

U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

NUCLEAR WASTE TECHNICAL REVIEW BOARD

**SUBJECT: THE EMERGING THERMAL
LOADING STRATEGY**

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Role of Thermal Management Strategy in Meeting Program Objectives

- **Design a repository system for timely disposal of the desired amount of waste at acceptable cost**
- **Establish a thermal loading range that is compatible with preclosure and postclosure performance objectives**
- **Maintain flexibility to optimize design and performance during construction and performance confirmation**

Program Evolution Related to Thermal Strategy

- **Decision to utilize multi-purpose canister**
- **Program Approach implementation**
 - **Phased testing to manage resources and to provide demonstrable measures of progress**
 - **Step-wise site-suitability evaluation**
 - **Increased confidence to support licensing milestones**
- **Modeling, lab and field studies have refined the understanding of thermal effects**

Key Topics Related to the Thermal Strategy

- **Maintaining multiple hypotheses about the effects of thermal loading**
- **Analyzing a range of thermal loadings to support critical program milestones**
- **Prioritizing and scheduling the testing needed to evaluate thermal effects**

Key Topics Related to the Thermal Strategy

(Continued)

- **Balancing objectives of various repository system elements**
- **Evaluating the impacts associated with early decisions about multi-purpose canister design**
- **Ensuring adequate repository capacity**

Multiple Hypotheses for Thermal Effects

- **Bounding cases**
 - high loading with possibility for extended dryout
 - low loading with potential for limited thermal disturbance
- **Goal: maintain design flexibility to increase thermal loading to improve postclosure performance and cost-effectiveness, if supported by test results**

Supporting Critical Milestones

- **1998 Technical Site Suitability**
 - Use best available site and engineering data to evaluate suitability over the range of thermal loadings under consideration
- **2001 License Application**
 - Evaluate performance for range of loads that can be supported with available site and engineering data
 - Maintain design flexibility to operate within the range of thermal loadings

Testing to Evaluate Thermal Effects

- **Earlier *in situ* testing options are being considered**
 - **early access to potential repository horizon (TSw₂) for thermal testing**
- **Understanding uncertainties in performance predictions over the range of thermal loadings is the key**

Balancing Repository Objectives: (Example)

- **Complexity of performance modeling reduced, if coupled processes are less important**
- **Waste package performance may improve, if dry near-field environment can be assumed**
- **Cost is lower, if less repository area is utilized**
- **Preclosure operations may favor lower thermal loadings**
- **Less thermal disturbance may increase distance for calculating groundwater travel time**

Multi-Purpose Canister Implementation

- **Multi-purpose canister as a canisterized waste form is an important consideration in evaluation of thermal loading**
- **Conceptual design and specifications for multi-purpose canister considered repository thermal constraints (e.g. rock wall temperature, cladding temperature)**
- **Goal: balance program needs against impacts of early multi-purpose canister design decisions**

Repository Capacity

- **Lower end of thermal loading range is likely to require larger repository area**
- **Contingency plans for limited characterization of potential expansion areas are under consideration**
- **Other design options may also exist**

Activities Underway Related to Thermal Loading

- **Developing a coherent thermal loading strategy**
- **M&O Draft White Paper on Thermal Loading**
 - **Currently under review**
 - **Defines key technical issues to be considered**
 - **Attempted to establish an integrated approach to evaluating options**
 - **Identifies key information needs**
- **Evaluating and prioritizing the *in situ* tests that will advance the understanding of thermal effects**
- **Developing flexible design plans for repository and waste package**