



Department of Energy

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TOPICAL REPORT "METHODOLOGY TO ASSESS FAULT DISPLACEMENT AND VIBRATORY GROUND MOTION HAZARDS AT YUCCA MOUNTAIN" (SCPB: N/A)

- References:
- (1) Ltr, Shelor to Holonich, dtd 6/30/94
 - (2) Ltr, Bell to Milner, dtd 9/7/94
 - (3) Ltr, Brocoum to Bell, dtd 11/9/94
 - (4) Ltr, Bell to Milner, dtd 1/12/95
 - (5) Reactor Site Criteria Including Seismic and Earthquake Engineering Criteria for Nuclear Power Plants and Proposed Denial of Petition From Free Environment, Inc., et al., Federal Register Vol. 59, No. 199, 10/17/94

At the January 26, 1995, U.S. Department of Energy (DOE)/U.S. Nuclear Regulatory Commission (NRC) Technical Exchange on Seismic Hazard Assessment and Seismic Design, representatives of the two agencies discussed the NRC review of DOE topical report YMP/TR-002-NP, "Methodology to Assess Fault Displacement and Vibratory Ground Motion Hazards at Yucca Mountain" (also referred to as Seismic Topical Report I). At that technical exchange, the NRC requested that the DOE respond in writing to the January 12, 1995 NRC letter expressing four points related to the DOE seismic hazards program. This letter provides the requested DOE response.

By letter of June 30, 1994 (Reference 1), the DOE submitted the topical report YMP/TR-002-NP, "Methodology to Assess Fault Displacement and Vibratory Ground Motion Hazards at Yucca Mountain" to the NRC for review. This report was the first in a series of three topical reports by which DOE intends to describe the seismic hazard assessment and seismic design methodology and document the seismic design input for the potential geologic repository at Yucca Mountain, Nevada. Seismic Topical Report I describes the methodology that DOE will use for probabilistic

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seismic hazard assessment at Yucca Mountain. Seismic Topical Report II, currently in preparation, will describe the methodology for designing systems, structures, and components in a Yucca Mountain repository to withstand vibratory ground motion and fault displacement hazards during the preclosure time period. Seismic Topical Report III will describe the methodology for developing the seismic design bases values and document the preclosure seismic design input for the repository. Seismic Topical Report III will also provide the results of the probabilistic seismic hazard assessment (i.e., the application of Seismic Topical Report I methodology) and the results of deterministic seismic hazard evaluations, a component that has been reconsidered since the June 30, 1994 letter.

By letter of September 7, 1994 (Reference 2), the NRC found Seismic Topical Report I unacceptable for review, citing three concerns: (1) lack of a deterministic hazard assessment component; (2) lack of information on whether faults would be treated in accordance with the draft NRC Staff Technical Position on Consideration of Fault Displacement Hazards in Geologic Repository Design; and (3) lack of detail on the expert elicitation process associated with the probabilistic seismic hazard assessment. The DOE responded to these specific concerns by letter of November 9, 1994 (Reference 3). In that letter, DOE also provided an overview of the proposed Yucca Mountain seismic hazard assessment and seismic design process, and clarified the intended coverage of Seismic Topical Reports I, II, and III. The NRC responded to the DOE by letter of January 12, 1995 (Reference 4). The NRC response provided the staff's understanding of four particular issues, and it stated that the NRC is willing to initiate its review of the topical report based on that understanding. At the January 26, 1995, Technical Exchange on Seismic Hazard Assessment and Seismic Design, the NRC stated its desire to receive a letter from the DOE confirming the NRC's understanding prior to initiating the review of the topical report. Each NRC understanding is repeated verbatim below, followed by a DOE statement of agreement or clarification. NRC's understanding is largely consistent with DOE's intended approach, with the clarifications provided below.

NRC Staff Understanding 1

DOE stated in both the video conference [October 7, 1994] and the conference call [January 5, 1995] that it will provide the results from traditional deterministic hazard assessments for vibratory ground motion and fault displacement, in addition to presenting the probabilistic seismic hazard results. However, it is not clear to the NRC staff where these assessments will be presented.

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As previously discussed with the NRC, DOE intends to include in Topical Report III deterministic hazard evaluations for the sources that dominate the vibratory ground motion and fault displacement hazards at probabilities of exceedance that are appropriate for design. This approach is believed to be consistent with the proposed revisions to the NRC's seismic siting criteria for nuclear power plants (Reference 5). Furthermore, in response to concerns expressed by the NRC staff, DOE intends to include an additional deterministic evaluation that will assess the ground motions and fault displacement for the maximum magnitude earthquake and closest distance on the dominant seismic sources.

At the January 26, 1995 DOE/NRC Technical Exchange on Seismic Hazard Assessment and Seismic Design, NRC staff expressed the concern that some faults near the potential repository that may be considered important by the NRC staff could be overlooked. DOE believes that its proposed seismic hazard assessment methodology provides reasonable assurance that no fault important to the seismic safety or design of the potential Yucca Mountain facility will be overlooked. However, in order to address this regulatory concern, DOE also intends to provide NRC with the results of deterministic hazard evaluations, assuming the maximum earthquakes at closest distances on Type I faults within five kilometers of the Yucca Mountain site. In other words, DOE intends to ensure that the additional deterministic evaluations for the maximum magnitude earthquake and closest distance on the dominant seismic sources (discussed in the previous paragraph) will be performed for Type I faults within five kilometers of the site. These evaluations should utilize the maximum earthquake magnitudes and ground motion models that will be developed during the probabilistic hazard assessment. These deterministic evaluations should show the relation of the hazard from these maximum earthquakes on nearby seismic sources to the overall seismic hazard at the site. DOE intends to provide these evaluations to the NRC as part of Seismic Topical Report III.

