Department of Energy
Washington, DC 20585

MAY 30 2001

Dr. Jared L. Cohon
Chairman
Nuclear Waste Technical Review Board
2300 Clarendon Blvd.
Suite 1300
Arlington, VA 22201-3367

JUN 22 2001

Dear Chairman Cohon:

We appreciated the opportunity to brief the Board at its May meeting. We recognize that our approach to evaluating and comparing repository performance was spread over several presentations, and clarification is needed as indicated by questions posed by individual Board members. Therefore, we have developed the enclosed paper to integrate, and hopefully clarify, our approach to evaluating and comparing a lower temperature repository operating concept with the base case (higher temperature) operating concept. We hope the Board will consider this letter when preparing its response to our May presentations.

Sincerely,

Ronald a. Milner

for Lake H. Barrett, Acting Director
Office of Civilian Radioactive
Waste Management

Enclosure

DOE's Approach to Evaluating and Comparing a Lower Temperature Repository Operating Concept with the Base Case Repository Operating Concept

DOE has taken the first step toward selecting an operational mode for a potential repository at Yucca Mountain by conducting a preliminary evaluation and comparison of the effects of two example operating scenarios on the post-closure performance of the site. The primary purposes of this evaluation and comparison are to provide insights into the effect of thermal parameters on overall repository performance, including uncertainty, and to develop confidence in repository performance over a range of thermal conditions. This evaluation and comparison will improve our understanding of the potential advantages and disadvantages associated with a range of thermal modes. However, the results are not intended to provide a sufficient basis for selecting the specific thermal requirements for an optimal repository design at this time.

The documentation supporting a potential decision to recommend the site presents a repository design that can be operated over a range of temperatures and can be constructed, operated, ventilated, and eventually closed over a range of timeframes. It is unlikely that the operating mode will be specified before the Secretary makes a decision on possible site recommendation because DOE is in the process of developing additional information needed to decide whether a higher or lower temperature mode is preferable.

As part of the documentation supporting a possible site recommendation decision, the Supplemental Science and Performance Analysis report (SSPA) will evaluate and compare the performance of the repository over a range of temperatures. For the purpose of evaluation and comparison in the SSPA, two specific examples—one higher and one lower temperature operating mode—will be analyzed. The examples represent only two of many combinations of the design and operating parameters that can be used to achieve a range of thermal objectives.

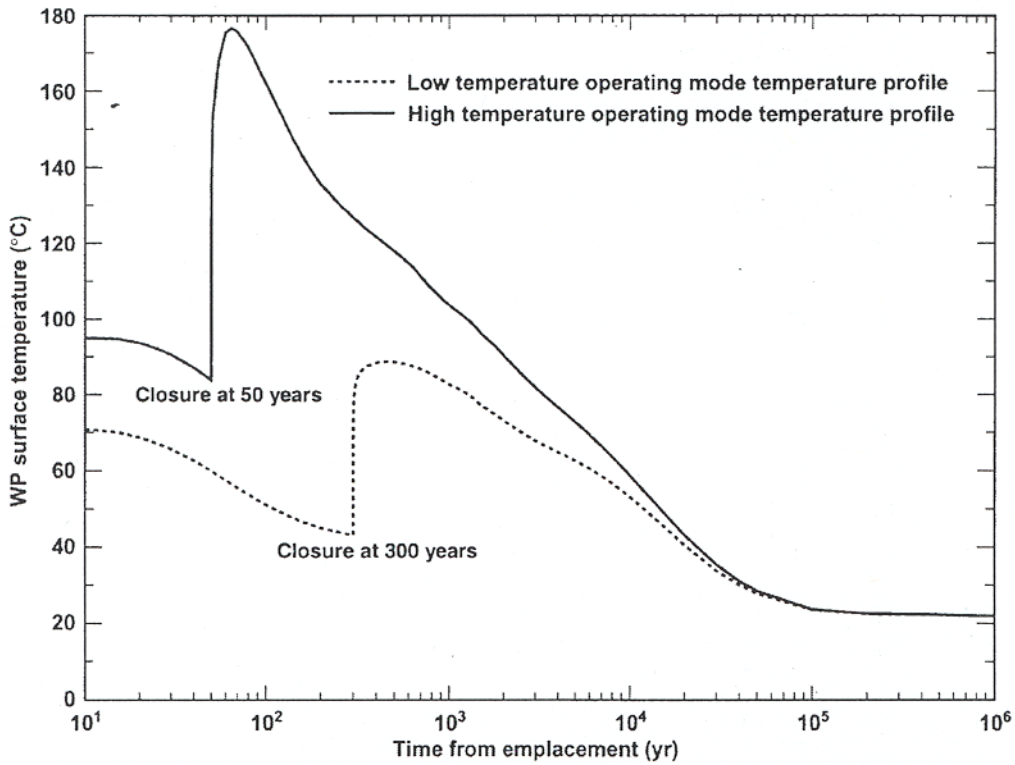
The table below lists the flexible operating parameters for the higher and lower temperature modes that will be evaluated and compared in the SSPA.

