



UNITED STATES
NUCLEAR WASTE TECHNICAL REVIEW BOARD
2300 Clarendon Boulevard, Suite 1300
Arlington, VA 22201

March 3, 1999

Mr. Lake H. Barrett
Acting Director
Office of Civilian Radioactive Waste Management
U.S. Department of Energy
1000 Independence Ave.
RW-2 / 5A-085
Washington, DC 20585

Dear Mr. Barrett:

On behalf of the Nuclear Waste Technical Review Board, I thank you and your staff for your hard work in preparing for the panel meeting on the repository license application and design selection (LADS) process held on January 25 and the full Board meeting held on January 26 and 27, 1999. The Board members felt that the full Board meeting was among the best we have had, in large part because of the quality and responsiveness of the DOE presentations. We were especially pleased that you were able to participate in the entire session devoted to the viability assessment (VA).

The panel meeting also was very productive and informative. The presentations for both meetings were well prepared, and several effective speakers were involved who had not previously participated in Board meetings. Claudia Newbury deserves special recognition for the excellent job that she did in coordinating the OCRWM's participation and helping ensure the success of the meetings.

Specific comments arising out of the presentations made at the Board and panel meetings follow.

The Viability Assessment (VA). The Board regards the DOE's completion of the VA as a significant accomplishment. The Board agrees with the DOE that the VA was not meant to be and is not a determination of the suitability of the site. However, the VA does integrate the data collected and the analyses performed for the Yucca Mountain Project thus far. It also establishes priorities for future investigations and analyses. The Board is pleased that, in general, the testing and research priorities in the VA are consistent with those identified by the Board in its November 1998 *Report to The U.S Congress and The U.S. Secretary of Energy*. As I indicated at the meeting, Board comments about the VA will be issued in the next few weeks, after we complete our evaluation. The information provided during the Board and panel meetings will be very helpful in our review.

Repository Design. The Board members were very pleased that the first LADS workshop encouraged the advocacy teams for competing designs to think well beyond the bounds of previous repository design concepts. The Board believes that the selection criteria and weighting must be clearly defined and that the transparency of the process should be improved. We look forward to receiving a list of the selection criteria as soon as they are finalized.

As you noted at the Board meeting, the VA reference design will undergo evolutionary change as a result of the LADS process. However, the Board reiterates that an analysis of alternative repository designs should not be simply an evaluation of "enhancements" to the reference design. In particular, high temperatures in the VA reference design lead to large uncertainties about how the site would behave both before and after closure. *Therefore, the Board believes that the DOE should give serious consideration to true alternatives to the reference design, including changing from a high-temperature to a ventilated low-temperature design.*

The Board believes that a repository design based on lower waste package surface temperatures could significantly reduce uncertainty, enhance licensability, and simplify the analytical bases required for site recommendation. Combined with improved shielding, such a design also could simplify preclosure performance confirmation by enhancing access to the tunnels, thus reducing or eliminating the need for separate performance confirmation drifts and permitting direct access to performance confirmation instrumentation near the waste packages.

Some of the factors that have influenced the Board's thinking on repository design follow.

- *Corrosion severity would be significantly reduced by lowering waste package temperatures.* For a given environment, chances for degradation of corrosion-resistant waste package materials would be significantly reduced if peak waste package surface temperatures were reduced (for example, limiting peak temperatures to below the local boiling point of water, 96°C). For defense-in-depth, the use of multiple corrosion-resistant barriers, such as Alloy 22 and Ti, may significantly enhance waste package performance.
- *There would be degradation of tunnel stability because of the thermal pulse.* Professor Tor Brekke, the chair of the DOE's Panel on Drift Stability, pointed out at the Board meeting that high repository temperatures would increase rock degradation. He also stated that the effects of such high temperatures on the different rock units within the repository block at Yucca Mountain are not known.
- *There would be significant reduction of coupled thermal-hydrologic and thermal-geochemical processes at lower temperatures.* Maintaining postclosure near-field temperatures below the boiling point of water—for example, by ventilation or aging—could reduce uncertainties about the movement of water and about associated geochemical processes in the near and far fields. This would simplify the analyses required for a site-suitability determination.

The Board recommends that a more complete quantitative analysis of a low-temperature repository design be undertaken before the completion of the LADS process. For example, preliminary calculations could be performed in the next several months to quantify the removal of heat and water from continuously ventilated repository tunnels. Such an evaluation also should include an analysis of the long-term stability of the tunnels.

Site Investigations. The Board was encouraged to hear about progress in a number of site investigations such as the tests being conducted at the Busted Butte facility. If these tests indicate a significant potential for sorption of radionuclides in the unsaturated zone (UZ), they could increase the credibility of the natural features at the site as contributors to repository performance.

However, the Board is concerned about the deferral, at best, of critically important geologic, geochemical, and hydrologic studies in the east-west cross-drift that are aimed at understanding the magnitude and distribution of seepage into the repository under present ambient conditions, as well as under conditions existing in the past, when climates were very different. Technically defensible arguments about the repository's hydrologic environment, which is the single most important natural feature affecting repository performance, will be difficult to make without this information. The studies include (1) the systematic analysis of the rock samples being collected, in particular with respect to chlorine-36 and other indicator isotopes; (2) flow and seepage tests at different locations along the drift, perhaps even closing off part of the drift for these studies; (3) tests in the lithophysal zones, where the majority of waste packages may be emplaced; and (4) studies of the Solitario Canyon fault, the active fault bounding the repository that also may serve as a main conduit for percolating water.

The Board also is concerned about the apparent premature cessation of surface-based drilling at WT-24, the borehole that was meant to shed light on the origin of the large hydraulic gradient located just north of the proposed repository.

Nye County Early Warning Drilling Program (EWDP). The EWDP gives the DOE a unique opportunity to obtain data from the saturated zone (SZ) that may help address significant uncertainties about flow and transport in the SZ. In particular, the Board will be very interested in the substantiation and interpretation of initial results from the EWDP indicating the existence of warm water at depth in some locations. The Board was pleased to see that some initial problems with coordination between the EWDP and DOE-sponsored investigations appear to have been overcome.

Summary. Although the Board believes that completion of the DOE's VA is a significant accomplishment, viability is not suitability. The 2001 date anticipated for the suitability decision is very ambitious, and much work remains to be completed. The Board supports continuing focused studies of both natural and engineered barriers at Yucca Mountain to attain a defense-in-depth repository design. Testing under way in the UZ at Busted Butte and drilling under the auspices of Nye County in the SZ may provide important data about water flow and potential radionuclide transport. In addition, the Board is concerned about the deferral of critical geologic, geochemical, and hydrologic studies in the east-west cross drift.

The Board reiterates that a repository design based on lower waste package surface temperatures has the potential to reduce uncertainty, enhance licensability, and simplify the analytical bases required for site recommendation. Through additional analysis and clear selection criteria, this potential alternative could be reasonably compared with the VA reference design or other variations of the VA design.

Finally, the Board is concerned that if cutbacks in science and engineering occur during the next two years, then the chances of accomplishing these needed activities also will decrease.

Thanks again to you and your team for helping make the Board and panel meetings successful.

Sincerely,

Jared L. Cohon
Chairman