NRC Staff Understanding 2

DOE also indicated in the November 9, 1994, letter that the DOE approach combines probabilistic and deterministic components in a manner similar to that outlined in Draft NRC Regulatory Guide DG-1032, "Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion." However, the staff needs clarification on how DOE will use DG-1032, and the exceedance probability mentioned in the Regulatory Guide, at Yucca Mountain.

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DOE has not committed to adopting DG-1032 for use at Yucca Mountain. DOE stated in the enclosure to its letter of November 9, 1994, that, "The DOE intends to apply an approach similar to those described in these documents [DG-1032 and the draft American Society of Civil Engineers Guideline, 'Seismic and Dynamic Analysis and Design Considerations for High Level Nuclear Waste Repositories'] to determine fault displacement and vibratory ground motion values appropriate for the seismic design of the Yucca Mountain facility SSCs. The approach will involve de-aggregating probabilistic seismic hazards at probability levels established by the seismic design requirements described in Topical Report II."

The DOE made this statement so the NRC would be aware that the approach that DOE intends to use is expected to be consistent with industry guidelines and with the approach that the NRC Office of Nuclear Reactor Regulation will adopt for nuclear power reactors. The DOE recognizes that NRC and industry guidance are evolving, and the DOE's approach for a geologic repository at Yucca Mountain may differ from the NRC's guidance for nuclear power reactors, once that guidance is finalized. Furthermore, the DOE agrees with the NRC position that nuclear power reactor seismic design regulations and guidance are not applicable to the geologic repository program.

The DOE will provide the NRC with the development and justification of seismic safety performance goals for different safety performance categories at Yucca Mountain in Topical Report II. The DOE will describe to the NRC the de-aggregation and development of seismic design inputs in Topical Report III. We do not believe the resolution of these issues is needed for the NRC review of Seismic Topical Report I, which describes the probabilistic seismic hazard assessment methodology, since the methodology can be applied for any appropriate seismic safety performance goal.

NRC Staff Understanding 3

DOE will use an expert opinion elicitation process similar to that of the Electric Power Research Institute, and this process will be explained in a forthcoming study plan. The staff notes that it may not be able to complete its review of the Topical Report pending receipt and review of the study plan.

The NRC staff's understanding is correct. The DOE intends to use a structured process to obtain consistent interpretations of seismic sources, source characteristics, and ground motion relationships and uncertainty in these interpretations as the bases for quantifying the vibratory ground motion and fault

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displacement hazards at the Yucca Mountain site. The process is expected to be essentially the same as the Electric Power Research Institute methodology. The DOE will describe the expert elicitation process in Study Plan 8.3.1.17.3.6, "Probabilistic Seismic Hazard Assessment." DOE anticipates that this study plan will be transmitted to the NRC for review in April 1995.

NRC Staff Understanding 4

The approach that will be used by DOE for considering Type I faults, when locating systems, structures, and components important to safety and waste isolation, will be consistent with NRC's guidance document NUREG-1494.

The DOE stated in its November 9, 1994 letter (Reference 3), "The approach that will be taken for considering Type I faults when locating important safety systems, structures, and components is part of the overall design methodology that will be described in Seismic Topical Report II. It is anticipated that this approach will be consistent with the technical positions concerning hazards resulting from fault displacement at a geologic repository, as contained in the NRC's guidance document NUREG-1494, 'Consideration of Fault Displacement Hazards in Geologic Repository Design.'"

The above statement expresses an intention. We are developing our approach now, and we expect that the design methodology presented in Topical Report II will be consistent with the guidance in NUREG-1494.

In conclusion, the NRC's understanding of the DOE seismic hazards program, as stated in the letter of January 12, 1995 (Reference 4), is largely consistent with the DOE's intended approach. Clarification is provided herein on the first, second, and fourth points. Commitments made by the DOE to the NRC are summarized and included in Enclosure 1.

We believe that we have been responsive to the NRC concerns, and that there are no outstanding issues that should prevent the NRC from initiating its review of Seismic Topical Report I. In addition, we believe that an early review of this report would significantly advance the overall regulatory review of the seismic design of the potential Yucca Mountain repository. Accordingly, the DOE requests that the NRC initiate its review of

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the topical report. If you have any questions, please contact either April V. Gil at (702) 794-7622 or J. Timothy Sullivan at (702) 794-7915.

for 
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AMSL:AVG-2174

Enclosure:
List of Commitments

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cc w/encl:

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Enclosure

Department of Energy (DOE) Commitments

The specific commitments made by the DOE to the NRC in this letter are collected and listed below.

1. Seismic Topical Report II, currently in preparation, will describe the methodology for designing systems, structures, and components in a Yucca Mountain repository to withstand vibratory ground motion and fault displacement hazards during the preclosure time period.
2. Seismic Topical Report III will describe the methodology for developing the seismic design bases values and document the preclosure seismic design input for the repository. Seismic Topical Report III will also provide the results of the probabilistic seismic hazard assessment (i.e., the application of Seismic Topical Report I methodology) and the results of deterministic seismic hazard evaluations.
3. The DOE will provide the NRC with the development and justification of seismic safety performance goals for different safety performance categories at Yucca Mountain in Topical Report II.
4. The DOE will describe to the NRC the de-aggregation and development of seismic design inputs in Topical Report III.
5. The DOE will describe the expert elicitation process in Study Plan 8.3.1.17.3.6, "Probabilistic Seismic Hazard Assessment."