



UNITED STATES  
NUCLEAR WASTE TECHNICAL REVIEW BOARD

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Arlington, VA 22201-3367

January 12, 1998

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

Dear Mr. Barrett:

The Nuclear Waste Technical Review Board (Board) would like to thank you and your staff and contractors for participating in several Board events during the last three months. During that time, the Board held one full Board meeting, three panel meetings, and one field trip. In my opening remarks at the October Board meeting, I indicated that the Board would provide feedback to the Office of Civilian Radioactive Waste Management (OCRWM) after each of its meetings. The comments below are offered in that context.

**Comments from the Board's October Meeting**

The Board's fall meeting focused on designs of the repository and the waste package that will be included in the viability assessment (VA) of the Yucca Mountain site.

*1. Alternative Designs.* The design options discussed at the Board meeting appear to involve "add-ons" (e.g., drip shields) to the existing reference designs. The reference waste package design and the reference repository subsurface design seem to have changed very little over the years, even though data obtained from the exploratory studies facility (ESF) in the last two years indicate that the repository may be "wetter" than originally thought. Although the discovery of possible fast pathways for infiltrating precipitation has triggered examination of other design options, these options have not been incorporated in the reference designs.

In addition to evaluation of design add-ons, we believe the program would benefit from serious study of other repository and waste package designs that represent alternatives to the reference designs. Examples of design concepts that could be explored include some or all of the following: (1) a design in which the boiling fronts do not coalesce between drifts; (2) a design permitting humans wearing typical work clothing to safely enter emplacement drifts containing waste packages to inspect, maintain, retrieve, or emplace them; (3) a design with a smaller emplacement-drift diameter (e.g., 3.5 meters) and simpler ground support; (4) a design using

preclosure or postclosure ventilation or both, based on natural convection, forced convection, or a combination of both; and (5) a waste package design using two corrosion-resistant materials. Each concept for repository design should address all thermal constraints *and* accommodate at least 70,000 metric tons in the current repository footprint.

We realize that these ideas—and many others—are not new to the program. We are not aware, however, that they have received a thorough and objective evaluation that considers new hydrologic data obtained from the site. The Board believes that including alternative repository and waste package designs in the VA is a good idea, although it is clear that alternatives will not be as fully developed as the reference case. In particular, we think it is vital that the VA that is conveyed to Congress includes alternatives that show an array of cost-versus-performance choices.

2. *Remote operations and ventilation.* We understand that the current design basis assumes that humans will not be allowed in emplacement drifts containing one or more waste packages and that all operations of emplacement, retrieval, monitoring, and maintenance in such drifts will be totally automatic. Although this design basis appears to be unprecedented for underground operations having durations of up to a century, temperatures ranging from ambient to several hundred degrees, and severe radiation fields, it is not technically infeasible. What is clear, however, is that a technical development program will be needed to demonstrate and debug the equipment and the control and communication systems necessary for implementing the design basis for underground operations. The costs of and the potential for problems with these remote systems should be recognized in the VA.

Given the current size and number of exhaust shafts, the rationale for including the north-south exhaust drift that runs underneath the repository is unclear. Assuming that the east, south, west, and north main drifts have the same diameter, it appears that the same amount of ventilation could be accomplished with or without the north-south exhaust drift. Also unclear is why the current design calls for the exhaust drift to be constructed below rather than above the repository. In any case, the repository design should take advantage of the density difference between the warm exhaust air and the cooler intake air to maximize preclosure heat removal by natural convection.

3. *Galvanic protection and waste package fabrication.* Presentations made at the meeting raise questions about whether the performance assessment and engineering design groups are using the same approach to galvanic protection for the base case of the VA. Specifically, it seems that (1) the performance assessment group intends giving little or no performance credit for galvanic protection in its VA base case and (2) the engineering designers assume that the waste package design for the VA base case *will* provide galvanic protection. Recently, both the Waste Package Expert Elicitation Project and the Total System Performance Assessment (TSPA) Peer Review Panel presented opinions that galvanic protection is likely to provide no more than several hundred years of additional protection. It is unlikely that data will be obtained and analyzed between now and the VA delivery date that will either refute or confirm these opinions with any degree of confidence. Therefore, we believe that a prudent course of action would be to omit galvanic protection entirely for the base case of the VA or to rely on it for no more than a few hundred years. At the same time, we realize that galvanic protection has significant potential, and we encourage continued experimental work in the area and sensitivity studies in VA cases other than the base case.

