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NUCLEAR REGULATORY COMMISSION

10 CFR Part 72

RIN 3150-AG93

Geological and Seismological Characteristics for Siting and Design of Dry Cask Independent Spent Fuel Storage Installations and Monitored Retrievable Storage Installations

AGENCY: Nuclear Regulatory Commission.

ACTION: Final rule.

SUMMARY: The Nuclear Regulatory Commission (NRC) is amending its licensing requirements for dry cask modes of storage of spent nuclear fuel, high-level radioactive waste, and power reactor-related Greater than Class C (GTCC) waste in an independent spent fuel storage installation (ISFSI) or in a U.S. Department of Energy (DOE) monitored retrievable storage installation (MRS). These amendments update the seismic siting and design criteria, including geologic, seismic, and earthquake engineering considerations. The final rule allows the NRC and its licensees to benefit from experience gained in the licensing of existing facilities and to incorporate rapid advancements in the earth sciences and earthquake engineering. The amendments make the NRC regulations that govern certain ISFSIs and MRSs more compatible with the 1996 amendments that addressed uncertainties in seismic hazard analysis for nuclear power plants. The amendments allow certain ISFSI or MRS applicants to use a design earthquake level commensurate with the risk associated with an ISFSI or MRS.

EFFECTIVE DATE: This final rule is effective on **(insert 30 days from date of publication)**.

FOR FURTHER INFORMATION CONTACT: Keith K. McDaniel, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, telephone: (301) 415-5252, e-mail: kkm@nrc.gov.

SUPPLEMENTARY INFORMATION:

I. Background

In 1980, the NRC added 10 CFR Part 72 to its regulations to establish licensing requirements for the independent storage of spent nuclear fuel and high-level radioactive waste (HLW) (45 FR 74693; November 12, 1980). In 1988, the NRC amended Part 72 to provide for licensing the storage of spent nuclear fuel and HLW in an MRS (53 FR 31651; August 19, 1988). Subpart E of Part 72 contains siting evaluation factors that must be investigated and assessed with respect to the siting of an ISFSI or MRS, including a requirement for evaluation of geological and seismological characteristics. ISFSI and MRS facilities are designed and constructed for the interim storage of spent nuclear fuel that has aged for at least one year, other solidified radioactive materials associated with spent fuel storage, and power reactor-related GTCC waste, that are pending shipment to a high-level radioactive waste repository or other disposal site.

The original regulations envisioned ISFSI and MRS facilities as spent fuel pools or single, massive dry storage structures. The regulations required seismic evaluations equivalent to those for a nuclear power plant (NPP) when the ISFSI or MRS is located west of the Rocky Mountain Front (west of approximately 104^0 west longitude), referred to hereafter as the western U.S., or in areas of known seismic activity east of the Rocky Mountain Front (east of approximately 104^0 west longitude), referred to hereafter as the eastern U.S. A seismic design requirement, equivalent to the requirements for an NPP (Appendix A to 10 CFR Part 100) seemed appropriate for these types of facilities, given the potential accident scenarios. For those sites located in the eastern U.S., and not in areas of known seismic activity, the regulations allowed for less stringent alternatives.

For other types of ISFSI or MRS designs, the regulation required a site-specific investigation to establish site suitability commensurate with the specific requirements of the proposed ISFSI or MRS. The NRC explained that for ISFSIs which do not involve massive structures, such as dry storage casks and canisters, the required design earthquake will be determined on a case-by-case basis until more experience is gained with the licensing of these types of units (45 FR 74697).

For sites located in either the western U.S. or in areas of known seismic activity in the eastern U.S., the regulations in 10 CFR Part 72 currently require the use of the procedures in Appendix A to Part 100 for determining the design basis vibratory ground motion at a site. Appendix A requires the use of "deterministic" approaches in the development of a single set of earthquake sources. The applicant develops for each source a postulated earthquake to be used to determine the ground motion that can affect the site, locates the postulated earthquake according to prescribed rules, and then calculates ground motions at the site.

Advances in the sciences of seismology and geology, along with the occurrence of some licensing issues not foreseen in the development of Appendix A to Part 100, have caused a number of difficulties in the application of this regulation. Specific problematic areas include the following:

1. Because the deterministic approach does not explicitly recognize uncertainties in geoscience parameters, probabilistic seismic hazard analysis (PSHA) methods were developed that allow explicit expressions for the uncertainty in ground motion estimates and provide a means for assessing sensitivity to various parameters. Appendix A to Part 100 does not allow this application.

2. The limitations in data and geologic/seismic analyses, and the rapid evolution in geosciences have required considerable latitude in technical judgment. The inclusion of detailed geoscience assessments in Appendix A has inhibited the use of needed judgment and flexibility in applying basic principles to new situations; and

3. Various sections of Appendix A are subject to different interpretations. For example, there have been differences of opinion and differing interpretations among experts as to the largest earthquakes to be considered and ground motion models to be used, thus often making the licensing process less predictable.

In 1996, the NRC amended 10 CFR Parts 50 and 100 to update the criteria used in decisions regarding NPP siting, including geologic and seismic engineering considerations for future NPPs (61 FR 65157; December 11, 1996). The amendments added a new § 100.23 requiring that the uncertainties associated with the determination of the Safe Shutdown Earthquake Ground Motion (SSE) be addressed through an appropriate analysis, such as a PSHA or suitable sensitivity analyses in lieu of Appendix A to Part 100. This approach takes into account the problematic areas identified above in the earlier siting requirements and is based on developments in the technical field over the past two decades. Further, regulatory guides have been used to address implementation issues. For example, the NRC provided guidance for NPP license applicants in Regulatory Guide 1.165, “Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion,” and Standard Review Plan NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Reactors,” Section 2.5.2, “Vibratory Ground Motion,” Revision 3. However, the NRC left Appendix A to Part 100 in place to preserve the licensing basis for existing plants and confined the applicability of § 100.23 to new NPPs.

The NRC is now amending 10 CFR Part 72 to require applicants at some locations to address uncertainties in seismic hazard analysis by using appropriate analyses, such as a PSHA or suitable sensitivity analyses, for determining the design earthquake ground motion (DE). The use of a probabilistic approach or suitable sensitivity analyses to siting parallels the change made to 10 CFR Part 100.

In comparison with an NPP, an operating dry cask ISFSI or MRS facility storing spent nuclear fuel is a passive facility in which the primary activities are waste receipt, handling, and storage. An ISFSI or MRS facility does not have the variety and complexity of active systems necessary to support safe operations at an NPP. Further, the robust cask design required for non-seismic considerations (e.g., drop event, shielding), assure low probabilities of failure from seismic events. In the unlikely occurrence of a radiological release as a result of a seismic event, the radiological consequences to workers and the public are significantly lower than those that could arise at an NPP. The conditions required for release and dispersal of significant quantities of radioactive material, such as high temperatures or pressures, are not present in an ISFSI or MRS. 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. 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 is designed to confine these nuclides.

The standards in Part 72 Subparts E, “Siting Evaluation Factors,” and F, ”General Design Criteria,” ensure that the dry cask storage designs are very rugged and robust. The

casks must maintain structural integrity during a variety of postulated non-seismic events, including cask drops, tip-over, and wind driven missile impacts. These non-seismic events challenge cask integrity significantly more than seismic events. Therefore, the casks have substantial design margins to withstand forces from a seismic event greater than the design earthquake.

Hence, the seismically induced risk from the operation of an ISFSI or MRS is less than at an operating NPP. As a result, the NRC is revising the DE requirements for ISFSI and MRS facilities from the current Part 72 requirements, which are equivalent to the SSE for an NPP.

As an additional minor change, the NRC is modifying § 72.212(b)(2)(i)(B) to require general licensees to 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. Accounting for dynamic loads in the analysis of ISFSI pads and areas will ensure that pads continue to support the casks during seismic events. General licensees currently evaluate dynamic loads for evaluating the casks, pads and areas, to meet the cask design bases in the Certificate of Compliance, as required by § 72.212(b)(2)(i)(A). Therefore, the rule will not actually require any general licensees operating an ISFSI to re-perform any written evaluations previously undertaken. Specific licensees are currently required, under § 72.122(b)(2), to design ISFSIs to withstand the effects of dynamic loads, such as earthquakes and tornados.

The NRC published the proposed rule, “Geological and Seismological Characteristics for Siting and Design of Dry Cask Independent Spent Fuel Storage Installations and Monitored Retrievable Storage Installations” in the Federal Register on July 22, 2002 (67 FR 47745) for public comment. The NRC stated on September 5, 2002 (67 FR 56876) that it intended to extend the comment period for an additional 15 days to allow interested persons additional

time to provide meaningful comments. The public comment period expired on October 22, 2002.

