



U.S. Department of Energy  
Office of Civilian Radioactive Waste Management



# Logic for Evaluating Engineered Barrier System Performance

Presented to:  
**Nuclear Waste Technical Review Board**

Presented by:  
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Office of Repository Development  
U.S. Department of Energy

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Washington, DC



# Introduction

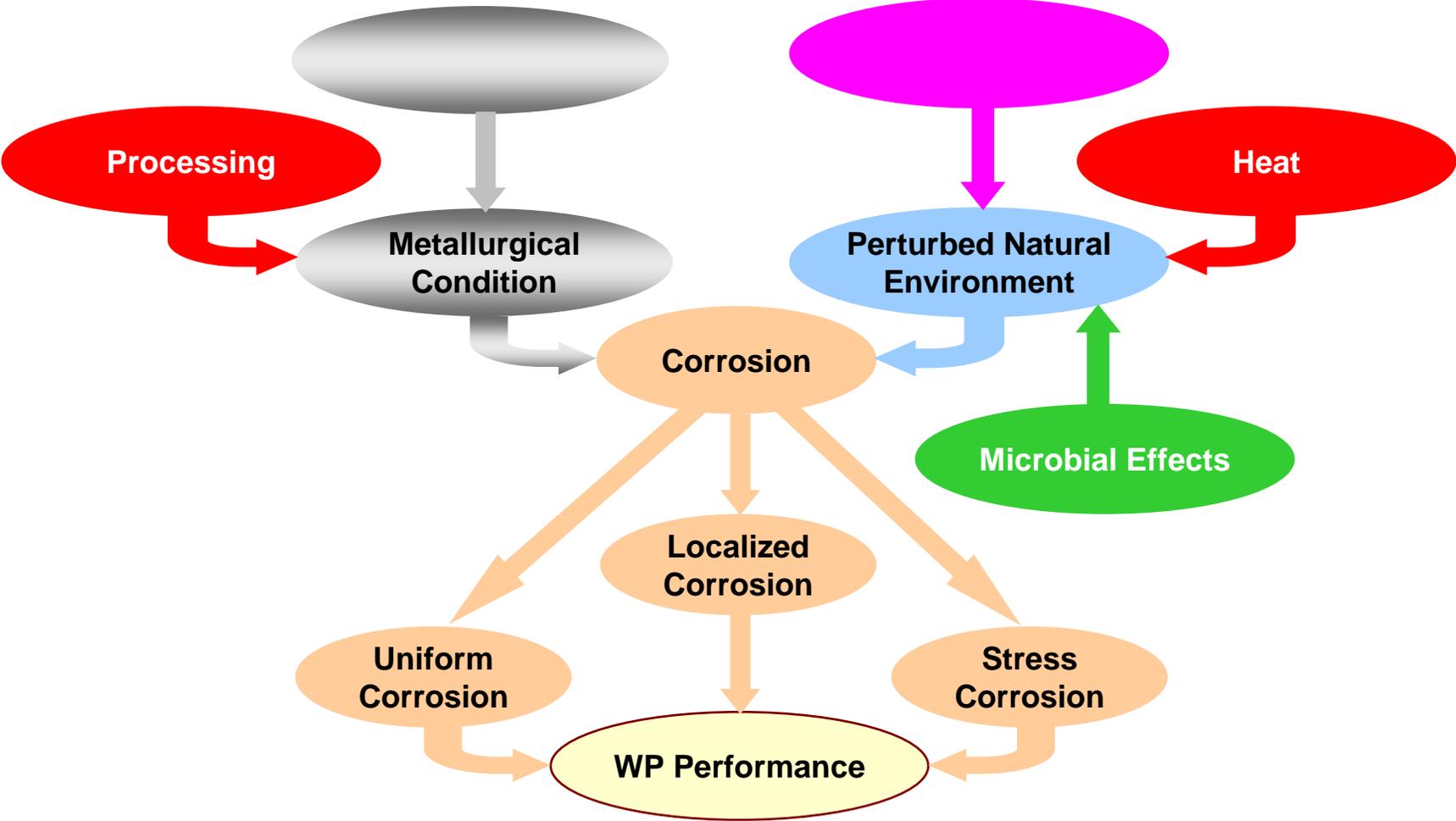
- **The objective is, through a series of integrated presentations, to demonstrate our technical basis for the evolution of the in-drift environment and effects on metal degradation during the post-closure period**
  - **Other features, events, and processes (e.g., seismic, drift degradation, thermal/mechanical, and thermal/hydrologic/mechanical effects) will not be discussed in detail**

