



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

January 29, 2007

The Honorable Nancy P. Pelosi
Speaker of the House
United States House of Representatives
Washington, DC 20515

The Honorable Robert C. Byrd
President Pro Tempore
United States Senate
Washington, DC 20510

The Honorable Samuel W. Bodman
Secretary
U.S. Department of Energy
Washington, DC 20585

Dear Speaker Pelosi, Senator Byrd, and Secretary Bodman:

The Nuclear Waste Technical Review Board was created by Congress in 1987 and charged with performing an independent evaluation of the technical and scientific validity of the Department of Energy's (DOE) activities related to disposing of, packaging, and transporting high-level radioactive waste and spent nuclear fuel. The Board is required to report its findings and recommendations at least twice yearly to Congress and the Secretary of Energy. A major focus of the Board's review is DOE's efforts to develop a proposed permanent repository for such wastes at Yucca Mountain in Nevada.

In accordance with provisions of the Nuclear Waste Policy Amendments Act, Public Law 100-203, the Board submits this letter report to Congress and the Secretary. The report, which is the Board's second report of 2006, contains summaries of Board findings and recommendations that were sent in letters to the Director of the Office of Civilian Radioactive Waste Management (OCRWM) following Board meetings held in February, May, and September of 2006 on the following subjects: processes affecting radionuclide transport; DOE's transport, aging, and disposal (TAD) canister concept; and the repository safety case. Also included is a short overview of Board findings from a letter and enclosures sent to the Director of OCRWM following a Board workshop on deliquescence-induced localized corrosion in September 2006. Finally, a synopsis of testimony presented in May 2006 by the Board's Chairman before the Senate Energy and Natural Resources Committee is provided. All documents on which the summaries are based may be accessed on the Board's Web site at www.nwtrb.gov.

Radionuclide Transport

Following a meeting on processes affecting radionuclide transport held in February 2006, the Board commented on DOE's work in this area in a March 6, 2006, letter to the Director of OCRWM. The Board expressed concern that methods used by DOE in its total system performance assessment (TSPA) do not properly represent the natural correlations of some specific parameters. For example, the Board noted that DOE's TSPA allows for combinations of physical parameters that produce extreme travel times in the hydrologic saturated zone (a decade or less and hundreds of thousands of years) that are not considered technically credible. Another example is that peak-dose sensitivity analyses indicate that seepage of water into the drifts is significant to dose but that percolation of the water that produces the seepage is not a significant parameter—a decoupling that is not well explained. The Board observed that improved treatment of parameter correlations can enhance the technical credibility of TSPA.

TAD Canister Concept

The Board met in May to discuss DOE's proposed TAD canister concept. In a follow-up letter dated June 14, 2006, to the Director of OCRWM, the Board observed that the TAD canister system could reduce the number of times individual spent-fuel assemblies are handled and consequently could improve facility throughput at Yucca Mountain. The Board noted that the TAD canister system also has the potential to simplify the design and reduce the cost of repository surface facilities. For these reasons, the Board found the TAD concept promising. However, the Board also noted that hurdles must be overcome for the potential advantages of a canister-based system to be realized fully. Among such challenges are timing of the availability of TAD's for storage at utility sites, reliance on construction and use of a rail line through Nevada for moving transportation casks from existing rail lines to the Yucca Mountain site, and the relationship of the TAD canister to the postclosure thermal-management strategy. The Board also noted that successful implementation of the concept could depend on resolving existing litigation between DOE and the nuclear utilities.

Repository Safety Case and Prototyping

Following a September meeting on DOE's repository safety case, the Board conveyed its views on DOE's efforts in a letter to the Director of OCRWM dated December 14, 2006. Among other things, the Board found that DOE's approach to developing a safety case may reflect an evolving understanding of its importance in building confidence in DOE estimates of repository performance. However, the Board concluded that work remains to be done in developing key elements of a comprehensive safety case. The Board found that each element of the safety case requires conceptual clarity and strong programmatic commitment to be credible and effective in supporting the safety case. Preclosure operations can have significant implications for postclosure performance; therefore, integration of preclosure activities with postclosure issues, such as repository design and thermal management, requires careful consideration.

In the same letter, the Board noted that efficacy of engineering designs—including operational processes—can be tested using prototyping. This is especially important in the case of the Yucca Mountain repository because many of the engineered elements are first-of-a-kind designs. Experience gained from engineering prototyping will enable OCRWM to identify potentially high-consequence design and operational flaws in an orderly and efficient manner. In addition, many engineering design specifications are important to TSPA calculations. Consequently, engineering prototyping can serve as an integrating mechanism and a cross-check for TSPA. Finally, engineering prototyping can be helpful as the repository program moves its focus from research and analysis to implementation.

Deliquescence-Induced Localized Corrosion

After its September workshop on localized corrosion, the Board sent its findings on DOE efforts to screen out deliquescence-induced localized corrosion from consideration in repository performance estimates to the Director of OCRWM on January 12, 2007. The Board found that significant uncertainties related to repository environments and to corrosion behavior at high temperatures persist and that there are apparent contradictions among some of DOE's experimental results. The Board believes that demonstrating an adequate technical basis for screening out deliquescence-based localized corrosion during the thermal pulse requires (1) determining the nitrate-to-chloride ratios that are inhibitive for the entire range of temperatures in which deliquescent brines may occur on waste package surfaces and (2) confirming the hypothesis that the preferential migration of nitrate ions into the crevice is sufficient to maintain nitrate-to-chloride ratios that are inhibitive.

Status of the Repository Program

In testimony before the Senate Energy and Natural Resources Committee on May 16, 2006, the Board's Chairman commented on the status of the repository program. In general, the Board found that DOE has made meaningful progress over the last year, especially in obtaining information on the performance capability of the engineered barrier system and on the chemistry, magnitude, and average rates of mountain-scale groundwater flow in the unsaturated and saturated zones. DOE also has used sophisticated simulation models for improving its ability to evaluate preclosure and postclosure performance as an integrated system. In addition, DOE has proposed a canister-based system to accommodate storage, transportation, and disposal of spent nuclear fuel that shows promise for reducing waste handling and simplifying repository surface facilities.

The Board found that there is considerable uncertainty about the source term incorporated in DOE's TSPA. (The source term refers to the compositions, kinds, and amounts of radionuclides that make up the source of a potential release of radioactivity from the engineered barrier system to the host rock.) To increase confidence in performance estimates, the Board suggested that DOE focus on analyzing the source term and on tracking radionuclides that are most significant to dose through the engineered and natural systems.

The Board will focus its evaluation in 2007 on technical issues that are most important to repository performance and on ways to enhance confidence in DOE's repository performance estimates. The Board looks forward to continuing to provide its technical and scientific perspective on these issues to Congress and the Secretary.

Sincerely,

{Signed by}

B. John Garrick
Chairman