The NRC received nine comment letters on the proposed rule. These comments and the NRC responses are discussed in Section VI of this document, "Summary of Public Comments on the Proposed Rule".

II. Objectives

An ISFSI is designed, constructed, and operated under a Part 72 specific or general license. A Part 72 specific license for an ISFSI is issued to a named person upon application filed under Part 72 regulations. A Part 72 general license for an ISFSI is issued under 10 CFR 72.210 to persons authorized to possess an NPP license under Part 50, without filing a Part 72 license application. A general licensee is required to meet the conditions specified in Subpart K of Part 72. An MRS may be designed, constructed, and operated by DOE under a Part 72 specific license.

The final rule reflects changes that are intended to (1) provide benefit from the experience gained in applying the existing regulation and from research; (2) provide needed regulatory flexibility to incorporate into licensing state-of-the-art improvements in the geosciences and earthquake engineering; and (3) make the regulations more risk informed, consistent with the Commission's recent policy.

The objectives of this final rule are to:

1. Require a new specific-license applicant for a dry cask storage facility located in either the western U.S. or in areas of known seismic activity in the eastern U.S., and not co-located with an NPP, to address uncertainties in seismic hazard analysis by using appropriate

analyses, such as a PSHA or suitable sensitivity analyses, for determining the DE. All other new specific-license applicants for dry cask storage facilities will have the option of complying with the requirement to use a PSHA or suitable sensitivity analyses to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation. (§ 72.103)

2. Allow new ISFSI or MRS specific-license applicants using a PSHA to select a DE appropriate for and commensurate with the risk associated with an ISFSI or MRS; and

3. Require general licensees to design cask storage pads and areas to adequately account for dynamic loads, in addition to static loads. (§ 72.212)

III. Applicability

This section clarifies the applicability of the new § 72.103 for Part 72 specific licensees, and modified § 72.212(b)(2)(i)(B) for Part 72 general licensees.

Applicability of new § 72.103

(1) Applicants who apply on or after the effective date of the final rule, for a Part 72 specific license for a dry cask storage ISFSI or MRS, located in either the western U.S. or in areas of known seismic activity in the eastern U.S., and not co-located with an NPP, will be required to address uncertainties in seismic hazard analysis by using appropriate analyses, such as a PSHA or suitable sensitivity analyses, for determining the DE.

(2) Applicants who apply on or after the effective date of the final rule, for a Part 72 specific license for a dry cask storage ISFSI or MRS, located in either the western U.S. or in areas of known seismic activity in the eastern U.S., and co-located with an NPP, will have the option of addressing uncertainties in seismic hazard analysis by using appropriate analyses, such as a PSHA or suitable sensitivity analyses, or using the existing design criteria for the

NPP, for determining the DE. When the existing design criteria for the NPP are used for an ISFSI at a site with multiple NPPs, the criteria for the most recent NPP must be used.

(3) Applicants who apply on or after the effective date of the final rule, for a Part 72 specific license for a dry cask storage ISFSI or MRS, located in the eastern U.S., except in areas of known seismic activity, will have the option of addressing uncertainties in seismic hazard analysis by using appropriate analyses, such as a PSHA or suitable sensitivity analyses, or using a standardized DE described by an appropriate response spectrum anchored at 0.25 g (subject to the conditions in new § 72.103(a)(1)), or using the existing design criteria for the most recent NPP (if applicable), for determining the DE.

(4) The new § 72.103 is not applicable to a general licensee at an existing NPP operating an ISFSI under a Part 72 general license anywhere in the U.S.

The changes apply to the design basis of both a dry cask storage type ISFSI and MRS, because these facilities are similar in design. The NRC does not intend to revise the 10 CFR Part 72 geological and seismological criteria as they apply to wet modes of storage because applications for this means of storage are not expected and it is not cost-effective to allocate resources to develop the technical bases for such an expansion of the rulemaking. The NRC also does not intend to revise the 10 CFR Part 72 geological and seismological criteria as they apply to dry modes of storage that do not use casks because of the lack of experience in licensing these types of facilities.

The applicability of § 72.103 is summarized in the table below.

Applicability of Amended § 72.212(b)(2)(i)(B)

The changes in § 72.212(b)(2)(i)(B), regarding the evaluation of dynamic loads for the design of cask storage pads and areas, will apply to all general licensees for an ISFSI.

The applicability of the modified § 72.212(b)(2)(i)(B) is summarized in the table below.

SUMMARY OF APPLICABILITY

Design Earthquake Ground Motion for ISFSI or MRS Specific-License Applicants for Dry Cask Modes of Storage on or after the Effective Date of the Final Rule	
Site Condition	Specific-License Applicant[1]
Western U.S., or areas of known seismic activity in the eastern U.S., **not** co-located with NPP	Must use PSHA or suitable sensitivity analyses to account for uncertainties in seismic hazards evaluations[2]
Western U.S., or areas of known seismic activity in the eastern U.S., **and** co-located with NPP	PSHA or suitable sensitivity analyses to account for uncertainties in seismic hazards evaluations[2], **or** existing NPP design criteria (multi-unit sites - use the most recent criteria)
Eastern U.S., and not in areas of known seismic activity	PSHA or suitable sensitivity analyses to account for uncertainties in seismic hazards evaluations[2], **or** existing NPP design criteria, if applicable (multi-unit sites - use the most recent criteria), **or** an appropriate response spectrum anchored at 0.25g (subject to the conditions in new § 72.103(a)(1)).

1. New § 72.103 does not apply to general licensees. General licensees must satisfy the conditions specified in 10 CFR 72.212.
2. Regardless of the results of the investigations anywhere in the continental U.S., the DE must have a value for the horizontal ground motion of no less than 0.10 g with the appropriate response spectrum.

IV. Discussion

The NRC is amending certain sections of Part 72 dealing with seismic siting and design criteria for a dry cask ISFSI or MRS. The NRC intends to leave the present § 72.102 in place to preserve the ISFSI licensing bases for applications before the effective date of the rule, and continue the present ISFSI or MRS licensing bases for applications for other than dry cask modes of storage. The NRC is changing the heading of § 72.102, adding a new § 72.103, and modifying § 72.212(b)(2)(i)(B).

A. Change to 10 CFR 72.102

The heading of § 72.102 will be changed to clarify that the present requirements are applicable to ISFSI or MRS specific licensees or specific-license applicants before the effective date of the rule. The requirements of § 72.102 that applied to ISFSI or MRS licensees, or license applicants for other than dry cask modes of storage will continue to apply.

B. New 10 CFR 72.103

New § 72.103 describes the seismic requirements for new specific-license applicants for dry cask storage at an ISFSI or MRS.

1. Remove Detailed Guidance from the Regulation.

Part 72 currently requires license applicants for an ISFSI or MRS, in the western U.S. or in other areas of known seismicity, to comply with Appendix A to Part 100. Appendix A contains both requirements and guidance on how to satisfy those requirements. For example, Section IV, "Required Investigations," of Appendix A states that investigations are required for vibratory ground motion, surface faulting, and seismically induced floods and water waves.

Appendix A then provides detailed guidance on what constitutes an acceptable investigation. A similar situation exists in Section V, "Seismic and Geologic Design Bases," of Appendix A to Part 100.

Geoscience assessments require considerable latitude in judgment because of (a) limitations in data; (b) changing state-of-the-art of geologic and seismic analyses; (c) rapid accumulation of knowledge; and (d) evolution in geoscience concepts. The NRC recognized the need for latitude in judgment when it amended Part 100 in 1996.

However, specifying geoscience assessments in detail in a regulation has created difficulty for applicants and the NRC by inhibiting needed latitude in judgment. It has inhibited the flexibility needed in applying basic principles to new situations and the use of evolving methods of analyses (for instance, probabilistic) in the licensing process.

The NRC is adding a new section in Part 72 that will provide specific siting requirements for an ISFSI or MRS instead of referencing another part of the regulations. The amended regulation will also reduce the level of detail by placing only basic requirements in the rule and providing the details on methods acceptable for meeting the requirements in an accompanying guidance document. Thus, the revised regulation contains requirements to:

(i) Evaluate the geological, seismological, and engineering characteristics of the proposed site;

(ii) Establish a DE; and

(iii) Identify the uncertainties associated with these requirements.