# Regulatory/Licensing Considerations

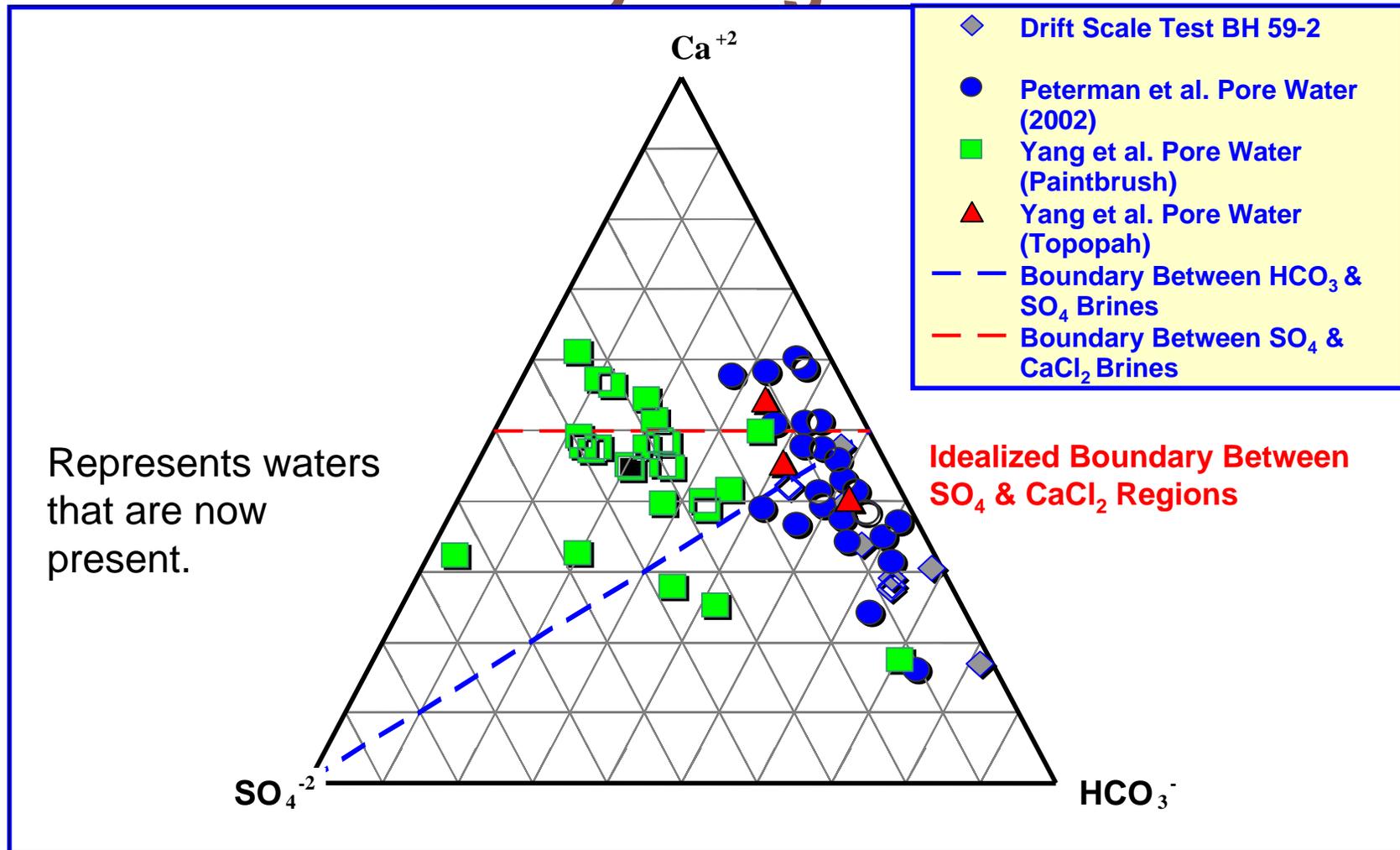
- **The License Application will provide the technical basis for “hot” postclosure thermal conditions**
  - **Flexibility to achieve “cooler” postclosure thermal conditions will be maintained during the preclosure period**
- **The data and conclusions presented today are preliminary**
  - **Final data and conclusions will be included in the licensing basis (e.g., analysis/modeling reports)**