The Board agrees with information presented at the October Board meeting indicating that shrinkfitting is technically feasible and that it is not a costly operation in itself. However, unless the parts to be mated are machined with a high degree of precision, the residual stresses from the shrinkfitting will be variable. Concerns have been expressed that the residual stresses left from shrinkfitting could exacerbate corrosion of the waste package or cause other unknown stress-related problems. As we understand it, the principal, perhaps the only, justification for shrinkfitting is to promote galvanic protection. Because the additional performance that galvanic protection will provide is considered limited, we question whether shrinkfitting should be included in the VA.

In addition, the Board has long been concerned, as have people within the program, about the inspectability of final closure welds (the welds made after waste has been placed in the package) of both the inner and the outer shells. We believe that this issue is completely resolvable and that its resolution may be postponed to well beyond the delivery date of the VA. However, we think it important to point out that the shrinkfit design makes the final closure welds, particularly those of the inner shells, difficult to inspect.

4. *Independent cost estimate.* The Board was pleased to learn that an independent cost estimate (ICE) of the mined geologic disposal system (MGDS) will be performed for the VA by a major U.S. engineering-construction firm. The Board is particularly interested in techniques, allowances, and contingencies the ICE provider will use to show technology-development costs (e.g., manufacture of prototype waste packages, development and testing of robotics systems for remote emplacement and monitoring) and to accommodate current technical uncertainties (e.g., alignment of emplacement drifts). We also would like to know how the ICE will address potential enhancements to the MGDS that are not part of the base case design. We believe that it is important for the Board to understand the approach being used for the ICE. We would appreciate receiving a copy of the statement of work from the contract with the ICE provider, as well as copies of task orders or other amendments to the statement of work as they are developed.

5. *ECRB and performance confirmation.* We thank you for sending the documentation for the planning effort for the enhanced characterization of the repository block (ECRB). We understand that some data from the ECRB will be available before the VA is delivered. We would like to know how the data could or would be used in the VA. Because data from the ECRB could be critical, we would appreciate your providing future ECRB plans and developments to the Board as they become available.

### **Comments from Board Panel Meetings and Field Trip**

In addition to the Board's fall meeting, held on October 22-23, 1997, the Board sponsored three panel meetings and one field trip in the last 11 weeks. The Board's Panel on the Environment, Regulations, and Quality Assurance held a meeting on October 21 on the DOE's interim performance measure for a Yucca Mountain repository; the Board's Panel on the Waste Management System held a meeting on the safety of spent-fuel transportation on November 19-20; and the Board's Panel on the Repository held a meeting on December 17 on the disposal of highly enriched aluminum-clad spent fuel. On December 3-4, a number of Board members and staff took part in a field trip to Amargosa Valley, during which we were briefed on several biosphere issues and toured the ESF. We are providing some limited feedback from each of these activities.

First, we are concerned about the DOE's exclusion of children from the definition of the critical group in the interim performance measure. If the exclusion is viewed by others as an attempt to bias downward the dose estimates for a Yucca Mountain repository, the DOE's credibility could suffer. The DOE should include in the VA estimates of the likely doses for children as well as adults.

Second, despite the high degree of public concern about transportation of spent fuel and high-level waste, the DOE's recent efforts in the transportation area have been limited essentially to the privatization of much of the transportation function. The Board's view is that there may be difficulties in implementing this approach as it is now envisioned and that developing contingency plans would be prudent

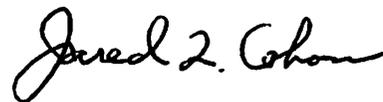
Third, several members of the Board had the opportunity to look over the drift-scale thermal test facility during their December 4 tour of the ESF. The Board is very pleased that drift-scale thermal testing has begun and considers the planning, design, construction, and start-up of the facility in less than two years a remarkable accomplishment. We share in the hope that the facility will provide valuable data for increasing understanding of the implications of various thermal loads for repository and waste package performance. The Board congratulates all involved on this well-integrated effort.

Finally, the OCRWM should carefully consider its technical bases for accepting highly enriched aluminum-clad spent fuel (essentially all of which is from domestic and foreign research reactors) for disposal in a repository at Yucca Mountain. Compared with commercial spent fuel, highly enriched aluminum-clad spent fuel is a waste form that degrades faster, leading to greater long-term doses on a ton-for-ton basis, and that may heighten concerns about criticality control.

To provide the rapid feedback we promised, we are furnishing the foregoing, which contains preliminary and formative thoughts. Accordingly, it seems inappropriate for the Board to request or expect a written response—although your informal reactions would be welcome. It is reasonable to expect that the views of many Board members and staff over the next few months will reflect the points articulated in this letter.

Thank you for your personal participation in our Board meetings and the participation of your staff and contractors. The Board hopes that this letter is helpful.

Sincerely,



Jared L. Cohon  
Chairman