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TRANSMITTAL OF REPORT *TECHNICAL BASIS DOCUMENT NO. 4: MECHANICAL DEGRADATION AND SEISMIC EFFECTS*, ADDRESSING 14 KEY TECHNICAL ISSUE (KTI) AGREEMENTS RELATED TO REPOSITORY DESIGN AND THERMAL-MECHANICAL EFFECTS (RDTME)

This letter transmits *Technical Basis Document No. 4: Mechanical Degradation and Seismic Effects* (enclosure 1) and a compact disk (CD) of this report (enclosure 2). The CD contains a pdf file with 28,974 kilobytes, and is publicly available. This Technical Basis Document contains a summary of the stability of repository excavations and potential mechanical degradation under the action of in situ, thermal, and seismic stresses during the preclosure and postclosure time periods and provides the context within which individual KTI agreements related to mechanical degradation and seismic effects are addressed. Appendices A through H provide direct responses to the following RDTME KTIs:

Appendix A - Rock-Mass Classification for Lithophysal Rock (Response to RDTME 3.05)

Appendix B - Scoping Analysis of Input Data and Sensitivity and Uncertainty Analysis of Emplacement Drift Stability (Response to RDTME 3.06)

Appendix C - Rockfall in Emplacement Drifts (Response to RDTME 3.15, RDTME 3.16, RDTME 3.17, RDTME 3.19, and Gen 1.01 (Comment 3))

Appendix D - Analysis of Load Combination and Modeling Approach Related to Evaluation of Emplacement Drift Stability (Response to RDTME 3.02, RDTME 3.10, and RDTME 3.13)

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Appendix E - Site-Specific Properties of the Host Rock (Response to RDTME 3.04)

Appendix F - Design Sensitivity and Uncertainty Analyses of the Fracture Patterns with Discontinuum Approach (Response to RDTME 3.08 and RDTME 3.12)

Appendix G - Analysis of Rock Movement in Invert (Response to RDTME 3.09)

Appendix H - Continuum and Discontinuum Analyses of Ground Support System Performance (Response to RDTME 3.11)

The subject document is one in a series of Technical Basis Documents that are being prepared to describe the Yucca Mountain, Nevada, repository system components and processes which are important for predicting the likely postclosure performance of the repository. The information presented in these documents, along with the associated references, forms an outline of the postclosure safety analysis that is being developed for the License Application (LA). This information also responds to open KTI agreements made between the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Energy (DOE). Placing the responses to individual KTI agreements in the context of the applicable repository system components and processes allows for a more direct discussion of the relevance of the agreements to the postclosure safety analyses that will be presented in the LA. The goal of this approach is to provide a more direct and transparent discussion of the relevant KTI agreements.

The enclosed Technical Basis Document discusses projections of mechanical degradation and seismic effects. It includes a description of processes and associated models that are important to understanding in situ, thermal, and seismic stresses during the preclosure and postclosure periods. The document further identifies the interactions of the mechanical degradation of the emplacement drifts with the engineered barriers, in-drift environment, and water seepage into the emplacement drifts. This document places the responses to individual KTI agreements related to RDTME within the context of overall conceptual understanding of mechanical degradation and seismic effects, explains their relationship to preclosure functionality and postclosure safety analyses, and provides a discussion of the relevance of KTI agreements.

The DOE considers the KTI agreements covered in *Technical Basis Document No. 4: Mechanical Degradation and Seismic Effects* to be fully addressed, and pending review and acceptance by NRC, they should be closed.

There are no new regulatory commitments in the body of this letter or its enclosures. Please direct any questions concerning this letter and its enclosures to Carol L. Hanlon at (702) 794-1324 or e-mail carol_hanlon@ymp.gov, or Kirk D. Lachman at (702) 794-5096 or e-mail kirk_lachman@ymp.gov.

Joseph D. Ziegler, Director
Office of License Application and Strategy

OLA&S: CLH-1296

Enclosures:
1. *Technical Basis Document No. 4: Mechanical Degradation and Seismic Effects,* Revision 1
2. CD of Enclosure 1

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