Detailed guidance on the procedures acceptable to the NRC for meeting the requirements are provided in Regulatory Guide 3.73, "Site Evaluations and Design Earthquake

Ground Motion for Dry Cask Independent Spent Fuel Storage and Monitored Retrievable Storage Installations."

2. Address Uncertainties and Use Probabilistic Methods.

The existing approach for determining a DE for an ISFSI or MRS, embodied in Appendix A to Part 100, relies on a "deterministic" approach. Using this deterministic approach, an applicant develops a single set of earthquake sources, develops for each source a postulated earthquake to be used as the source of ground motion that can affect the site, locates the postulated earthquake according to prescribed rules, and then calculates ground motions at the site.

Although this approach has worked reasonably well for the past several decades in the sense that the SSE for NPPs sited with this approach are judged to be suitably conservative, the approach has not explicitly recognized uncertainties in geosciences parameters. Because so little is known about earthquake phenomena (especially in the eastern U.S.), there have been differences of opinion and differing interpretations among experts as to the largest earthquakes to be considered and ground-motion models to be used, often making the licensing process less predictable.

Probabilistic methods that have been developed in the past 15 to 20 years for evaluation of seismic safety of nuclear facilities allow explicit incorporation of different models for zonation, earthquake size, ground motion, and other parameters. The advantage of using these probabilistic methods is their ability to incorporate different models and data sets, thereby providing an explicit expression for the uncertainty in the ground motion estimates and a means of assessing sensitivity to various input parameters. The western and eastern U.S. have fundamentally different tectonic environments and histories of tectonic deformation.

Consequently, application of these probabilistic methodologies has revealed the need to vary the fundamental PSHA methodology depending on the tectonic environment of the site.

In 1996, when the NRC accepted the use of a PSHA methodology or suitable sensitivity analyses in § 100.23, it recognized that the uncertainties in seismological and geological information must be formally evaluated and appropriately accommodated in the determination of the SSE for seismic design of NPPs. The NRC further recognized that the nature of uncertainty and the appropriate approach to account for it depends on the tectonic environment of the site and on properly characterizing parameters input to the PSHA. Methods other than probabilistic methods (PSHA), such as sensitivity analyses, may be adequate for some sites to account for uncertainties. The NRC believes that certain new applicants for ISFSI or MRS specific licenses, as described in Section III, "Applicability," of this document, must use probabilistic methods or other sensitivity analyses to account for uncertainties instead of using Appendix A to Part 100. The NRC does not intend to require new ISFSI or MRS specific-license applicants that are co-located with an NPP to address uncertainties because the criteria used to evaluate existing NPPs are considered to be adequate for ISFSIs, in that the criteria have been determined to be safe for NPP licensing, and the seismically induced risk of an ISFSI or MRS is considerably lower than that of an NPP, as described in Section IV of this document.

The key elements of the NRC's approach for seismic and geologic siting for ISFSI or MRS license review and approval consists of:

a. Conducting site-specific and regional geoscience investigations;

b. Setting the target exceedance probability commensurate with the level of risk associated with an ISFSI or MRS;

c. Conducting PSHA and determining ground motion level corresponding to the target exceedance probability;

d. Determining if other sources of information change the available probabilistic results or data for the site; and

e. Determining site-specific spectral shape, and scaling this shape to the ground motion level determined above.

In addition, the NRC will review the application using all available data including insights and information from previous licensing experience. Thus, the revised approach requires thorough regional and site-specific geoscience investigations. Results of the regional and site-specific investigations must be considered in applying the probabilistic method. Two current probabilistic methods are the NRC-sponsored study conducted by Lawrence Livermore National Laboratory and the Electric Power Research Institute's seismic hazard study. These are essentially regional studies. The regional and site-specific investigations provide detailed information to update the database of the hazard methodology to make the probabilistic analysis site-specific.

Applicants must also incorporate local site geological factors, such as stratigraphy and topography, and account for site-specific geotechnical properties in establishing the DE. Guidelines to incorporate local site factors and advances in ground motion 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 rational 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. 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 tornado loads, be evaluated to meet the cask design bases. Specific licensees are currently required, under § 72.122(b)(2), to design ISFSIs to withstand the effects of dynamic loads, such as earthquakes and tornados.

V. Related Regulatory Guide and Standard Review Plans

On July 22, 2002, the NRC published DG-3021, "Site Evaluations and Determination of Design Earthquake Ground Motion for Seismic Design of Independent Spent Fuel Storage

Installations and Monitored Retrievable Storage Installations" for public comment (67 FR 48956; July 26, 2002). Regulatory Guide 3.73, *Site Evaluations and Design Earthquake Ground Motion for Dry Cask Independent Spent Fuel Storage and Monitored Retrievable Storage Installations* (formerly DG-3021), provides guidance to licensees for procedures acceptable to the NRC staff for:

(1) Conducting a detailed evaluation of site area geology and foundation stability;

(2) Conducting investigations to identify and characterize uncertainty in seismic sources in the site region important for the probabilistic seismic hazard analysis (PSHA);

(3) Evaluating and characterizing uncertainty in the parameters of seismic sources;

(4) Conducting PSHA for the site; and

(5) Determining the DE to satisfy the requirements of 10 CFR Part 72.

This guide describes acceptable procedures and provides a list of references that present acceptable methodologies to identify and characterize capable tectonic sources and seismogenic sources. Section IV.B of this SUPPLEMENTARY INFORMATION describes the key elements of the regulatory guide. A document announcing the availability of Regulatory Guide 3.73 will be published in the Federal Register in the near future.

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In the future, editorial changes to NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems," and NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities," will be made. For example, the standard review plans will be updated to reference the new § 72.103 and Regulatory Guide 3.73.

VI. Summary of Public Comments on the Proposed Rule

This section presents a summary of the public comments received on the proposed rule and supporting documents, the NRC's response to the comments, and changes made in the final rule and supporting documents as a result of these comments.

The NRC received nine comment letters on the proposed rule from eight commenters. The commenters were the Nuclear Energy Institute (NEI), the U.S. Department of Energy (DOE), two nuclear power utilities, three State agencies, and one license applicant for an independent spent fuel storage installation. All the commenters agreed with the proposal to address uncertainty by requiring the use of a PSHA or suitable sensitivity analyses for an ISFSI or MRS in the western U.S., not co-located with an NPP, and in areas of known seismic activity in the eastern U.S. However, commenters were divided on the specific question for public comment related to the appropriate value for the MAPE posed by the Commission in the proposed rule. These comments are summarized in this section under the heading "Related Regulatory Guide." All commenters supported the concept of requiring general licensees to evaluate both dynamic loads and static loads for ISFSI and MRS cask storage pads and areas.

Copies of the public comments are available for review in the NRC Public Document Room, 11555 Rockville Pike, Rockville, MD. A review of the comments and the NRC responses follow:

GENERAL COMMENTS

Comment 1:

A commenter stated that proposed 10 CFR 72.103(f)(1) does not comply with the notice and comment requirements of Section 553 of the Administrative Procedure Act (APA) because of the way the rule is structured. The commenter believes that the proposed rule "is in the guise of a substantive rule," but that the substantive requirements are found in the draft guidance, a document which is not a rule. In the commenter's view, "the Commission attempts to give concrete form to its proposed rule through an interpretative document, DG-3021, and the Commission thereby circumvents [APA] § 553 notice and comment rulemaking procedures," citing Paralyzed Veterans of America v. D.C. Arena L.P., 117 F.3d 579 (D.C. Cir. 1997). According to the commenter, a significant defect of this structure is that the rule gives no standards against which a licensing board or intervenors may evaluate whether an applicant has complied with the rule and, instead, gives "unbridled and unchecked discretion to the staff in determining the seismic design standard for ISFSIs sited in seismic areas." The proposed rule, in the commenter's view, has no force of law because it has no binding standards and thus is unenforceable. Another commenter disagreed and supported the NRC's view that the rule is substantive and in compliance with the APA.

Response:

First, the NRC rejects the claim that the rule is not being promulgated in compliance with § 553 of the APA. Section 553 requires that notice of a proposed rulemaking be

published in the *Federal Register*, including the terms or substance of the proposed rule, and that interested persons be given an opportunity to comment. The APA also provides an exception for interpretative rules and general statements of policy enabling those documents to be issued as final rules without prior notice and comment. In this case, the NRC has not availed itself of the exception but rather has issued both the draft guidance and the proposed rule for public comment. Thus, there has been no violation of the notice and comment requirements of Section 553 of the APA even if the guidance were to be considered part of the rule. The Paralyzed Veterans case, cited by the petitioner, concerned a guidance document issued by the Department of Justice which had been issued without prior notice and comment and raised the issue whether the Government could rely upon the guidance in an enforcement action. The court ultimately found that there was no need for the Government to rely on the guidance to enforce the regulation. Here, the guidance has been issued for comment and the NRC does not contend, as explained below, that the guidance is legally enforceable.

