



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

June 20, 2002

Dr. Margaret S. Y. Chu  
Director  
Office of Civilian Radioactive Waste Management  
U.S. Department of Energy  
1000 Independence Avenue, SW  
Washington, D.C. 20585

Dear Dr. Chu:

On behalf of the Nuclear Waste Technical Review Board, I would like to thank you and your colleagues from the Department of Energy (DOE) and its contractors who participated in the Board's meeting on May 7-8, 2002, in Washington, D.C. We appreciated your presentation and the presentation by Under Secretary of Energy Robert Card. We also were pleased that you were able to attend so much of the two-day meeting. The Board found it especially useful that, to varying degrees, all the presentations at the meeting touched on the important task of increasing confidence in the technical basis for the DOE's repository performance estimates.

### **Increasing Confidence**

#### *Waste Package Corrosion and Repository Design*

Two presentations directly addressed two Board priorities: (1) progress in understanding the underlying fundamental processes involved in predicting the rate of waste package corrosion and (2) an evaluation and a comparison of the DOE's base-case (high-temperature) repository design with a low-temperature design.

The Board commends the DOE for convening the Waste Package Materials Performance Peer Review Panel, whose excellent final report is both comprehensive and timely. The report contains many recommendations for further research and development that should increase confidence in the technical basis for predictions of the long-term performance of the waste package. The Board strongly endorses the recommendations in the report, especially the recommendation for better addressing issues related to waste package design, fabrication, and closure. Because of the importance to repository performance of the Alloy 22 protective passive layer, the Board continues to believe that the technical basis for extrapolating corrosion behavior over thousands of years needs to be more firmly established. The DOE should continue to search diligently for natural and archaeological analogues and should perform experimental and analytical studies on the analogues that appear to have been protected for long periods by passive layers.

One objective of repository design is to provide tunnel environments that will slow waste package corrosion and minimize its associated uncertainties. As you know, the Board believes that high temperatures increase uncertainties and decrease confidence in the predictions of performance of waste package materials. Therefore, the Board is encouraged that the DOE is

committed to preserving the option of a low-temperature repository. However, the technical basis for the DOE's selection of a high-temperature repository design for a potential license application remains unclear to the Board, particularly in view of the uncertainties associated with a high-temperature design and the lack of data on high-temperature corrosion. Furthermore, the DOE's current high-temperature repository design differs from the one assumed in the documentation for the site recommendation in key areas, such as waste package spacing. Finally, design flexibility deserves further analysis in light of recent ventilation calculations and the current uncertainties about the thermal conductivity of the rocks in the repository horizon. Seriously considering designs other than the DOE's current high-temperature base-case design may be of considerable value to the program if it proceeds into the licensing phase.

### *Repository Safety Case and Performance Confirmation*

As stated in previous correspondence from the Board to the DOE, the Board strongly supports the DOE's efforts to develop a repository safety case now for supporting a potential license application and for improving the DOE's communication with decision-makers and the public. The safety case should explain how a repository at Yucca Mountain would isolate radioactive waste for many thousands of years and should rely on the numerical analyses used to predict repository performance as well as other evidence that supports those numerical analyses. Such supporting evidence addresses two other Board priorities: (1) meaningful quantification of conservatism and uncertainties in performance assessments and (2) development of multiple lines of evidence to support the repository safety case. Consistent with the approach taken in other countries, the Board recommends that the DOE prepare a working draft of its safety case as soon as possible to provide ample opportunities for modification and refinement in response to technical and public comment.

The Board believes that performance confirmation should focus on evaluating the validity of estimates of long-term repository performance and challenging their underlying assumptions. However, the DOE presentations did not make clear to the Board what the DOE's overall goal for performance confirmation is or how the DOE intends to validate its predictions of repository performance. Progress in developing a meaningful performance confirmation plan will be limited until a safety case has been drafted. Development of a meaningful plan may be complicated further by the potential for competing interpretations of the data that are gathered (e.g., efforts to explain chlorine-36 data and the appearance of water in the closed-off section of the cross-drift).

### *Adaptive Staging*

Adaptive staging is a management approach that could potentially increase confidence in the DOE's repository development efforts by ensuring that the logic and the underlying technical arguments of the safety case will be reviewed periodically and that midcourse corrections will be made if necessary. As the National Research Council's panel on repository staging notes in its recently released progress report, adaptive staging differs significantly from a linear, predetermined repository development process, which is characterized by an unwavering commitment to a single course of action to secure a fixed outcome. The panel observes that adaptive staging is a "promising approach," but the panel also cautions that systematic organizational learning—a key requirement for adaptive staging—is challenging under the best of circumstances. The Board encourages the DOE to develop a better understanding of adaptive

staging and to analyze the implications of this approach for its present organization and for its interaction with the public.

The presentation on flexible repository design and thermal operating conditions came closest of all the presentations at the meeting to illustrating how adaptive staging might work during performance confirmation. In that presentation, discrete decision points were identified, additional data that need to be collected and integrated were specified, milestones for reevaluating and reassessing decisions were established, and choices that might foreclose future options were clearly highlighted. Just as technical flexibility will be a prerequisite for adaptive staging, it is essential that the DOE be willing to make midcourse technical or programmatic corrections during performance confirmation if they are required. In summary, using adaptive staging will require that the DOE address with specificity the following questions: What information can be gathered over what time frame? How will that information be used to determine whether previous decisions and assumptions about repository performance remain valid? What midcourse corrections or remedial actions, if any, are warranted?

### **New Organizational Structure**

As noted in the Board's January 24, 2002, letter report to Congress and the Secretary of Energy, improving understanding and filling in existing data gaps are important for increasing confidence in estimates of repository performance and for better defining necessary activities associated with performance confirmation. At the May meeting, the DOE informed the Board that it had established a task force to develop options for increasing fundamental understanding of the proposed repository system and for increasing confidence in projections of repository performance. Of course, the Board expects that work directed toward a potential license application would increase confidence as well. New information and analyses may have important implications for the development of a safety case as well as for repository design.

Any work undertaken by this task force not only should supplement but also should be integrated with the work already planned for a potential license application. The Board looks forward to reviewing the studies initiated by the new task force as well as the ongoing efforts to refine parameter estimates, models, and scenarios and to develop the next iteration of performance assessment.

Again, the Board thanks you, the DOE staff, and the DOE's contractors for supporting its May Board meeting. It looks forward to your promised September update, which could provide more details about investigations to improve understanding of the role of natural barriers, such as the saturated zone, in containing and isolating waste. The Board also would like to hear how the DOE plans to address the issues discussed in this letter.

Sincerely,

{Signed by}

Jared L. Cohon  
Chairman

cc: Robert G. Card