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

NUCLEAR WASTE TECHNICAL REVIEW BOARD
FULL BOARD MEETING

SUBJECT: M&O PROPOSED THERMAL LOADING STRATEGY

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PRESENTER'S TITLE
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Introduction

- A proposed program thermal strategy was developed by the M&O to provide a "roadmap" to a thermal loading recommendation
  - Describes the process to select the thermal loading
  - Identifies alternatives
  - Identifies activities needed
  - Identifies timetable
- Proposed strategy based on currently available information
  - Analysis (performance assessment, system studies, thermohydrologic process models)
  - Testing (surface based, laboratory, G-tunnel, etc.)
  - Technical judgment
- The proposed program thermal strategy represents current work in progress. Under review by DOE and the program team

Basis of Current Understanding

- Analytic models developed and analysis conducted
  - Thermohydrologic predictions indicate more complex phenomena than previously was envisioned
  - High thermal loads may produce large-scale water movement
  - Low thermal loads may also produce water movement to some extent
  - Potential waste package corrosion issues
- Some testing information available
  - G-tunnel
  - Laboratory testing (rock properties, geochemical, thermomechanical)
  - Natural analogs

Proposed Thermal Strategy

- Maintain design flexibility, as necessary, and provide a phased approach to obtaining the necessary information. An evaluation of alternatives will be provided at License Application in 2001 with thermal loading update in 2008
- Goals are to
  - Meet preclosure and postclosure requirements
  - Meet the Program's key milestones of Technical Site Suitability, Environmental Impact Statement, License Application and License Application update
  - Identifies activities for achieving the objectives

Steps in the Decision Process

Considering the information available today and what probably will be available at each major milestone, the strategy steps were selected from a consideration of alternatives:

1. Determine a sufficiently low thermal load for TSS for 1998 such that significant perturbations would not occur at distances from the emplacement drifts
2. Evaluate various alternative loadings during EIS Assessment
3. Determine Maximum Design Thermal Load (MDTL) for LA before 2001; based on available information, conservative and flexible design, bounding analyses, and planned confirmatory testing
4. Evaluate responses to alternative loadings in range from low (TSS) to high (MDTL) for LA in 2001
5. Select range of loadings from low to MDTL between 2001 and 2008. Select operating thermal loading for emplacement ($\leq$ MDTL)
6. Continue to conduct performance confirmation testing for thermal loading after initial waste emplacement

Technical Site Suitability (TSS) Evaluation in 1998

- Will rely on laboratory, large block test, plus *in situ* thermal testing results and bounding analyses for 1998
- TSS evaluation will be based largely on test information gained from near-ambient conditions
- At this time, it is expected that the evaluation will be at the low end of a range of thermal loadings
- The proposed strategy calls for increased characterization of expansion areas, as needed

Between 1998 and 2000

- Evaluation in this period will further consider thermal loading alternatives
- Additional results from short-term *in situ* heater tests become available in this time period
- Purpose will be to identify the appropriate range of loadings, in particular the upper bound for LA (maximum design thermal loading)

License Application

- Will develop a flexible design capable of accommodating a range of thermal loadings
- Identify maximum design thermal loading and responses to this loading
- LA will provide an evaluation of repository responses for a range of loadings up to the MDTL
- Performance confirmation testing also will be discussed

License Application Update

- A thermal loading for initial waste emplacement will be selected
- Results of performance confirmation tests will be evaluated
- Plans for ongoing performance confirmation testing will be described

Options for Maintaining Flexibility

- A flexible approach to design is being implemented
- Subsurface designs that can accommodate the range of thermal loading
  - Range of loading accommodated by waste package (WP) spacing and/or not loading all the drifts
  - Phased construction
  - Expansion areas can be included, as needed
  - Thermal management options (ventilation, aging, etc.)
- Flexible surface facilities
  - Handle multiple MPC sizes
  - Lag storage

Options for Maintaining Flexibility

(Continued)

- Flexible and conservative waste package approach that would permit
  - Robust materials for warm, humid conditions
  - Multiple MPC sizes (125 and 75 ton)
  - Phased procurement
- Waste acceptance considerations that warrant further evaluation
  - Oldest fuel first
  - Receipt and throughput rates

Testing to Support Decision Process

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008

"Minimal-Disturbance" Premises

1. Ambient conditions favorable
2. No significant perturbation to ambient
3. Adequate WP containment
4. Thermomechanical effects acceptable

"Extended-Dry" Premises

① Focused Flow ② Dryout of Local Conditions ③ Rewetting*

④ Condensate*

⑤ Thermochemical effect acceptable

ESF Heater Tests Intermediate scale

ESF Heaters Tests Large Scale

*Scaling and bounding analyses will provide information on these by 2001

Summary

- Completed a paper that provides a proposal for a program thermal strategy
- Providing a focus for discussion and ensuring the necessary flexibility is being incorporated in the design