Second, the NRC does not agree that "substantive requirements" have been placed in the guidance document. Regulatory Guide 3.73 (formerly DG-3021) provides information on methods acceptable to the NRC for implementing specific parts of the rule, but it does not place any particular requirements on applicants. As the commenter points out, "staff regulatory guides are not regulations, do not have the force of regulations, and when challenged, are considered only one way in which an applicant may meet the regulations."

Finally, the commenter really appears to be objecting to the NRC's risk-informed, performance-based approach in this rulemaking in lieu of the deterministic approach for determining a design earthquake embodied in Appendix A to 10 CFR Part 100. The overall performance criteria for protection against environmental conditions and natural phenomena in

the design of Part 72 facilities are contained in 10 CFR 72.122(b) of the NRC's regulations. In particular, § 72.122(b)(2)(i) provides:

> Structures, systems, and components important to safety must be designed to withstand the effects of natural phenomena such as earthquakes . . . without impairing their capability to perform their intended design functions. The design bases for these structures, systems, and components must reflect:
>
> (A) Appropriate consideration of the most severe of the natural phenomena reported for the site and surrounding area, with appropriate margins to take into account the limitations of the data and the period of time in which the data have accumulated; and
>
> (B) Appropriate combinations of the effects of normal and accident conditions and the effects of natural phenomena.

These performance criteria are supplemented by the requirements of 10 CFR 72.103 governing selection of a site and determination of a DE. This new regulation provides specific siting requirements for an ISFSI or MRS instead of referencing another part of the regulations (Appendix A to Part 100). This new regulation also reduces the level of detail by placing only basic requirements in the rule and providing the details on methods acceptable for meeting the requirements in an accompanying guidance document. Thus, the new 10 CFR 72.103(f) establishes basic requirements for determining a DE for use in the design of structures, systems, and components of the ISFSI or MRS. These regulations include a requirement that the geological, seismological, and engineering characteristics of a proposed site and its environs be investigated in sufficient scope and detail to provide sufficient information to

support evaluations performed to arrive at estimates of the DE (§ 72.103(f)(1)); a requirement that a DE be determined for the site (§ 72.103(f)(2)); and a requirement that uncertainties be addressed through an appropriate analysis, such as a probabilistic seismic hazard analysis or suitable sensitivity analyses (§ 72.103(f)(2)(i)). The regulation further requires determinations of the potential for surface tectonic and nontectonic deformations (§ 72.103(f)(2)(ii)); the design bases for seismically induced floods and water waves (§ 72.103(f)(2)(iii)); and the siting factors for other design conditions, such as liquefaction potential (§ 72.103(f)(2)(iv)), as well as a requirement that the DE must have a value for the horizontal ground motion of no less than 0.10 g with the appropriate response spectrum (§ 72.103(f)(3)). More specific guidance for meeting these standards, including guidance on an acceptable reference probability, is provided in Regulatory Guide 3.73 (formerly DG-3021).

Determining whether an applicant has complied with these performance standards may be more difficult than would be the case with a prescriptive regulation; however, that does not mean that the NRC has "unbridled discretion" in deciding whether the standards are met nor that the standards (as opposed to the guidance) are not binding. The NRC uses informed technical judgment to determine if an application has satisfactorily met the standards. The NRC's rationale and judgment are expressed in a safety evaluation report (SER) subject to evaluation and potential challenge by members of the public. In the event of a hearing, a licensing board would have the technical skills necessary to evaluate any conflicting claims.

Comment 2:

A commenter noted that, although the NRC's approach is similar to that used in the amendments issued for seismic evaluation for the siting of NPPs, the NRC has no compelling

reason to follow that approach. First, the commenter argued, if the approach violates the APA, it should be rejected. Second, the commenter stated that because no new applications for siting NPPs have been submitted using the new requirements, the rule has not been put to the test. Finally, the commenter indicated that there are no data for ISFSIs that establish design basis ground motions, unlike the SSE for a nuclear power plant, which has at least some data to provide guidance to the NRC and the public.

Response:

First, the NRC disagrees that either the amendments issued for the seismic evaluation of siting of NPPs or these Part 72 amendments have been issued in violation of the APA. See comment 1. Second, although no new license applications for siting of NPPs have been received to test the new requirements in 10 CFR § 100.23, the guidance associated with the use of probabilistic methods for siting of NPPs (Regulatory Guide 1.165) has been used in the PSHA prepared for a proposed ISFSI site. It is also being followed by applicants for an early site permit under to 10 CFR Part 52. Finally, the NRC agrees that there are limited data for ISFSIs that establish design basis ground motions because the current Part 72 regulations for seismic design of ISFSIs are conservatively based on the nuclear power plant seismic design criteria, and thus, are not risk-informed. However, experience has been gained in the design and construction of numerous facilities using the philosophy of a graded, risk-informed approach described in the standard building codes, similar to the approach proposed in the rule for ISFSIs. The graded risk-informed approach is also used by the Department of Energy in designing its facilities for seismic loads with risks varying from conventional facilities to NPPs.

Comment 3:

A commenter noted that if clear seismic standards are not established in the rule, the opportunity for interested persons to participate in a licensing proceeding involving the seismic design of an ISFSI will become essentially prohibited. This is because a panoply of specific expertise is needed to evaluate the seismic design and there is only a small universe of seismic experts. Utilizing these experts is often not feasible because of the financial burden on intervenors in obtaining highly specialized expertise to analyze probabilistic seismic risks and design of nuclear facilities.

Response:

The NRC believes the standards for ISFSI or MRS facility earthquake designs are clear. See the response to Comment 1. However, the NRC recognizes that the proposed use of the probabilistic methods in seismic design of ISFSIs is more complex than the current deterministic methods of 10 CFR Part 100 Appendix A, and would require specific expertise to participate in the licensing proceedings. The NRC staff's safety evaluation report (SER) that independently assesses the applicant's method of compliance with regulations is available to assist the public in evaluating the risk of the facility and could help intervenors to focus their resources. The NRC does not intend to limit public participation in the licensing process; however, the Congress has barred the use of appropriated funds to pay the expenses of, or otherwise compensate, parties who intervene in NRC regulatory or adjudicatory proceedings.

Comment 4:

A commenter stated that the proposed rule placed too much stock on the integrity of the dry storage cask. The commenter indicated that of the 19 ISFSI licenses issued in the past decade, none were in seismic areas. The NRC has not licensed unanchored cylindrical casks in any seismic areas. The commenter noted that there are no performance data, test data, or earthquake experience data for dry casks or for ISFSIs. The commenter further stated that the rule is based on principles that are antithetical to earthquake engineering principles because, for unanchored casks, the NRC relies solely on the predictions of non-linear computer models. The commenter also stated that, up to this point, the non-linear computer model predictions of the seismic behavior of casks have not been validated with shake table data or actual performance data. The commenter also stated that without adequate and reliable performance and test data, it cannot be determined if the casks will actually provide the critical barrier described and relied upon in the rule. Another commenter stated that non-linear dynamic analyses are inherently reliable. Further, the commenter noted that proper input parameters for cask stability analyses are not elusive unknowns but can be determined from basic physical principles, and that these analyses have been shown not to be highly sensitive to changes in input parameters. Therefore, the commenter argued, shake table testing is unnecessary.

Response:

The integrity of the dry storage cask during an earthquake is a key to protecting the health and safety of the public because it confines the radioactivity during a potential accident event, such as an earthquake, and prevents it from being dispersed into the environment. Contrary to traditional building designs, the cask design is not governed by stresses resulting from an earthquake, but is governed by requirements resulting from shielding, thermal, criticality, and postulated handling accidents. Therefore, the critical performance requirement for a cask is that it would remain stable and not displace excessively to impact adjacent casks. The cask stability can be determined by nonlinear dynamic analyses, considering uncertainties in engineering parameters, and using multiple computer codes. The NRC has also performed structural analyses of casks tipping and sliding. In neither case did the canister fail.

It is a common engineering practice to design and build structures, including new design concepts, based on detailed structural analyses using sound engineering principles and laws of physics, without performing confirmatory experiments. For example, new concepts in structural designs and construction of landmark structures, such as the Sears Tower, Hancock Tower, Eiffel Tower, and space vehicles were based solely on analyses.

