



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

July 17, 2001

Mr. Lake 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:

On behalf of the Nuclear Waste Technical Review Board, thank you for attending and supporting the Board's meeting in Arlington, Virginia, on May 8 and 9, 2001. This letter conveys the Board's reactions to the presentations made by the Department of Energy (DOE) and its Yucca Mountain Project contractor team at that meeting.

Meaningful Quantification of Uncertainties and Conservatisms

The Board is encouraged by the work being undertaken by the Project to quantify uncertainties and conservatisms in its performance assessments (PA). The work appears to be responsive to the concerns that the Board has voiced in the past. The Board will have more detailed comments on this issue when it completes its review of the *Supplemental Science and Performance Analyses (SSPA)* report.

Dealing adequately with uncertainty inherent in a large and complex system is challenging and requires many difficult analytical judgments. The Board has two concerns in this regard. First, the Project may be dismissing some sources of uncertainty prematurely simply because they seem to have very minor effects on the performance of a particular barrier or component. One purpose of carrying out a PA is to gain insights into the behavior of the system as a whole that cannot necessarily be gleaned from looking at the subsystems alone. Some subsystems may have nonlinear interactions. Second, even if uncertainty in a single component or barrier does not have a large effect on final dose calculations, it may, together with other "minor" uncertainties, have a nonnegligible cumulative effect. As the questions from the Board at the meeting suggest, the criteria for including some variables and not others in the next round of PA are not clear.

Progress in Understanding the Underlying Fundamental Processes of Corrosion

The Board continues to believe in the importance of developing an understanding of underlying physical phenomena of corrosion processes. Although obtaining better model parameters has obvious appeal in the short run, the Board continues to have concerns about the validity of the underlying models. We are encouraged that the Nuclear Regulatory Commission's Center for Nuclear Waste Regulatory Analyses is trying to develop insights into conceptual models of corrosion processes.

The Board is pleased that the Project will obtain an independent peer review in this area and urges the Project to make the review process as open and accessible as possible to interested and affected parties. The review will complement the international workshop on long-term extrapolation of passive behavior of metals that the Board will sponsor in July.

Evaluation and Comparison of Base-Case and Low-Temperature Repository Designs

In its response to a written question from Representative Joe Barton last August, the Board concluded that the technical basis for projecting the long-term performance of the Project's base-case (high-temperature) repository design has "critical weaknesses." These weaknesses include the apparently large uncertainties associated with projections of repository performance that are due to the relatively high temperatures produced by the base-case design. The Board therefore urged the Project to evaluate a low-temperature design and to compare its performance with the high-temperature design as a means of gaining further insights into system performance and reducing key uncertainties.

The Project decided to address this area of Board concern by taking a single general repository design and comparing its performance and associated uncertainties when it is operated in a high-temperature mode and in a selected low-temperature mode. This choice was influenced, in part, by the fact that the same process models and PA's could be used to evaluate both modes.

It is premature to determine whether the Project's approach, presented at the May meeting and elaborated in a letter to the Board dated May 30, 2001, will address adequately the questions the Board raised. We look forward to examining closely the content of the *SSPA* to ascertain whether the Project actually has gained the needed further insight. In particular, the Board is looking for clarity of objectives, transparency in design evaluation and comparison (including the Project's choice of designs), adequacy of representations and analysis between natural and engineered systems, and technical defensibility of the underlying models included in PA.

Development of Multiple Lines of Evidence to Support the Proposed Repository Safety Case

The presentation on multiple lines of evidence was candid and gave the Board specific and useful information. The Board is encouraged that the Project now intends to develop

multiple lines of evidence more aggressively than it has in the past. The Board urges the Project to integrate those lines fully into its analyses and documents. As the Board stated in its June 11, 2001, letter on multiple lines of evidence, "...the DOE should indicate which [PA] conclusions are supported by multiple lines of evidence, which are contradicted by multiple lines of evidence, and which are not supplemented at all by multiple lines of evidence."

More specifically, analogues that provide insights into the areas that PA suggests have substantial uncertainty and effect on performance should be given priority. Thus, the Board encourages the Project to explore analogues, such as those at Peña Blanca, Paiute Ridge, and Yellowstone National Park. An examination of natural analogues to man-made metals, including, but not limited to, josephinite, also may be promising.

Observations About Other Technical Investigations

The Board believes that the Project continues to make important progress in gathering data and developing models that can be useful in supporting PA. The infiltration studies in the cross-drift and the development of more-sophisticated climate models are examples. Nevertheless, the Board reiterates its earlier comments about the importance of expeditiously resolving ambiguities in interpreting the source of moisture in the bulk-headed drift and in determining if bomb-pulse chlorine-36 has migrated to the repository horizon.

Furthermore, the Board is concerned that investigations needed to connect the near-field natural environment with the engineered repository system, such as studies of deliquescence of brines on the waste package and drip shield, colloid transport, and thermal conductivity of the lower lithophysal rock unit, still have not been completed.

Finally, the presentations at the meeting revealed what appeared to be an instance of poor communication among Project scientists, designers, and modelers. The repository layout described in the *Science and Engineering Report* extends over a new area that includes a part of the large hydraulic gradient, but the repository layout evaluated in the PA for site recommendation does not include this area. This inconsistency may have significant potential consequences. The Board urges the Project's management to understand why this occurred and to resolve whatever problems are discovered so that inconsistencies like this are prevented in the future.

The Board again thanks you and your colleagues for participating in its May meeting.

Sincerely,

{Signed by}

Jared L. Cohon
Chairman