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

March 11, 2002

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:

Thank you very much for the participation of the Department of Energy (DOE) and its contractors at the January 29-30, 2002, meeting of the U.S. Nuclear Waste Technical Review Board in Pahrump, Nevada. We very much appreciate the hard work and extensive preparation required for the meeting. The presentations and discussions were both interesting and informative.

On the basis of presentations at the meeting and its previous oversight activities, the Board has three principal recommendations. First, because of existing uncertainties, a sustained commitment to continued scientific and engineering investigations is required to improve the technical basis for evaluating the performance of the proposed nuclear waste repository at Yucca Mountain. Second, data and analyses from this research should be assimilated into a realistic total system performance assessment (TSPA) analysis. Third, the DOE needs to communicate its results more clearly and effectively to decision-makers and the public. The recommendations are explained further below.

Scientific and Engineering Investigations

It is very important that the DOE vigorously pursue sustained scientific and engineering investigations to improve understanding of the capability of the site and associated engineered systems to isolate radioactive waste.

The DOE has made considerable progress in quantifying uncertainties and conservatisms in many areas. The products of these efforts can help to guide or focus further scientific and engineering investigations. However, the Board is concerned that some hydrogeologic processes that may either substantially accelerate or retard radionuclide transport in the unsaturated zone and saturated zone in and under Yucca Mountain remain poorly understood. For example, colloid-facilitated transport may accelerate radionuclide migration, and secondary mineralization may retard it. Furthermore, there is not yet a technically credible analysis of water accumulation and movement in and around the bulkheaded section of the exploratory cross-drift, no empirical evidence exists to support the drift-shadow concept, no large-scale field measurements of hydraulic properties of major geologic faults at Yucca Mountain have ever been made, and

improvements in the regional saturated zone hydrogeologic model have not been incorporated in the site-scale model.

The DOE's current base-case repository design would produce temperatures on the waste package of 120 ºC or higher for 500 to 1,000 years and peak temperatures as high as approximately 160 ºC. The Board questions the DOE's conclusion that there is no significant long-term difference in repository performance predictions that is attributable to temperature. That conclusion appears to be inconsistent with statements by DOE scientists at the meeting indicating that uncertainties in hydrologic processes increase at higher repository temperatures. Furthermore, experimental work and analyses clearly indicate that potentially corrosive aqueous environments are possible in a repository at Yucca Mountain at temperatures up to approximately 160 ºC. Yet, the DOE has essentially no corrosion data for Alloy 22 above 120 ºC under repository-relevant conditions. Therefore, assessing the likelihood that localized corrosion could penetrate waste packages (causing them to fail) during the first few thousand years after repository closure is not possible currently. These uncertainties weaken the technical basis of the DOE's performance predictions.

Performance assessment calculations in the site recommendation show igneous activity to be the largest contributor to radioactive dose during the first 10,000 years. As discussed at the Board's September 2001 meeting, significant differences exist between Nuclear Regulatory Commission-sponsored models and the DOE models. The Board expressed its concerns about this situation in its October 17, 2001, letter to the DOE. On the basis of the reports of external experts, which were provided to the Board subsequent to that letter (all available at www.nwtrb.gov), the Board believes that the model proposed by the Nuclear Regulatory Commission-sponsored consultants may be overly conservative, and our concerns have lessened. However, because of the significance of igneous activity to the estimated dose, additional work leading to a better understanding of igneous consequences is needed to resolve this issue.

At the Board meeting and in a letter to the Board dated January 24, 2002, the DOE concluded that the hypotheses of hydrothermal upwelling proposed by Mr. Jerry Szymanski had been adequately addressed and may be discounted. These conclusions were based on the DOE's positive response to a Board recommendation that a joint federal-State of Nevada project be conducted to determine the ages of fluid inclusions at Yucca Mountain. A systematic joint study was coordinated by University of Nevada-Las Vegas scientists and can be considered a model for successful resolution of some contentious scientific issues. The Board concurs with the DOE's conclusions and considers this issue resolved. The Board also concurs with the stated commitment of the DOE to continue study of secondary minerals for the information they can provide about infiltration, flux rate, thermal effects, waste package geochemistry, paleohydrology, and radionuclide transport and to continue ongoing studies of the thermal history of the younger of the fluid inclusions.

Total System Performance Assessment

The DOE's compliance-oriented TSPA for site recommendation contains a mix of conservative, realistic, and nonconservative elements. Making performance estimates more realistic and characterizing the full range of uncertainty would increase confidence in the DOE's performance estimates and would provide a mechanism for assessing the magnitude of conservatism of the current compliance-oriented TSPA. Building confidence in the analyses is particularly important in light of the unique long-term implications of the policy decisions to be

made in the near future. A realistic analysis can yield a better understanding of the performance of the major subsystems for radioactive waste isolation at Yucca Mountain, and especially an improved understanding of the behavior of the unsaturated and saturated zones (without engineered barriers). To that end, the DOE should perform "one-on" TSPA dose calculations from waste initially exposed at the accessible environment boundary, then mitigated by transport through the unsaturated zone, then further mitigated by transport through the saturated zone, and finally mitigated by the cumulative effect of the engineered barrier system in concert with the natural barriers.

Clear and Effective Communication

Technical information and—as important—uncertainties associated with that information should be communicated clearly and effectively to decision-makers and the public. The meeting offered satisfactory and unsatisfactory examples of clear and effective communication. For example, the explanations presented at the Board meeting related to the evaluation of the uncertainties tabulated by the DOE were important and comprehensible. On the other hand, the risk curves of probability-weighted dose resulting from low-probability igneous events, although required for regulatory analyses, by themselves mislead diverse audiences who may be trying to better understand either the consequences or the probability of these events.

Thank you again for participating in the Board's meeting and for your cooperation with our ongoing efforts. We look forward to further interactions with the DOE on these issues.

Sincerely,

{Signed by}

Jared L. Cohon
Chairman