The advent of computers has helped in the development of analytical tools, including the non-linear dynamic analyses. Results of these analyses are being used to design structures more complex than a dry storage cask. The concept of free-standing casks is not new. The buildings the NRC uses every day are free-standing on a foundation, and thus would move during an earthquake. The analytical tools for non-linear structural analyses are verified and validated using multiple computer codes and available experimental data. Therefore, shake table tests or actual performance data are not necessary.

Comment 5:

A commenter requested a rule to establish a definitive design basis earthquake at a return period level [the return period of an earthquake is an inverse of the mean annual probability of exceedance (MAPE) of the earthquake] greater than 2,000 years that is tied to defined risk and performance goals.

Response:

The NRC does not agree that we must establish a definitive design basis earthquake by rule. The current regulations in § 72.122(b)(2)(i), require that the structures, systems, and components of an ISFSI or MRS must be designed to withstand the effects of natural phenomena, such as earthquakes, without impairing their capability to perform their intended design functions. For earthquakes, these requirements are then supplemented by the requirements at §§ 72.102, 72.103, and 72.122 for detailed site investigations and appropriate consideration of the most severe of the natural phenomena and associated probability of occurrence, including consideration of uncertainties, in the prediction of earthquakes. This approach is consistent with the NRC's philosophy of using risk-informed, performance-based regulations. In a risk-informed, performance-based approach, the design of the ISFSI or MRS facility is based on an assessment of the radiological risk (potential for adverse consequences) due to an earthquake. Thus, specifying a value for the reference probability in the rule would preclude applicants from considering structures, systems, and components with risks other than the risk associated with the specified reference probability.

Comment 6:

A commenter stated that the supplementary information in the final rule should state that the NRC's policy for promulgating risk-informed regulations was a primary motivation for the rule changes.

Response:

The NRC agrees that the supplementary information for the final rule should more clearly state that the rule was amended, in part, to conform to the Commission's recent policy to increase the use of risk insights and information in its regulatory applications. An additional statement has been added to Section II, Objectives, of the Supplementary Information portion of this document, that states the intent to revise the regulation in accordance with this policy.

APPLICABILITY OF PROPOSED § 72.103

Comment 7:

A commenter requested clarification of the proposed rule so that applicants for an ISFSI co-located with an NPP have the option of using the existing DE of the NPP without any further evaluations and that this applies to all sections of the rule. The commenter pointed out that the proposed amendments at §§ 72.103(a)(2) and 72.103(b), as well as explanatory statements made in the proposed rule indicate that applicants for an ISFSI that are co-located

with an NPP have the option of using the existing NPP design criteria without additional evaluations, but that this option is not identified in § 72.103(f).

Response:

To further clarify the NRC's intent that an applicant for an ISFSI that is co-located with an NPP has the option of using the existing DE of the NPP without the need to undertake any additional evaluations of the sort described in § 72.103(f), the introductory phrase of that section has been modified so that it now reads: "Except as provided in paragraphs (a)(2) and (b) of this section, the DE for use in the design of structures, systems, and components must be determined as follows."

Comment 8:

Two commenters stated that the criteria presented for establishing the DE for ISFSI and MRS sites at existing NPPs allows for the use of the existing NPP SSE as one alternative. This alternative is key to ensuring that significant new probabilistic ground motion studies are not required at existing NPP sites.

Response:

The commenters are correct. The regulatory changes allowing the licensee flexibility to use the existing SSE for an NPP at co-located ISFSIs or MRSs means that new studies are not required at ISFSIs or MRSs co-located with NPPs.

ALTERNATIVE OF ADOPTING 10 CFR 100.23

Comment 9:

One commenter recommended withdrawing the proposed rule and adopting the option of directing new applicants for specific licenses to comply with 10 CFR § 100.23 in its entirety, including conforming the DE to the SSE criteria. The commenter noted that by adopting § 100.23 in its entirety, there would be no need to make distinctions among locations of facilities and the rule would incorporate state-of-the-art improvements in the geosciences and earthquake engineering and would allow uncertainty to be addressed. The commenter further noted that NRC had cited its 10 years of experience in reviewing dry cask storage installation applications as a reasonable basis for allowing an exceedance probability greater than that applied to a nuclear power plant, but pointed out that this was 10 years of analytical, not practical experience. In the commenter's view, this lack of practical experience, and the fact that a probabilistic analysis is, by its very nature, risk-informed with respect to uncertainty, means that there does not seem to be a quantifiable safety basis for any exceedance margin other than that now applied to seismic analysis for nuclear power plant proposals. The commenter stated that, absent any definitive experience, the seismic design criteria for an ISFSI should be no less protective than that of a nuclear power plant.

Response:

The NRC disagrees that new applicants for specific licenses should comply with § 100.23 in its entirety, including conforming the DE to the SSE criteria. Adopting the

recommendation would fail to recognize the differences in risk between an NPP and an ISFSI or MRS facility in seismic design requirements. This is counter to the Commission policy encouraging development of risk-informed, performance-based regulations, and the Commission's Performance Goals.

The NRC acknowledges that actual earthquake performance data for ISFSI facilities are not available and thus that NRC's decision to allow an exceedance probability greater than that applied to a nuclear power plant is not based on practical experience. However, NRC has gained sufficient analytical experience to understand the performance of these facilities, by reviewing the analyses of these facilities performed by the licensees, and by performance of independent analyses. Additionally, experience has been gained in the design and construction of numerous facilities using the philosophy of a risk-informed approach described in the standard building codes, similar to the one proposed in the rule for ISFSIs. The risk-informed approach is also used by the Department of Energy in designing its facilities for seismic loads with risks varying from conventional facilities to NPPs. NRC staff's analyses show that ISFSI storage casks are sufficiently robust, due to design requirements other than for earthquakes, that there is no release of radioactivity at an ISFSI site with a DE at a magnitude equal to the SSE for a NPP. This analytical experience provides a basis for allowing an exceedance probability greater than that applied to a nuclear power plant.

PROPOSED CHANGE TO 10 CFR 72.103

Comment 10:

With respect to the provision in § 72.103(b) that sites "that lie within the range of strong near-field ground motion from historical earthquakes on large capable faults should be avoided," a commenter stated that the definition of "range of strong near-field ground motion" is not well defined but is often believed to be about 15 km. The commenter noted that this is a very large set-back from faults. The commenter argued that the key issue is that the design ground motion should represent the conditions at the site. If a site is located close to a large capable fault, then near-fault effects should be incorporated into the design ground motions rather than excluding these site locations.

Response:

The NRC agrees with the comment. The sentence: "Sites that lie within the range of strong near-field ground motion from historical earthquakes on large capable faults should be avoided." has been removed from § 72.103(b). Section 72.103(f)(2)(iv) requires an evaluation of the effects of vibratory ground motion that may affect the design and operation of the proposed ISFSI or MRS. Therefore, near-fault effects must be included in the development of the ground motion used in design.

Comment 11:

One commenter suggested removing the distinction in § 72.103 between western U.S. and eastern U.S. The commenter stated that the characterization of areas of known seismicity east of the Rocky Mountain Front as including three specific areas is misleading. The commenter argued that the entire region of the U.S. east of the Rocky Mountain Front is subject to earthquake occurrence and that one area should not be treated differently from another for the purpose of assessing seismic sources. Further, the commenter stated that 10 CFR Part 100, Appendix A, does not allow for less stringent alternatives for any area. Rather, the commenter noted, the fundamental requirements of that regulation apply uniformly to all regions of the U.S., independent of variations in the local rate of seismicity.

Response:

In specifying the criteria for determining the DE, the current Part 72 regulations distinguish between the western U. S. and the eastern U. S. Although the entire eastern U.S. is subject to earthquake occurrence, the areas east of the Rocky Mountain Front, except in specific areas of known seismic activity, do not experience significant seismic activity. Therefore, the use of an appropriate seismic response anchored at 0.25 g is considered as bounding for the design. However, for the western U. S. there is significant seismic activity varying from region to region. Therefore, it is not practical to use a bounding approach in specifying the DE for those sites.

However, if the applicant chooses the option of performing the PSHA for a site located in the eastern U. S., as allowed in § 72.103(a)(2), the seismic sources are assessed with the

same rigor as the seismic sources for the PSHA performed for a site located in the western U.S. (§ 72.103(f)). In this case, the regulatory requirements of assessing the seismic sources for the PSHA method would apply uniformly to all regions of the U.S., independent of variations in the local rate of seismicity.

Comment 12:

One commenter suggested inserting the word “sites” after “NY” in the first sentence of § 72.103(a)(1) to be consistent with language in § 72.102.