Thermal Operating Parameters	Higher-Temperature Operating Mode Example	Lower-Temperature Operating Mode Example
Average waste package maximum surface temperature	~160ºC	<85ºC
Areal mass loading	55 MTHM/acre	46 MTHM/acre
Waste package spacing	0.1 m	Variable, from 0.1 m minimum to 2.8 m maximum, with 1.2 m average
Lineal thermal loading objective at emplacement	1.35 kW/m	1.13 kW/m
Repository footprint	4.7 km^2 (~1,150 acres, upper block only) (~52 drifts)	5.6 km^2 (~1,464 acres, upper block only) (~64 drifts)
Years of forced ventilation after start of the emplacement	50	300
Heat removal by forced ventilation	70%	80%
Years of natural ventilation after forced ventilation period	0	0

The table below identifies the design parameters that are fixed for the potential site recommendation decision, which could be modified in preparation of a license application.

Design Parameters	Fixed for SR for all mode examples
Repository capacity	70,000 MTHM
Emplacement rate	3,000 MTHM/year after 5-year ramp-up
Emplacement period	~23 years
Sequence of waste package emplacement	Interspersed hotter and cooler packages to achieve average lineal power density
Waste package design	Large, horizontally emplaced packages with corrosion-resistant outer shell of Alloy-22 and structural inner shell of stainless steel
Number of waste packages	~11,000
Initial waste package power	11.8 kW, maximum
Drift diameter	5.5 meters
Drift spacing	81 meters
Drip shields	Titanium, continuous

The temperature profiles of the low-temperature and high-temperature examples are presented below.



Twp_SC&SC1 **Temperature of a Typical PWR Waste Package Near the Center of a Potential Repository**

[Note: The maximum waste package surface temperatures presented in this figure are calculated near the center of the repository, and therefore, they are higher than the average waste package maximum surface temperatures presented in the previous table.]

Both the lower and higher temperature examples represent possible approaches to achieving their respective thermal objectives for the purposes of this preliminary comparison of long-term performance and uncertainty. However, neither represents an optimal design. The lower temperature example was chosen because it facilitates the comparison by using the same process models and total system performance assessment that were developed for the higher temperature mode. However, implementation of this lower temperature example would raise policy and cost issues associated with long-term (300 years) forced ventilation. DOE is evaluating other low temperature combinations of waste package spacing, natural and forced ventilation, aging and blending, and lineal heat loads; similar repository performance and associated uncertainty results are expected.

The SSPA analyses and comparison of the long-term performance will include the following information:

- Total system performance assessments showing the estimated annual doses for 1 million years for both operating mode examples
- Sensitivity analyses to explore some of the differences in subsystem response to different thermal operating modes
- Uncertainty assessments that indicate the degree to which performance is affected by temperature and other parameters
- Multiple lines of evidence to address the degree to which process models adequately represent the processes that affect long-term performance

The results of this evaluation and comparison of the long-term performance of higher and lower temperature modes are not expected to be the sole basis for selecting the preferred operating temperature. DOE will consider other issues associated with the thermal mode selection, including preclosure safety, economic costs, and the timeframe for construction, operation, ventilation, and eventual closure. DOE will prepare an integrated evaluation and comparison prior to the Secretary's site recommendation decision. These issues will be further considered in the process of developing the detailed design for a possible license application. This process will be informed by the results of ongoing field studies, laboratory tests, further development of performance assessment models, continued evolution of design, and other research and analysis. However, this process is not expected to be completed before the Secretary decides whether to recommend the site to the President.