

attenuation models, and to determine ground motion estimates, are outlined in NUREG-0800, Section 2.5.2.

Methods acceptable to the NRC for implementing the revised regulation related to the PSHA or suitable sensitivity analyses are described in RG 3.73.

### 3. Revise the Design Earthquake Ground Motion

The present DE in part 72 is based on the deterministic requirements contained in Appendix A to 10 CFR Part 100 for NPPs. In the Statement of Considerations accompanying the initial part 72 rulemaking, the NRC recognized that the required design earthquake need not be as high as for an NPP and should be determined on a "case-by-case" basis until "more experience is gained with licensing of these types of units" (45 FR 74697; November 12, 1980). With the advances in probabilistic seismic hazard evaluation techniques, over 10 years of experience in licensing dry cask storage (10 specific licenses have been issued and 9 locations use the general license provisions), and analyses demonstrating robust behavior of dry cask storage systems (DCSSs) in accident scenarios, the NRC now has a reasonable basis to consider more appropriate DE parameters for a dry cask ISFSI or MRS. Therefore, in those instances when an ISFSI or MRS specific-license applicant uses PSHA methods, the NRC will allow a DE commensurate with the lower risk associated with these facilities.

I. Factors that result in the lower radiological risk at an ISFSI or MRS compared to an NPP include the following:

a. In comparison with an NPP, an operating ISFSI or MRS is a passive facility in which the primary activities are waste receipt, handling, and storage. An ISFSI or MRS does not have the variety and complexity of active systems necessary to support an operating NPP. After the spent fuel is in place, an ISFSI or MRS is essentially a static operation.

b. During normal operations, the conditions required for the release and dispersal of significant quantities of radioactive materials are not present. There are no components carrying fluids at high temperatures or pressures during normal operations or under design basis accident conditions to cause the release and dispersal of radioactive materials. This is primarily due to the low heat-generation rate of spent fuel that has undergone more than one year of decay before storage in an ISFSI or MRS, and to the low inventory of volatile radioactive materials readily available for release to the environment.

c. The long-lived nuclides present in spent fuel are tightly bound in the fuel materials and are not readily dispersible. Short-lived volatile nuclides, such as I-131, are no longer present in aged spent fuel. Furthermore, even if the short-lived nuclides were present during a fuel assembly rupture, the canister surrounding the fuel assemblies would confine these nuclides. Therefore, the NRC believes that the seismically induced radiological risk associated with an ISFSI or MRS is significantly less than the risk associated with an NPP.

II. Additional rationale for allowing the use of a DE level commensurate with the risk associated with an ISFSI or MRS includes the following:

a. Because the DE is defined as a smooth broad-band spectrum, which envelops the controlling earthquake responses, the vibratory ground motion specified is conservative.

b. To evaluate dry cask storage systems' behavior during an earthquake, typical storage systems (one a cylindrical cask, HI-STORM 100, the other a concrete module type, NUHOMS) were analyzed for a range of earthquakes. Based on the results of the analyses, the NRC has concluded that a free-standing dry storage cask remains stable and will not tip-over, or would not slide and impact the adjacent casks during an earthquake approximately equal to the magnitude of a SSE for an NPP. Additionally, parametric studies indicated that dry cask storage systems have significant margins against tip-over and sliding, to withstand an earthquake significantly higher in magnitude than the SSE for an NPP, without releasing radioactivity. Further, a cask is analyzed for a non-mechanistic tip-over event during an earthquake, to verify that it would maintain its structural integrity, and radioactivity from spent fuel would not be released to the environment. Therefore, based on drop accident analyses and non-mechanistic tip-over event evaluations, and on the results of the generic studies for the cask behavior during an earthquake, it can be concluded that there would be no radiological consequences at a dry cask ISFSI or MRS facility due to an earthquake.

c. The rationale for allowing a DE for an ISFSI or MRS to be lower than a DE for an NPP is consistent with the approach used in DOE Standard DOE-STD-1020, "Natural Phenomena Hazards Design Evaluation Criteria for Department of Energy Facilities."

Regulatory Guide 3.73 (formerly DG-3021) recommends an acceptable mean annual probability of exceedance (MAPE) for the DE that is commensurate

with the lower risk associated with an ISFSI or MRS as compared to an NPP. The basis for the recommendation is provided in a report entitled, "Selection of the Design Earthquake Ground Motion Reference Probability". This report may be accessed through the NRC's Public Electronic Reading Room on the Internet at <http://www.nrc.gov/reading-rm/adams.html>. If you do not have access to ADAMS or if there are problems in accessing the documents located in ADAMS, contact the NRC's PDR reference staff at 1-800-397-4209, 301-415-4737, or by email to [pdr@nrc.gov](mailto:pdr@nrc.gov). Discussion on the recommended mean annual probability of exceedance is also in Section VI of this FRN, "Summary of Public Comments on the Proposed Rule."

### C. Change to 10 CFR 72.212(b)(2)(i)(B)

The NRC is modifying § 72.212(b)(2)(i)(B) to require that general licensees evaluate dynamic loads, in addition to static loads, in the design of cask storage pads and areas for ISFSIs to ensure that casks are not placed in unanalyzed conditions. During a seismic event, the cask storage pads and areas experience dynamic loads in addition to static loads. The dynamic loads depend on the interaction of the casks, cask storage pads, and areas. Consideration of the dynamic loads of the stored casks, in addition to the static loads, for the design of the cask storage pads and areas, will ensure that the cask storage pads and areas will perform satisfactorily during a seismic event.

The revision will also require consideration of potential amplification of earthquakes through soil-structure interaction, and soil liquefaction potential or other soil instability due to vibratory ground motions. Depending on the properties of soil and structures, the free-field earthquake acceleration input loads may be amplified at the top of the storage pad. These amplified acceleration input values must be bound by the design bases seismic acceleration values for the cask, specified in the Certificate of Compliance. Liquefaction of the soil and instability during vibratory motion due to an earthquake may affect the cask stability.

The changes to § 72.212 will not actually impose a new burden on the general licensees because they currently need to consider dynamic loads to meet the requirements in § 72.212(b)(2)(i)(A). Section 72.212(b)(2)(i)(A) requires that general licensees perform written evaluations to meet conditions set forth in the cask Certificate of Compliance. These Certificates of Compliance require that dynamic loads, such as seismic and