Response:

The NRC agrees with the commenter’s suggestion. The word “sites” will be inserted after “NY” in the first sentence of § 72.103(a)(1) to be consistent with language in § 72.102. In addition, other minor editorial changes have been made to this sentence.

REMOVE DETAILED GUIDANCE FROM THE REGULATION

Comment 13:

One commenter stated that removing detailed guidance from the regulation that is related to analyzing non-seismic factors affecting geologic stability of the site would allow excessive discretion for the applicant and would result in too much uncertainty for a safety

evaluation. This commenter noted that removing requirements for specific types of evaluation also removes the certainty for both the license applicant and the public as to what is expected during a review. The commenter requested retaining Appendix A of Part 100 as requirements for licensing.

Response:

See the response to Comment 1.

Comment 14:

A commenter questioned NRC's statement explaining that NRC proposed to remove detailed guidance from the regulation, in part, because "specifying geoscience assessments in detail in a regulation has created difficulties for applicants and the NRC by inhibiting needed latitude in judgment [and] [i]t has inhibited the flexibility needed in applying basic principles to new situations." This commenter asked for an explanation as to how and when latitude and flexibility in judgment and in applying basic principles to new situations because geoscience assessments were specified in detail in a regulation, were inhibited.

Response:

The current regulation (§ 72.102) requires that for areas of known potential seismic activity, seismicity will be evaluated by the techniques of Appendix A to Part 100. Appendix A contains both requirements and guidance on how to satisfy the requirements. For example,

Section IV, "Required Investigations," of Appendix A, states that investigations are required for vibratory ground motion, surface faulting, and seismically induced floods and water waves. Appendix A then provides detailed guidance on what constitutes an acceptable investigation. Such investigations require considerable latitude in judgment. This latitude in judgment is needed because of limitations in data and rapidly evolving state-of-the-art geologic and seismic analyses.

However, having geoscience assessments detailed and cast in a regulation has created difficulty for applicants and the NRC in terms of inhibiting the use of needed latitude in judgment. Also, it has inhibited flexibility in applying basic principles to new situations and the use of evolving methods of analyses (for instance, probabilistic) in the licensing process.

As an example, a prescriptive requirement of applying the capable fault criteria (see Part 100, Appendix A, § III(g)) to sites in California meant conducting investigations and analyses for surface rupture potential. If a fault does not cause a surface rupture (blind fault), the fault would not be considered a capable fault under the Appendix A criteria, and thus would not be considered in determining the DE. This would lead to seismic hazard at a facility which would be not conservative. This has been demonstrated by the occurrences of the 1989 Loma Prieta, 1992 Petrolia, and 1994 Northridge earthquakes during which the causative faults did not rupture ground surface. On the other hand, the young faults, the last movements of which may satisfy the Appendix A criteria for classifying them as capable faults, may not be capable faults in the true meaning of the criteria because the most recent displacements on them may be related to non-tectonic natural phenomena. In this case, use of the Appendix A criteria would lead to a finding of seismic hazard at a facility which would be overly conservative. Inclusion of detailed criteria or specific numbers in the regulation prevents a scientific

evaluation of methodologies and approaches that advance with the state of the art, and the rule eventually becomes a hindrance to the exercise of rational judgement.

ADDRESS UNCERTAINTIES AND USE PROBABILISTIC METHODS

Comment 15:

A commenter urged revision of § 72.103 to continue to allow an applicant located in the western U.S. or in areas of known seismic activity in the eastern U.S., and not co-located with an NPP, to use a deterministic analysis similar to the analysis specified in Appendix A to 10 CFR Part 100, for developing design earthquake ground motions because a utility may decide to perform seismic hazards analysis on deterministic bases that are more conservative than the proposed rule.

Response:

In using the deterministic approach for determining a SSE for a nuclear reactor site embodied in Appendix A to 10 CFR Part 100, there have often been differences of opinion and differing interpretations among experts as to the largest earthquakes to be considered and ground-motion models to be used. This often makes the licensing process relatively unstable. Over the past decade, analysis methods for incorporating these different interpretations have been developed and used. These "probabilistic" methods have been designed to allow explicit incorporation of different models for zonation, earthquake size, ground motion, and other

parameters. The advantage of using these probabilistic methods is the ability to incorporate different models and different data sets and weight them using judgments as to the validity of the different models and data sets. This process provides an explicit expression for the uncertainty in the ground motion estimates and a means of assessing sensitivity to various input parameters.

Section 72.103 explicitly recognizes that there are inherent uncertainties in establishing the seismic and geologic design parameters and requires the use of a probabilistic seismic hazard methodology capable of propagating uncertainties to address these uncertainties. The rule further recognizes that the nature of uncertainty and the appropriate approach to account for it depend greatly on the tectonic regime and parameters, such as the knowledge of seismic sources, the existence of historical and recorded data, and the understanding of tectonics. Therefore, methods other than the probabilistic methods, such as sensitivity analyses, may be adequate for some sites to account for uncertainties.

Consistent with § 100.23 for an NPP, § 72.103 does not allow the use of the deterministic methods in Appendix A to 10 CFR Part 100, to determine the DE because the deterministic methods do not account for the uncertainties in the seismic hazard analysis. However, § 72.103 allows the applicant to use methods other than the probabilistic methods, such as sensitivity analyses, to account for uncertainties. Additionally, § 72.103 allows a utility applying for a specific license for an ISFSI co-located at an NPP, the option of using the seismic design criteria of the NPP, which may be based on the deterministic methods of Appendix A to 10 CFR 100.

For these reasons, the NRC declines to amend § 72.103 as suggested by the commenter. However, a utility applying for a specific license for an ISFSI co-located at an NPP has the option of using the seismic design criteria of the NPP.

Comment 16:

A commenter stated that the use of the term “uncertainty” in the Background section of the proposed rule (67 FR 47746) is ambiguous, and suggested that the term be revised to “aleatory uncertainty”. The commenter stated that the report “Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts,” NUREG/CR-6372 (SSHAC), distinguishes between “aleatory” and “epistemic” uncertainties. The deterministic approach can explicitly recognize epistemic uncertainty just as in the probabilistic approach. The deterministic approach does not explicitly include all components of aleatory variability. The commenter noted that sensitivity analyses are generally intended for addressing epistemic uncertainty, not aleatory variability.

Response:

Despite extensive advances in seismic knowledge in recent years by a large and active community of researchers around the world, there are still major gaps in the understanding of the mechanisms that cause earthquakes. These gaps in understanding mean that in any seismic hazard analysis, either deterministic or probabilistic, there are inevitably significant uncertainties in the numerical results. These uncertainties can be classified into two different categories: (1) epistemic uncertainty which is due to lack of knowledge because the scientific understanding is imperfect for the present, but is of a character that in principle is reducible through further research; and (2) aleatory uncertainty which is due to the randomness of seismic events and, in principle, cannot be reduced. As stated in the SSHAC report, “The division between the two different types of uncertainty, epistemic and aleatory, is somewhat

arbitrary, especially at the border between the two. This is because, conceptually, some of the processes and parameters whose uncertainties the NRC will characterize here as aleatory ("random") may be partially reducible through more elaborate models and/or further study". As stated further in the SSHAC report, "the PSHA that does not deal appropriately with both the epistemic and the aleatory uncertainties must be considered inadequate." Based on this, the term "uncertainty' included in the proposed rule is appropriate.

REVISE THE DESIGN EARTHQUAKE GROUND MOTION

Comment 17:

A commenter stated that performance standards are not clearly articulated in the proposed rule. The commenter also stated that before the design standard is lowered, the performance standards or goals by which the proposed changes were evaluated should first be identified.

Response:

The current regulations in § 72.122(b)(2)(i) require that the structures, systems, and components of an ISFSI or MRS must be designed to withstand the effects of natural phenomena, such as earthquakes, without impairing their capability to perform their intended design functions. For earthquakes, these requirements are then supplemented by the §§ 72.102 and 72.103 requirements for the detailed site investigations and consideration of

uncertainties in the prediction of earthquakes. This approach is consistent with the Commission's philosophy of using risk-informed, performance-based regulations. In a risk-informed, performance-based approach, the design of the facility is based on considering the risk (potential for adverse consequences) due to an earthquake.

Comment 18:

One commenter is concerned that lowering the existing DE may result in a concomitant lowering of the design basis for locally-sourced tsunamis. The commenter is concerned because the most likely scenario for release of radiation in a coastal setting would be damage to an ISFSI or MRS during a major earthquake, followed by inundation of the facility by a tsunami.