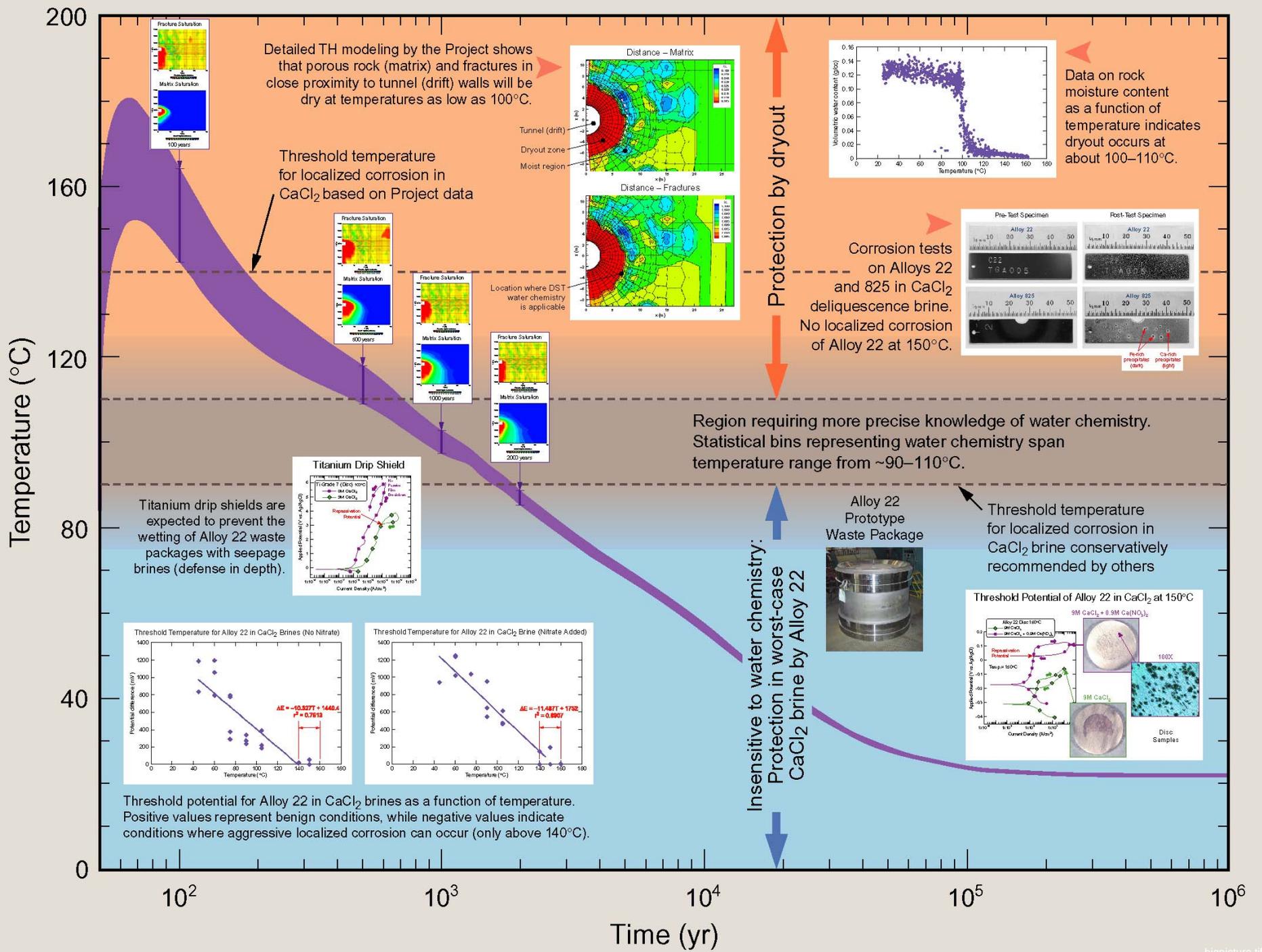


# Conceptual Model



# Evolution of In-Drift Chemistry Ternary Diagrams





Detailed TH modeling by the Project shows that porous rock (matrix) and fractures in close proximity to tunnel (drift) walls will be dry at temperatures as low as 100°C.

