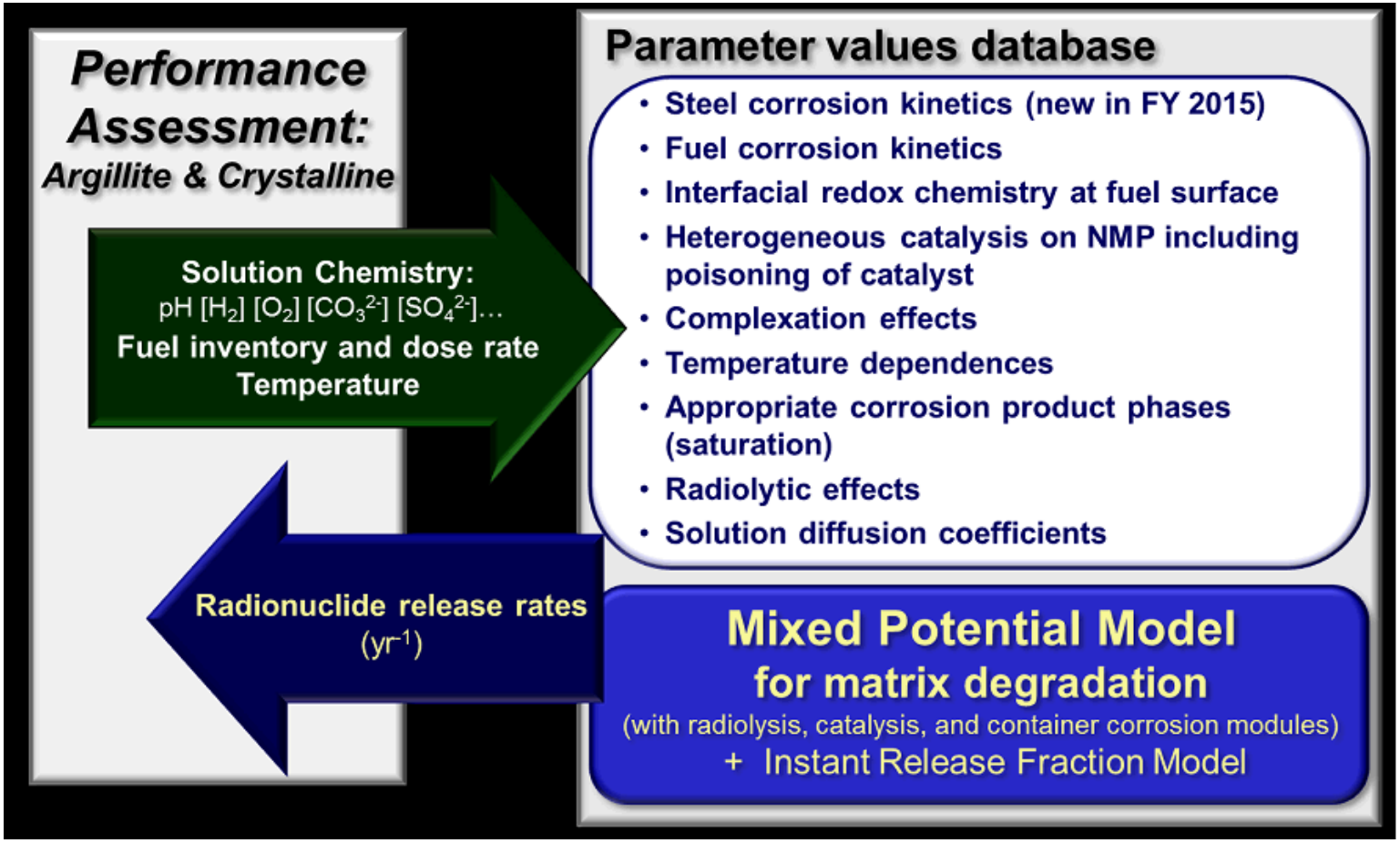
Fuel Matrix Degradation Model (FMDM)



Fuel Matrix Degradation Model (FMDM)

- **FMDM calculations and inputs/outputs to PFLOTRAN**