UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 3, 1994

Mr. Ronald A. Milner, Acting Director
Office of Program Management
and Integration
Office of Civilian Radioactive
Waste Management
U.S. Department of Energy, RW 30
1000 Independence Avenue
Washington, DC 20585

SUBJECT: REVIEW OF ANNOTATED OUTLINE FOR THE DOE TOPICAL REPORT,(TR#2),"SEISMIC DESIGN METHODOLOGY FOR A GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN."

Reference: Topical Report YMP/TR-002-NP - "Methodology to Assess Fault Displacement and Vibratory Ground Motion Hazards at Yucca Mountain," June 1994, U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Las Vegas, Nevada (TR#1)

Dear Mr. Milner:

Your letter of August 22, 1994, to J. Holonich of the U.S. Nuclear Regulatory Commission, requested a scoping review of the annotated outline (AO) of the subject document, Topical Report (TR#2) on "Seismic Design Methodology for a Geologic Repository at Yucca Mountain." The AO was reviewed in the context of the status of the referenced topical report (TR#1), which NRC has not accepted for detailed review. NRC's reasons for not accepting the TR#1 for detailed review were lack of information on (1) deterministic approach in the methodology, (2) how structures would be located with respect to Type I Faults, and (3) use of expert elicitation. During a U.S. Department of Energy (DOE)/NRC meeting, on October 7, 1994, DOE stated that it planned to present all the above missing information, but that would be described elsewhere. DOE reiterated that it plans to submit three topical reports on the seismic design for the geologic repository at Yucca Mountain; TR#1 was a report on the hazard assessment methodology, TR#2 would be a report on the seismic design method (approach), and TR#3 would be a report on the details of the development of seismic design inputs. NRC stated that it needed to understand DOE's overall approach to seismic hazard assessment methodology and design, and had expected to find such a description in TR#1. As agreed to in the meeting of October 7, 1994, DOE should explain in an overview document/letter its approach to seismic design, items that will be addressed in the topical reports, where they will be presented, and the sequence of their presentation. NRC suggested a meeting to discuss this overview document to enable a clear understanding of DOE's approach to this topic.

Based on a review of the AO of TR#2, NRC staff has the following concerns which should be addressed by DOE in the Topical Report on Seismic Design Methodology.

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- It is clear from the AO of TR#2 that DOE intends to use the performance goal-based seismic design method for the design of the surface and subsurface facilities at Yucca Mountain. It is our understanding that this method has been developed primarily for surface facilities, for which a body of knowledge is available that is critical for determining the performance goals. Even with this knowledge, the use of a risk reduction-factor is essentially judgmental and may not be conservative for the repository surface facilities. Furthermore, this method, along with the risk reduction-factor, has not been applied to licensed nuclear facilities. The body of knowledge from which the performance goals can be derived may not be applicable for subsurface facilities, especially for the conditions that will exist in the repository (such as thermal and repetitive seismic loads, etc.). As a result, the appropriateness of implementing the performance goal-based seismic design method to the subsurface facilities is questionable, based on current knowledge. DOE needs to justify, with adequate supporting data on performance of subsurface facilities in repository environment, the appropriateness and applicability of this methodology.

- DOE has indicated that the post-closure performance will not be addressed by the subject topical report, but will be covered in the total system performance assessment of the site. It is not clear whether this statement implies that the performance goals mentioned in the AO are developed to exclude post-closure performance concerns; that is, to satisfy pre-closure performance measures only. If this is true, the ultimate seismic design for underground drifts and ground support systems may not be conservative from the point of view of meeting post-closure performance objectives of 10 CFR Part 60. DOE may provide a clarification on this item in its overview document/letter explaining its approach to seismic design for the repository.

- Although Section 2.0 of the AO of TR#2 indicates that both vibratory ground motion and fault displacement hazards will be addressed, the description of the contents in the outline for the following sections does not indicate how fault offsets will be assessed either deterministically or probabilistically. This topic should be addressed in some detail.

- The AO does not mention whether the potential effects of repetitive episodes of seismic loadings will be considered in the seismic design for underground drifts and ground support systems. The concern regarding such effects is the primary basis of Comment 121 in the Site Characterization Analysis (SCA). This comment recognizes the fact that the response and performance of a rock mass is determined by the amount of permanent joint deformation accumulated from a number of episodes of seismic activity. A rock mass becomes weaker as joint deformation accumulates. This weakening will substantially increase the potential for deleterious rock movement or fracturing of overlying or surrounding rock, leading to a noncompliance with regulatory requirement 10 CFR 60.133(e)(2). Such deleterious rock movement may change hydrological properties of and flow paths in the rock mass, and create preferential pathways, all of which may have serious implications for the repository post-closure performance. While the effects of

repetitive episodes of seismic loads are more important to post-closure concerns, they are also a potential concern for the stability of drifts during the approximately 100-year operational life of the facility, especially for retrievability, given the conditions that will exist in the repository. Without considering these potential adverse effects, the design may not be conservative, and it is not clear how the method to be proposed could/would address concerns of SCA Comment 121, which is a related open issue.

In summary, although the AO for the topical report on the seismic design methodology for a geologic repository at Yucca Mountain contains many items for describing the methodology needed to determine the appropriate seismic hazard levels for design, it is considered incomplete by the staff. The NRC concerns listed above should be addressed in the revised version of the AO of the topical report. During the proposed meeting to discuss the overview document/letter, the staff will provide any clarifications that DOE may need. We are prepared to meet with DOE at an early time. Should you have any questions on this, please contact Banad Jagannath at (301) 415-6653.

Sincerely,
(ORIGINAL SIGNED BY:)
Michael J. Bell, Chief
Engineering and Geosciences Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

cc: R. Loux, State of Nevada
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