Threshold temperature for localized corrosion in CaCl<sub>2</sub> based on Project data

Titanium drip shields are expected to prevent the wetting of Alloy 22 waste packages with seepage brines (defense in depth).

Region requiring more precise knowledge of water chemistry. Statistical bins representing water chemistry span temperature range from ~90-110°C.

Alloy 22 Prototype Waste Package

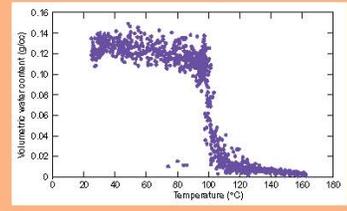
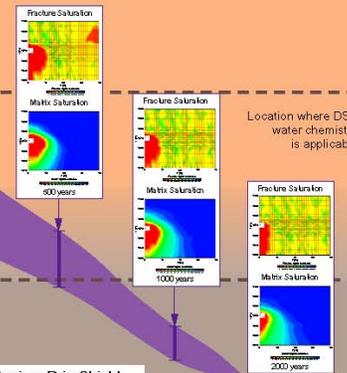
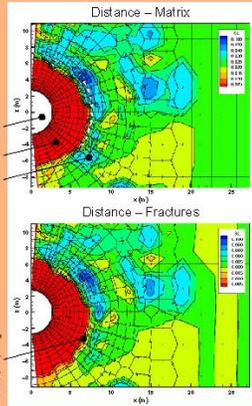
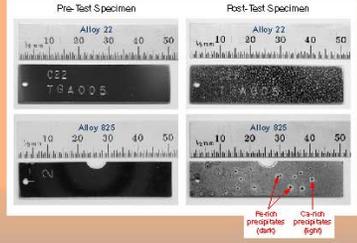
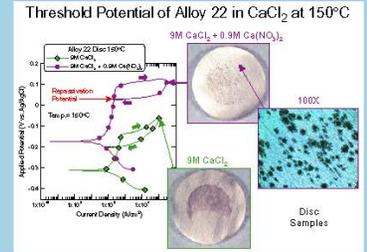
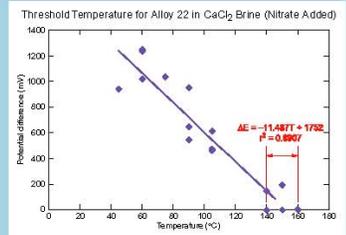
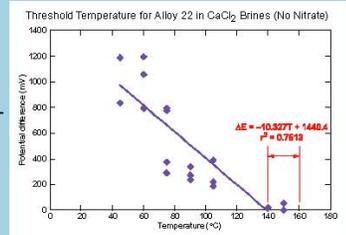
Insensitive to water chemistry: Protection in worst-case CaCl<sub>2</sub> brine by Alloy 22

Data on rock moisture content as a function of temperature indicates dryout occurs at about 100-110°C.

Corrosion tests on Alloys 22 and 825 in CaCl<sub>2</sub> deliquescence brine. No localized corrosion of Alloy 22 at 150°C.

Threshold temperature for localized corrosion in CaCl<sub>2</sub> brine conservatively recommended by others

Threshold potential for Alloy 22 in CaCl<sub>2</sub> brines as a function of temperature. Positive values represent benign conditions, while negative values indicate conditions where aggressive localized corrosion can occur (only above 140°C).



# What You Will Hear for the Rest of the Day

- **The Character of the Unsaturated Zone:  
Bo Bodvarsson**
  - Unsaturated Zone coupled processes, evolution of chemistry in the rock
- **The Character of the In-drift Environment:  
Mark Peters**
  - In-drift processes, evolution of chemistry in the drift
- **Materials Performance: Joe Farmer**
  - Effects on corrosion of the waste package and drip shield
  - Summary of overarching strategy

