



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

April 22, 2008

Mr. Edward F. Sproat III  
Director  
Office of Civilian Radioactive Waste Management  
U.S. Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585

Dear Mr. Sproat:

Thank you very much for participating in the U.S. Nuclear Waste Technical Review Board's meeting in Las Vegas, Nevada, on January 16, 2008. The Board appreciates your comments about issues related to the schedule for submitting a Yucca Mountain license application (LA) to the Nuclear Regulatory Commission (NRC). We understand from remarks you made on March 13, 2008, at an NRC conference that the Department of Energy (DOE) plans to submit a high-quality LA by late June of this year. The Board looks forward to updates on this and other program milestones. The Board also thanks the other DOE and DOE-contractor personnel who participated in the meeting. We believe that the technical content of the meeting was good and that the discussions were open and productive. The Board's comments on the discussions follow.

### **Deliquescence-Induced Localized Corrosion**

At the meeting, DOE representatives described corrosion research that is planned for the next several years. The plans do not appear to address issues that the Board has raised regarding deliquescence-induced localized corrosion. The Board continues to have questions about the technical basis for DOE's decision to exclude deliquescence-induced localized corrosion of waste packages from the total system performance assessment, as discussed in the Board's January 2007 and July 2007 letters to DOE.

Among other things, the Board noted in its January 2007 letter that DOE could strengthen the technical basis for screening out deliquescence-induced localized corrosion by (1) determining nitrate-to-chloride ratios inhibitive of localized corrosion over the *entire* range of temperatures at which brines could form on waste package surfaces due to deliquescence, and (2) showing that nitrate ions sufficient to maintain inhibitive nitrate-to-chloride ratios would preferentially migrate into crevices. DOE's November 20, 2007, letter to the Board discussed issues raised in the Board's January 2007 letter, but resolving most of the issues will require additional laboratory work. It appears that the national laboratories supporting DOE's work have the equipment and staff capabilities to perform the tests needed to resolve these two issues.

In its July 2007 letter, the Board stated that DOE should analyze the full range of factors that would affect nitrate-to-chloride ratios (e.g., organics in dust, acid-gas devolatilization, radiolysis). DOE's November 20, 2007, letter did not respond to that Board recommendation. How the waste package environment will evolve because of factors such as the passage of time, thermal conditions, radiolysis, or chemical reactions (e.g., reactions between nitrate salts and organic materials in the

dust that is deposited on waste packages) is important. The Board believes that a basic understanding of the evolution of the waste package environment due to *all* factors is needed.

Providing the evidence and analysis asked for in the Board letters is important because DOE's repository design will result in some waste-package surface temperatures that far exceed the boiling point of water during the first 2,000 years after repository closure. The results of laboratory studies performed by the U.S. Geological Survey (USGS) and presented at the Board meeting show that heating of dust on waste package surfaces in a Yucca Mountain repository may diminish nitrate concentration. Consequently, the Board strongly encourages DOE to make use of the USGS dust data as the program endeavors to characterize the evolution of likely waste package environments after repository closure.

### **Thermal-Loading Strategy**

At the Board meeting, DOE clarified its thermal-loading strategy for meeting the following four upper thermal limits related to repository performance and operations:

- mid-pillar temperature of 96°C
- drift-wall temperature of 200°C
- waste package outer-barrier temperature of 300°C
- commercial spent nuclear fuel cladding temperature of 350°C

DOE's analysis indicates that the 96°C mid-pillar thermal limit is controlling (i.e., if it is not exceeded, the other limits also will not be exceeded). However, the Board has questions about the technical basis for the 96°C mid-pillar temperature limit. The Board would like to see a better justification for this thermal limit and its relationship to the water movement and the assumed drainage of water in the mid-pillar area during the thermal pulse. If the 96°C mid-pillar temperature limit were eliminated, the 200°C drift-wall temperature would be the controlling thermal limit; this could increase flexibility in thermal loading of the repository and waste package sequencing. The Board also recommends that DOE investigate the feasibility and technical advantages of determining the thermal conditions at repository closure and varying the duration of the ventilation as needed to achieve thermal limits. Because DOE's current thermal limits will produce waste package surface temperatures that exceed 150°C, the potential for deliquescence-induced localized corrosion should be analyzed.

### **Surface-Facility Throughput**

In reviewing DOE's analysis of surface-facility throughput, the Board notes that DOE addresses each facility independently and assumes that all transportation system input (e.g., loaded transportation casks and empty waste packages) will be available on demand and that output (e.g., empty transportation casks and loaded waste packages) can be moved efficiently through the system. However, it seems highly likely that the amount of waste arriving at repository surface facilities will fluctuate, depending on factors such as the availability of transportation casks and transportation, aging, and disposal (TAD) containers. Fluctuations also may be caused by the ability of different utilities to load TADs and transportation casks and the timing of the loadings. More realistic modeling assumptions and a more integrated analytical approach may show, among other things, that additional transportation equipment and surface facilities will be required to achieve the desired throughput or that more waste will have to be stored on aging pads. These changes could significantly affect facility-design and operating costs as well as throughput. The changes also could affect safety because of the need for additional handling of the waste.

In DOE's letter to the Board dated April 11, 2008, DOE maintains that the design basis for the TAD-based repository includes "a certain amount of operational and design contingencies to account for uncertainties in the mix of TAD canistered to non-TAD canistered CSNF." DOE also states that the TAD concept is fully integrated into the waste management system and that the primary focus should be on evaluating potential event sequences and consequences associated with operation of the surface facilities at the *maximum* capacity and *maximum* rate of receipt, as required by regulation. At this point, the Board has not seen studies performed by DOE that demonstrate sufficient flexibility in the incoming waste stream, nor has the Board seen an integrated analysis of surface-facility systems that evaluates operational and safety risk. Moreover, confidence in the performance of surface facilities can be enhanced by analyzing surface facility operations under conditions of *minimum* capacity and a *maximum* rate of receipt, because the system will be most severely tested under these conditions. Accordingly, the Board recommends that an integrated throughput analysis be performed that includes all the surface facilities as a single, holistic system, uses realistic assumptions about transportation input and output, and demonstrates the robustness of the surface facility design to handle variations in the timing and characterization of the arriving waste shipments.

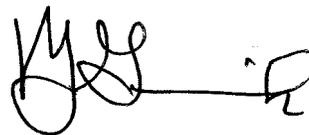
### **Transportation**

DOE representatives confirmed at the meeting that developing a waste management system using TADs makes the Nevada rail line necessary. As acknowledged in DOE's April 2008 letter to the Board, constructing a Nevada rail line will present significant institutional challenges. The Board, therefore, reiterates its recommendation that DOE initiate contingency planning to identify alternatives to rail that can be implemented if significant delays are encountered during construction of the rail spur. In addition, the Board understands that DOE has initiated a review of the capability of short-line railroads to move loaded TADs from utility sites to mainline connections. The Board looks forward to reviewing this evaluation.

In accordance with its congressional mandate, the Board will continue its ongoing review of the technical validity of DOE's activities related to DOE's implementation of the Nuclear Waste Policy Act. The Board remains especially interested in DOE's work that is related to localized corrosion and the in-drift environment and how these two issues could affect DOE's thermal strategy for emplacing waste in a Yucca Mountain repository.

Thank you again for your participation in the Board's January meeting.

Sincerely,

A handwritten signature in black ink, appearing to read "B. John Garrick". The signature is stylized with a large initial "B" and a long horizontal stroke extending to the right.

B. John Garrick  
Chairman