Response:

Section 72.103(f)(1) requires consideration of actual or potential geologic and seismic effects at the proposed site, including locally-sourced tsunamis. Potential inundation of the facility by a tsunami is required to be addressed in the design of the facility under § 72.122(b)(2). Under the amended rule, the tsunami magnitudes corresponding to the DE would be lower than for a nuclear power plant. However, an earthquake similar in magnitude to the SSE for an NPP would not damage an ISFSI or MRS facility, thus no release of radioactivity would occur even if the facility were inundated by a resulting locally-sourced tsunami.

Comment 19:

A commenter stated that in order to issue a coastal development permit in California the State or a local government must make a finding that the proposed ISFSI will minimize risks to life and property in areas of high geologic hazard, and assure stability and structural integrity of the proposed coastal development. The commenter noted that, for the San Onofre Nuclear Generating Station (SONGS) ISFSI, the required finding was able to be made by the State only because the applicant proposed a seismic design standard far in excess of the SSE for the co-located NPP. The commenter indicated that such a finding may not be possible at future ISFSI sites if the applicant submits a design standard lower than those required for an NPP. The commenter stated that the proposed rule change makes approval of coastal development permits in California for future ISFSIs difficult at best.

Response:

The NRC sees no reason why the rule would make this finding difficult. The rule ensures adequate protection of public health and safety in all environs. The close proximity of faults or populations are considered in the regulations (for example, the dose requirements contained in §§ 72.104(a) and 72.106(b)). Applying a risk-informed approach to seismic design of ISFSIs takes these factors into account and the analyses indicate that protection of public health and safety are adequately addressed.

PROPOSED CHANGE TO 10 CFR 72.212(b)(2)(i)(B)

Comment 20:

Two commenters noted that although the proposed change to 10 CFR 72.212(b)(2)(i)(B) to require that the cask storage pads and areas be designed to adequately support dynamic loads, as well as static loads, of the stored casks, may require more analytical effort than the static load evaluations that some licensees had attempted to utilize in the past, they find the new requirements to be technically correct and support the concept that the seismic evaluation should be conducted using state-of-the-art structural dynamics principles, including consideration of dynamic loads. One commenter had no objection to the portion of the proposed rule that would require design of cask storage pads and areas to adequately account for dynamic loads. Another commenter stated that requiring this evaluation for storage pads and areas clearly improves the assurance of safety.

Response:

The commenters support the NRC's decision to require evaluation of dynamic loads for storage cask pads and areas. Further, general licensees currently consider dynamic loads for evaluating the casks, pads and areas to meet the cask design bases in the Certificate of Compliance, as required by 10 CFR 72.212(b)(2)(i)(A); therefore, the rule change will not actually impose a new burden on the general licensees.

RELATED REGULATORY GUIDE

Comment 21:

A commenter stated that Draft Regulatory Guide DG-3021 "is short on firm standards" because, although it recommends a DE at a MAPE of 5E-4, it also allows an applicant to demonstrate that the use of a higher probability of exceedance value would not impose any undue radiological risk to public health and safety. Thus, the draft guidance, in the commenter's view, "leaves open the possibility of an even lower standard for seismic sites." Another commenter defends the guidance that an applicant could propose a higher probability of exceedance value as being an exemption to what the commenter sees as the norm being established in DG-3021.

Response:

Section 72.103(f)(2)(i) of the rule requires that an applicant include a determination of the DE for the site, considering the results of the investigations required by paragraph (f)(1) and addressing uncertainties through an appropriate analysis, such as a PSHA or suitable sensitivity analyses. Regulatory Guide 3.73 (formerly DG-3021) states that a mean annual probability of exceeding the DE of 5E-4 is recommended to be used in conjunction with the PSHA for determining the DE. As the commenter notes, the draft guidance also indicated that "[t]he use of a higher reference probability will be reviewed and accepted on a case-by-case basis." This statement was made in recognition of the fact that a regulatory guide does not establish legally-binding requirements. An alternative reference probability would not be an

exemption from a requirement, but would be an alternative proposal which would need to be demonstrated to be acceptable. Thus, it is conceivable that an applicant could propose a higher MAPE value that the NRC staff would then have to consider. Although this is necessarily the case for recommendations suggested in guidance documents, the NRC did not mean to imply that it viewed an applicant's ability to make the necessary safety case for a higher MAPE as being a likely prospect. To avoid any such implication, that sentence has been removed from the final guidance.

Comment 22:

One commenter stated that a DE at a MAPE of 5E-4 (2,000 year return period) is not defensible. The commenter said that there are numerous standards that already use a DE at a MAPE of 4E-4 (2,500 year return period), including DOE Standard 1020-2000. The commenter noted that DOE's standard is inextricably tied to meeting performance and risk goals. Further, the commenter indicated that certain buildings, such as hospitals, must meet a DE at a MAPE of 4E-4 (2,500 year return period), as must interstate bridges in the State of Utah. The commenter stated that, at a minimum, a standard lower than these cannot be adopted.

Response:

The NRC disagrees with the commenter that the proposed standard for the DE at a MAPE of 5E-4 (2,000 year return period) is lower than the DOE Standard DOE-STD-1020-2002, or the other standards, such as the International Building Code (IBC-2000 Code).

According to the DOE Standard DOE-STD-1020-2002, ISFSIs can be classified as Performance Category 3 (PC-3) facilities. For PC-3 facilities, the seismic design forces for the DE are initially determined at 90 percent of the DE at a MAPE of 4E-4 (2,500 years return period). This brings the DE levels to approximately a MAPE of 5E-4 (2,000 year return period), specified in the earlier DOE 1020 standard, DOE-STD-1020-94. The Foreword of the DOE-STD-1020-2002 explains the change in the return period as follows:

"It is not the intent of this revision to alter the methodology for evaluating PC-3 facilities, nor to increase the performance goal of PC-3 facilities, by increasing return period for the PC-3 from a 2,000-year earthquake to a 2,500-year earthquake. Rather, the intention is more for convenience to provide a linkage from the NEHRP maps and DOE Standards".

Therefore, use of the reference probability of 5E-4/yr (2,000 year return period), for the ISFSI or MRS facility DE, would be consistent with that used in the DOE Standard DOE-STD-1020, for similar type facilities.

For the IBC-2000 Code, the commenter is incorrectly comparing the ISFSI or MRS DE at a MAPE of 5E-4 (2,000 year return period), with the Maximum Considered Earthquake (MCE) at a MAPE of 4E-4 (2,500 year return period). The DE, according to the IBC-2000 Code, is two-thirds of the MCE, which is equivalent to a DE at a MAPE of 1.1E-3 (909 year return period) earthquake in the western United States, and a DE at a MAPE of 7E-4 (1,430 year return period) in the eastern United States. Thus, the DE for the ISFSI or MRS facility included in DG-3021 at a MAPE of 5E-4 is greater than the IBC Code DE design level.

The NRC agrees that hospital building structures and bridges having critical national defense functions are designed for the DE at a MAPE of 4E-4 (2,500 year return period). These structures are generally occupied by a significant number of people. Therefore, these structures are designed for loads greater than those for traditional buildings to limit building

deformations, and to minimize human losses due to an earthquake. The ISFSI or MRS facility, on the other hand, has a relatively small number of people occupying the Canister Transfer Building at any one time.

Comment 23:

A commenter requested that the regulatory guide specify a DE at a MAPE of 1E-4 (10,000 year return period), consistent with the requirement for NPPs. This commenter believes that meeting NPP standards would be easier at an ISFSI or MRS due to the relative simplicity of construction and robust character of the structures as compared to an NPP.

Response:

The NRC disagrees with the commenter and believes that the proposed DE at a MAPE of 5E-4 (2,000 year return period) for an ISFSI or MRS facility is adequate for protecting public health and safety. The seismically induced risk from the operation of an ISFSI or MRS is less than from the operation of an NPP, and based on the review of the current seismic design practice, the proposed DE design level is reasonable and consistent with the NRC's policy of risk-informed, performance-based regulations. Details of the NRC's review for the proposed DE level are provided in the report, "Selection of 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.

