UNITED STATES
NUCLEAR REGULATORY COMMISSION
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April 23, 1999

MEMORANDUM TO: C. William Reamer, Chief
High-Level Waste and Performance
Assessment Branch, DWM/NMSS

THRU: Sandra L. Waster, Acting Section Leader
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SUBJECT: TRIP REPORT - SECOND DRIFT STABILITY WORKSHOP

I attended the second workshop on drift stability conducted by the expert panel set up by the U.S. Department of Energy (DOE), on April 13 and 14, 1999, in Las Vegas, NV. On April 15, 1999, I had discussions with DOE and its contractors on items related to the Design Basis Events (DBE) technical exchange held here at the U.S. Nuclear Regulatory Commission (NRC) on March 31, 1999. This trip report summarizes the workshop only. The discussions related to the DBE technical exchange will be summarized separately in meeting minutes currently under preparation.

You may recall that the expert panel on drift stability (the panel) met in December 1998 to look into the specific questions related to ground control and ground support for the underground facility at the Yucca Mountain site (see my trip report on the subject dated December 23, 1999). The panel submitted its first report on the subject in February 1999 and concluded that the rock mass characteristics, as encountered in the cross drift, were more favorable than anticipated based on pre-excavation investigations. The panel also concluded that a rock reinforcement system consisting of corrosion-protected rock bolts and heavy wire mesh appeared to be the most suitable ground control approach for the proposed emplacement drift design. The panel further concluded that the proposed "monitored geologic repository concept" would make it difficult to predict stability for the very long pre-closure period of 300 years. The panel gave its opinion that it would be prudent to significantly reduce this pre-closure time frame (to a duration under 100 years).

DOE had set up a separate consulting board (the board) to provide oversight to the exploratory studies facility design and construction groups. The services of the same board have been extended to provide oversight to the repository design. The board members were also present to observe the workshop proceedings. During the viability assessment designs, the board had recommended to DOE that precast concrete segments would provide the best long-term

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maintenance-free roof support for the waste emplacement drifts. However, DOE performance assessment groups have identified some uncertainties associated with a potential for long-term adverse impacts during the post-closure period. Thus, there are pro's and con's associated with the use of concrete for supporting the emplacement drift excavations. The panel considered during the first workshop, and appeared to continue to consider during the second workshop, that the jointed rocks that are loosened during excavation and then subjected to cycles of heating and cooling need to be reinforced by rock bolts. The board however, would recommend steel sets and lagging as the second best alternative ground control, and would conclude that the roof bolt system recommended by the panel may not be adequate for providing a maintenance-free ground support. The board also believes that for DOE to make a strong licensing case and avoid questions related to the uncertainties in the long-term behavior of the rock bolts and mesh, either the precast concrete segments, or the steel sets and lagging, would be the preferred alternatives.

Yet another important parameter that might make an impact on the roof support design, drift stability and performance assessment is if, and when, a backfill may be placed in the emplacement drifts. Dr. Charles Fairhurst (member, Advisory Committee for Nuclear Waste), expressed his (personal) preference for placing backfills which might remove several questions related to potential rock-falls on the waste packages. DOE's current design alternative has backfill as an optional feature. The panel will submit a letter-report to DOE in May 1999 which is expected to be available to NRC soon after.

There were several discussions related to numerical modeling, consideration of joints and discontinuities, laboratory and in situ test results, and intact and rock mass thermal and mechanical input parameters used in the analyses of underground facility performance. It became apparent that a wide ranging set of results could be calculated based on whether joints and fractures are considered in the analyses or not, and whether the input thermal and mechanical properties are derived from laboratory tests or from rock mass characteristics. The values of stresses and displacements calculated can vary significantly depending on the approach chosen for the analyses. The prediction of failures depends heavily on the estimated values of strength parameters which are extremely difficult to measure on a large scale. Lack of a precedence in designing openings that will be subjected to heating and cooling, and difficulty of maintaining the facility for very long periods, add to the other complexities and uncertainties discussed earlier. There is a need for NRC to follow DOE's design selection process and how the final design adopts an appropriate roof support alternative from among seemingly conflicting recommendations from the board and the panel.

For any clarifications or details of the workshop, I am available at (301) 415-6695, or through E-mail (msn1).

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