



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE AND MATERIALS
WASHINGTON, D.C. 20555-0001

ACNWMR-0277

January 8, 2008

The Honorable Dale E. Klein
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: SEISMIC DESIGN OF PRE-CLOSURE FACILITIES AT THE PROPOSED
YUCCA MOUNTAIN GEOLOGIC REPOSITORY OPERATIONS AREA

Dear Chairman Klein:

At its 183rd meeting the Advisory Committee on Nuclear Waste & Materials (ACNW&M or the Committee) conducted a working group meeting to examine how the NRC seismic design requirements for the proposed Yucca Mountain repository compare with other NRC-licensed nuclear facilities. The Committee was interested in the relative stringency of the pre-closure surface facilities seismic design requirements for the proposed repository, in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada," compared with other seismic regulations for facilities.

Previously, the NRC staff developed supplemental guidance in the form of Interim Staff Guidance-01 (DHLWRS ISG-01–NRC, 2006) regarding the effects of seismic hazards on the geologic repository operations area (GROA) systems, structures, and components (SSCs) important to safety. The purpose of the supplemental guidance was to clarify the approach in the NUREG-1804, "Yucca Mountain Review Plan," (NRC 2003) that the staff plans to follow in its review of the U.S. Department of Energy's (DOE) pre-closure GROA seismic design. In developing this guidance, stakeholders — the Nuclear Energy Institute and the Electric Power Research Institute — suggested that DHLWRS ISG-01 could have the unintended consequence of imposing more stringent seismic design requirements on Yucca Mountain pre-closure GROA facilities than exist for nuclear power reactors. In particular, they were concerned that rare, large magnitude seismic events would need to be explicitly addressed in the design of the GROA in order to meet the 10 CFR 63.111(b) performance objectives, and subsequently introduce an excessive safety margin and cost into the GROA.

Observations

As a result of its review, the Committee observes that NRC's approach to seismic design requirements and performance objectives for the GROA are different from the seismic design approaches used at other NRC licensed facilities. Prior to 10 CFR Part 63, the Commission's regulations specified a minimum seismic design basis for SSCs important to safety in terms of a mean annual exceedance of probability for a specific seismic event. By contrast, consistent with the Commission's 1995 Probabilistic Risk Assessment Policy Statement, the

Yucca Mountain site-specific regulation calls for the evaluation of an event sequence¹ that takes into account both the seismic hazard and the structural fragilities of SSCs important to safety in the event sequence. The regulations in 10 CFR Part 63 require the NRC to consider probabilities of occurrence and event sequences rather than deterministic designs of an individual SSC for a single seismic event.

A comparison between the event sequence-based probabilistic performance requirements of 10 CFR Part 63 and the event-based deterministic requirements of other NRC regulations requires normalizing the respective regulations. The Committee believes that a comparative (normalizing) analysis is not needed because the event-based consequence analysis is similar to procedures successfully employed by NRC licensees using a seismic margins approach to the design of nuclear power reactors. Furthermore, the methodology specified in DHLWRS ISG-01 is consistent with the American Society of Civil Engineers (ASCE) consensus standard ASCE/SEI 43-05 (ASCE, 2005) on seismic design criteria for nuclear facilities. This consensus standard has been recently used by the staff in its review of the mixed-oxide fuel fabrication facility.

Both the DOE (2007) and the NRC staffs believe that the 10 CFR Part 63 design approach as specified in DHLWRS ISG-01 is workable and can be met without undue burden. Only a modest number of SSCs are important to safety, and a small source term is expected within the GROA spent fuel handling facilities at any time.

Conclusion

The Committee supports the interim staff guidance (DHLWRS ISG-01) provided by the NRC staff. We note that the approach specified in this guidance has proven useful in previous seismic design reviews of nuclear facilities. DHLWRS ISG-01 is consistent with the recent ASCE consensus standard for design criteria, and the DOE and NRC find the approach workable without placing undue effort on the licensee.

Sincerely,

/RA/

Michael T. Ryan
Chairman

References

1. American Society of Civil Engineers, ASCE/SEI 43-05, "Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities." ASCE Nuclear Standards Committee: Reston, VA. 2005.

¹ As described in 10 CFR Part 63 ("Definitions"), *event sequence* means a series of actions and/or occurrences within the natural and engineered components of the GROA that could potentially lead to exposure of individuals to radiation. An event sequence includes one or more initiating events and associated combinations of repository system component failures, including those produced by the action or inaction of operating personnel. Those event sequences that are expected to occur one or more times before permanent closure of the GROA are referred to as Category 1 event sequences. Other event sequences that have at least a 1 in 10,000 chance of occurring before permanent closure are referred to as Category 2 event sequences.

2. U.S. Department of Energy, YMP/TR-003-NP, Rev. 5, "Preclosure Seismic Design and Performance Demonstration Methodology for a Geologic Repository at Yucca Mountain Topical Report." Office of Civilian Radioactive Waste Management: Las Vegas, NV. June 2007.
3. US. Nuclear Regulatory Commission, NUREG-1804, Rev. 2, "Yucca Mountain Review Plan – Final Report." Office of Nuclear Materials Safety and Safeguards. July 2003.
4. U.S. Nuclear Regulatory Commission, "Review Methodology for Seismically Initiated Event Sequences; Availability of Final Interim Staff Guidance Document [Notice of Availability]." *Federal Register*. Vol. 71, No. 189, pp. 57579-57584. September 29, 2006.

2. U.S. Department of Energy, YMP/TR-003-NP, Rev. 5, "Preclosure Seismic Design and Performance Demonstration Methodology for a Geologic Repository at Yucca Mountain Topical Report." Office of Civilian Radioactive Waste Management: Las Vegas, NV. June 2007.
3. US. Nuclear Regulatory Commission, NUREG-1804, Rev. 2, "Yucca Mountain Review Plan – Final Report." Office of Nuclear Materials Safety and Safeguards. July 2003.
4. U.S. Nuclear Regulatory Commission, "Review Methodology for Seismically Initiated Event Sequences; Availability of Final Interim Staff Guidance Document [Notice of Availability]." *Federal Register*. Vol. 71, No. 189, pp. 57579-57584. September 29, 2006.

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