



Department of Energy
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Office of Nuclear Material
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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Linehan:

The Department of Energy (Department) is preparing comments on the Nuclear Regulatory Commission's (NRC) draft technical position on methods of evaluating the seismic hazard at a geologic repository, published on August 24, 1989, (54 FR 35266). The Department recognizes the importance of the issue and is concerned with a number of elements in the proposed technical position.

The draft technical position states that the NRC's position is that the methodologies prescribed in Appendix A of 10 CFR Part 100 (Appendix A) are considered to be appropriate for addressing preclosure and postclosure seismic and faulting hazards at a geologic repository operations area. The Department notes that while the application of Appendix A has resulted in safely designing nuclear power plants, numerous licensing hearings have been controversial and lengthy resulting in costly delays because of problems interpreting the intent and meaning of the terminology contained in Appendix A.

The primary disadvantage with Appendix A is that the terminology and concepts contained within the regulation are out-of-date. As discussed at an NRC sponsored conference (LLNL 1987), "A revision of Appendix A is desired because the regulation is out-of-date, hard to use, and the cause of licensing delays." The regulation was codified in November, 1973 and is based on state-of-the-art professional practice of the late 1960's. At that time it was hoped that seismicity could be related to specific geologic structures and the theory of plate tectonics was just beginning to be developed. Indeed, it was recognized as early as 1979 that Appendix A was likely to need revision. As discussed in a report to the USNRC Commissioners (SECY-79-300) "the staff is inhibited in certain parts of its review from using state-of-the-art because Appendix A, as a regulation, cannot be easily modified to accommodate developments in science or engineering methodology. ... the validity of various procedures employed in the geologic and seismic review process has been increasingly questioned by experts in the earth science community familiar with these current

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procedures." Appendix A dictates burdensome and unnecessary investigations that don't or may not relate to estimation of future seismicity and seismic design values. Numerous technical advancements have occurred since that time, particularly with respect to fault and earthquake hazard assessment, including incorporation of probabilistic seismic hazard evaluation. Careful application of such technical advancements may make it possible to avoid many of the difficult concepts and terminology in Appendix A.

The difficulties in the use of terminology contained in Appendix A, including the role that deterministic and probabilistic methods have, was summarized as follows in LLNL (1987): "An important issue in revising Appendix A is whether the modifications produce more, less, or about the same level of conservatism as currently exists. The current level of conservatism is unspecified and only implied with terms like "without undue risk" and "maximum." Thus, some of the central issues are issues of probabilistic vs. deterministic approaches and how to assess the conservatism implied in the current definition of terms such as "undue risk" and "maximum." Such terms imply a hidden probabilistic assessment that makes it difficult to determine which outliers should be included or excluded in the specification of the SSE (Safe Shutdown Earthquake). In the end, such statements philosophically take the decision out of the political arena and put it into the hands of the technical specialists." The process of determining the appropriate seismic design for a given facility should be as explicit as possible in terms of needed conservatism, removing such judgements from individual technical specialists.

It should be recognized that Appendix A has never been applied to a site in a geologic setting such as the Southern Basin and Range, where Quaternary faults are common but the time between earthquakes is very long. The seismic hazard at a site is determined not only by an earthquake's size and proximity, but also by its recurrence time. In practice, terms contained within Appendix A, such as greatest magnitude and maximum vibratory ground motion are evaluated independent of an earthquake's recurrence time, contrary to present state-of-the-art. Additionally, the application of Appendix A has generally resulted in the vibratory ground motion being equivalent to an 84th percentile of the assumed motion. The Department believes that the choice of the ground motion percentile should also not be judged independent of the recurrence interval.

Appendix A incorporates concepts that are explicitly tied to reactor safety that are not appropriate for a repository. One of these reactor concepts is that of the safe shutdown earthquake, the definition of which is clearly linked to reactor structures, systems, and components. Use of the terms in Appendix A would presume that a nuclear power reactor is being sited and would not take into account the differences between a nuclear power reactor and a nuclear waste repository with respect to components and potential accident scenarios and consequences. The surface facilities of a geologic repository are likely to have a very different risk profile compared to a nuclear power plant and the design of the surface facilities should consider this. Other concepts such as underground vibratory ground motion and postclosure tectonic scenarios are topics not contained within Appendix A, which require evaluation for a geologic repository. Thus, Appendix A is incomplete in providing guidance on these topics.

The Department notes that a recent revision of DOE Order 6430.1A (United States Department of Energy General Criteria), which is applicable to non-reactor DOE facilities, incorporates probabilistic criteria for seismic design, including specific criteria for vibratory ground motion input and seismic engineering analytical methods. The approach described in DOE Order 6430.1A represents the current state-of-the-art in terms of seismic design requirements, and may be of sufficient scope and conservatism to meet the appropriate 10 CFR Part 60 requirements. We look forward to discussing the concepts in DOE Order 6430.1A with you, to determine if the seismic design methods discussed in the Site Characterization Plan are sufficient to meet the design requirements specified in 10 CFR Part 60.

In summary, the Department believes that there are numerous disadvantages with the potential use of Appendix A for development and evaluation of a geologic repository. These disadvantages have been recognized by the NRC staff on more than one occasion (SECY 79-300, LLNL 1979). The Department is in the process of preparing its final comments on this subject. Considering the importance of the seismic hazard topic and the nature of our concerns, we believe that it would be appropriate to defer finalizing this technical position pending the outcome of detailed discussions between the Department and the NRC on this topic as part of the upcoming scheduled technical exchanges on tectonics.

Please feel free to contact Mr. Jeffrey K. Kimball of the Siting and Geosciences Branch at 586-1063 or Mr. Steven H. Rossi of my staff at 586-9433 with any questions regarding this correspondence.

Sincerely,



Gordon Appel, Chief
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Reference: Lawrence Livermore National Laboratory, Summary Report of the Symposium on Seismic and Geologic Siting Criteria for Nuclear Power Plants, NUREG/CP-0087, June 1987.