NUCLEAR WASTE TECHNICAL REVIEW BOARD
FULL BOARD MEETING

SUBJECT: DOE DECISION STRATEGY FOR THERMAL LOADING

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Decision Strategy for Thermal Loading

• **Goal:** Develop a Civilian Radioactive Waste Disposal System (CRWMS) in which all system elements contribute to meeting applicable regulatory requirements
  - Mined Geologic Disposal System (MGDS) (pre-closure and post-closure)
  - Monitored Retrievable Storage (MRS) and transportation

• **Strategy:** Enhance the performance of the CRWMS by appropriate use of the repository waste heat
Regulatory Basis for Thermal-Loading Selection

- 60.133(i) “The underground facility shall be designed so that the performance objectives will be met taking into account the predicted thermal and thermomechanical response . . .”

- 60.133(a) “. . . design of any engineered barriers . . . shall contribute to the containment and isolation of radionuclides”

- 60.133(h) “Engineered barriers shall be designed to assist the geologic setting in meeting the performance objectives for the period following permanent closure”

- Others such as 10 CFR 60.111, 10 CFR 60.112, 10 CFR 60.113. . . .

- Thermal loading is a key variable in EBS performance
Importance of Thermal Loading

• Affects
  - Magnitude and content of site characterization
  - Material selection and design of waste package
  - Repository design and operation

• All of which affects
  - Overall system performance and licensability
Thermal-Loading Decision

Requires Integration of

- Site characterization
- Design
- Performance Assessment
- Multi-Purpose Canister (MPC) studies

Through

- Thermal-loading study
- Modeling and code development
- Laboratory and field testing
- Performance calculations
- MPC design studies
Thermal-Loading Decision

(Continued)

- Major decision: above or below boiling
  - Implemented by Technical Baseline Control Process based on technical analysis and system implications
  - Initial decision needed as early as possible

- Follow-on decision: specific range of thermal loading
  - Only needed if major decision is above boiling
  - Decision is included in design process
  - Will be developed over time as testing results are obtained
  - Final range selected by time of design freeze

- Thermal-loading range confirmed by additional testing
Thermal-Loading Model Development

1. Design Engineered System
2. Characterize Site
3. Evaluate Integrated System

- Concept Models/Codes → Test Requirements
- Test Results
- Laboratory and Field Tests → Test Requirements
- Test Results
- Models/Codes
Thermal-Loading Interactions

- Initiate SAR Design
- Complete Design
- Initiate Fabrication

**MPC Implementation Activities**

- MPC Feasibility Study
- MPC Conceptual Design
- NRC LA Review
- MPC Fabrication & COC

**System-Wide Studies (Architecture, Transportation, MRS...)**

- Site Characterization (Laboratory and Field Tests)
- Large-Block Heater Tests
- Abbreviated Heater Tests
- ESF Heater Tests

**Refinement of Models/Codes for PA & Design**

**Phase I Thermal Study**

- Models/ Codes Evaluation
- FY93 MGDS Thermal-Loading Study

**MGDS Systems Studies**

- (Thermal Loading, Waste Package, Retrievability, ...)

**Optimize Alternatives For Final Study**

- Narrow Options

**FY Years**

- FY92
- FY93
- FY94
- FY95
- FY96
- FY97
- FY98
- FY99
- FY00
- FY01

**Performance Confirmation**
Questions Being Addressed

• Can it be demonstrated that the thermal option will achieve post-closure performance?
  - Release and containment limits
  - Adequate multiple barriers

• Will the thermal options meet pre-closure requirements?
  - Safety
  - Environmental (radiation dose and temperature)
  - Retrieval

• What analytic models can be used to adequately predict post-closure performance?
  - Validation
  - Coupled effects

• What test data is required to support the above efforts and to reduce uncertainty to an adequate level?

• Does sufficient suitable area exist in Yucca Mountain to emplace waste at the thermal option that will be selected eventually?
Status

- A wide range of thermal loadings are being evaluated in systems studies
- State-of-the-art models have been developed and are being used to evaluate performance of the options
- Models have identified key hypotheses important to the thermal-loading issue
- A test program has been identified to test these hypotheses, to support model enhancement, and to support the decision process
Thermal-Loading Decision

Requires Integration of

- Site characterization
- Design
- Performance Assessment
- Multi-Purpose Canister (MPC) studies

Through

- Thermal-loading study
  Steve Saterlie
- Modeling and code development
  Dave Stahl
- Laboratory and field testing
  Dave Stahl
- Performance calculations
  Jerry Boak
- MPC design studies
  Tom Doering