The NRC agrees with the commenter that the cask structure is simple in construction and robust in character resulting from the design considerations other than earthquake effects. Earthquake loads and the DE level would not govern the cask design. However, this is not the case in the design and stability evaluation of other ISFSI or MRS facility structures, systems, and components, such as the concrete pad, foundation, and the canister transfer building. Designs of these structures, systems, and components depend on the DE level. Further, because of the inherent safety margins in the design criteria in NUREG-1536 and NUREG-1567, the structures, systems, and components designed for a DE at a MAPE of 5E-4 (2,000 year return period) would be able to withstand a DE at a MAPE of 1E-4 (10,000 year return period consistent with the NPP requirements) without impairing the ability to meet the Part 72 dose limits for protecting public health and safety. Therefore, it is an unnecessary burden on the applicant to require the ISFSI or MRS facility to design for a DE at a level consistent with NPP requirements.

Comment 24:

Two commenters stated that the seismic design standard (MAPE of 5E-4 (2,000 year return period)) is less protective than the seismic standard for municipal solid waste landfills in California (maximum credible earthquake (MCE) of 4E-4 (2,500 year return period)), and the International Building Code (MCE of 4E-4 (2,500 year return period)), both of which are more stringent than the proposed rule. One commenter is concerned that a DE at a MAPE of 5E-4 (2,000 year return period) may not provide an adequate margin of safety to protect the public.

However, two other commenters stated that the rigor of the seismic evaluation criteria and the conservatism of the seismic design requirements significantly exceed those in modern

conventional building codes. One of the commenters stated that the annual probability of unacceptable seismic performance for a dry cask ISFSI designed to a DE at a MAPE of 5E-4 (2,000 year return period) will be substantially less than that of an essential or hazardous facility designed to the modern conventional building code for which the DE was established at 67 percent of the MCE of 4E-4. Another commenter stated that the level of safety for a dry cask storage facility designed to a DE at a MAPE of 5E-4 (2,000 year return period) provides at least twice the level of safety attained by facilities designed under the International Building Code.

Response:

The NRC disagrees with the commenters that the seismic design standard (MAPE of 5E-4) is less protective than the seismic standard for municipal solid waste landfills in California (Code of Regulations Section 66264.25(b), and the International Building Code - 2000 (IBC-2000). The California standard requires the municipal waste landfills to be designed to withstand the maximum credible earthquake (MAPE of 4E-4) of the IBC-2000 without decreasing the level of public health and environmental protection. The cask and the cask transfer building at an ISFSI or MRS facility, designed to a DE at a MAPE of 5E-4, has the capacity to withstand earthquakes of greater magnitude than the one associated with the MAPE of 4E-4. This is because of the conservatism in the seismic evaluation criteria and of NRC's NUREG-1536 and NUREG-1567, which significantly exceed those in modern conventional building codes. Additionally, the risk of the ISFSI or MRS facility to public health and safety is lower than the risk for hazardous waste and municipal solid waste landfills because the spent nuclear fuel is contained within a sealed steel cask in an isolated facility

away from the public, with a controlled boundary at a minimum distance of 100 m. Landfills, on the other hand, may be open and in close proximity to public areas.

Comment 25:

Three commenters stated that the proposed rule provided no basis or quantitative analysis to justify lowering the DE to any particular value. One of these commenters indicated that absent any quantitative evidence justifying a particular value, the conservative, precautionary approach of requiring ISFSIs and MRSs to meet the same design standard as a nuclear power plant is most appropriate. One of these commenters noted that the adequacy of the MAPE should be addressed with respect to the change in the DE. The commenter stated that this could be addressed by using the higher proposed MAPE versus what is currently required and then determining if the change in the level of risk of a release is significant or not.

Response:

The DE level proposed in the draft regulatory guide was selected based on the fact that the ISFSI or MRS risk is lower than that of an NPP and on the fact that this level is consistent with the hazard levels used in the nuclear industry for similar facilities. Details of the NRC's analyses for establishing the DE level are provided in the report, "Selection of 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.

Comment 26:

Two commenters strongly endorsed the proposal to lower the DE. The commenters stated that the DE provided in the draft regulatory guide at a MAPE of 5E-4 (2,000 year return period) provides a level of relief in establishing the DE that is completely consistent with the risk-informed regulation policy and is an excellent example of the application of the policy. One commenter stated that the philosophy of applying a graded approach to seismic design requirements for facilities of differing risks has been in existence for more than 30 years. The commenter described DOE's approach for seismic design requirements for DOE facilities, which span a range of potential risks. The commenter went on to state that based on the amount of radioactive material stored in a large dry cask ISFSI, the resulting classification using the DOE approach would result in a design standard with a MAPE of 5E-4. The commenter stated that considering the minor radiological consequences from a single canister failure and a lack of a credible mechanism to cause such a failure from a seismic event would suggest that this design criteria level is more than adequately conservative for a dry cask ISFSI.

Response:

The commenters support the NRC's recommendation of the seismic design earthquake level to a MAPE of 5E-4 (2,000 year return period).

FINDING OF NO SIGNIFICANT ENVIRONMENTAL IMPACT: AVAILABILITY

Comment 27:

Three commenters challenged the assertion that the NRC has considerable experience in licensing dry cask storage systems and analyzing cask behavior. One commenter noted that the NRC has licensed only four ISFSIs in the western U.S., the most seismically active part of the country, and none as close to major plate-boundary faults as the three planned for coastal California. The commenters also said that analytical experience in licensing does not equate with practical experience. One commenter stated that this will only be achieved when an ISFSI experiences strong ground motions as a result of a major earthquake. As a result, the commenter believes that neither the specific nor general licenses issued have been tested.

Response:

As discussed in the NRC response to Comment 4, cask stability can be evaluated with adequate reliability by using non-linear dynamic analyses because the concept of free-standing structures is not a new one. One does not need to test all structures prior to using them, provided structures are simple and can be reliably analyzed.

REGULATORY ANALYSIS

Comment 28:

A commenter noted that the proposed changes impose no new burdens on establishing the DE for an ISFSI over the current requirements in 10 CFR Part 72.

Response:

The NRC's analysis actually indicates that there would be an overall reduction in the total burden placed on licensees from these changes. The estimate of values and impacts to a specific-license applicant indicates additional costs of $100,000 for addressing uncertainties in seismic hazard analysis. In some cases, ISFSI specific-license applicants have sought exemptions from the design requirements contained in § 72.102, considering site characteristics and other factors. The rule would reduce or eliminate the need for these exemption requests by reducing the DE level for certain structures, systems, and components, resulting in a savings of $150,000 per license applicant. Further, no structures, systems, and components would be required to be designed to withstand a DE at a MAPE of 1E-4 (equivalent to the SSE of an NPP), resulting in lower analytical and certain capital costs. The overall effect of the rule would be a cost savings to new specific-license applicants. However, the amount of these savings is highly site-specific, depending on site characteristics and the specified DE level.

Finally, the rule will change § 72.212(b)(2)(i)(B) to require written evaluations, prior to use, establishing that cask storage pads and areas have been evaluated for the static and

dynamic loads of the stored casks. There are no additional costs associated with evaluating cask pads and areas for dynamic loads because general licensees are already required to consider dynamic loads to meet the cask design basis of the Certificate of Compliance under § 72.212(b)(i)(A).

VII. Summary of Final Revisions

This final rule will make the following changes to 10 CFR Part 72:

Section 72.9 Information collection requirements: OMB approval.

In § 72.9, the list of sections where approved information collection requirements appear is amended to add § 72.103.

Section 72.102 Geological and seismological characteristics. (Current Heading)

Section 72.102 Geological and seismological characteristics for applications before [insert Effective Date of the Rule] and applications for other than dry cask modes of storage. (New Heading)

The heading of § 72.102 is revised because § 72.103 is added for ISFSI or MRS applications after the effective date of the rule. Section 72.103 will only apply to dry cask modes of storage. Therefore, the heading of § 72.102 is being modified to show the revised applicability of this section. The requirements of § 72.102 will continue to apply for an ISFSI or MRS using wet modes of storage or dry modes of storage that do not use casks.

The NRC does not intend for existing Part 72 licensees to re-evaluate the geological and seismological characteristics for siting and design using the revised criteria in the changes to the regulations. These existing facilities are considered safe because the criteria used in

their evaluation have been determined to be safe for NPP licensing, and the seismically induced risk of an ISFSI or MRS is significantly lower than that of an NPP. The change leaves the current § 72.102 in place to preserve the licensing bases of present ISFSIs.

Section 72.103 Geological and seismological characteristics for applications for dry cask modes of storage on or after **[insert Effective Date of the Rule]**.

The trend towards dry cask storage has resulted in the need for applicants for new licenses to request exemptions from § 72.102(f)(1), which requires that for sites evaluated under the criteria of Appendix A to Part 100, the DE must be equivalent to the SSE for an NPP. By making § 72.102 applicable only to existing ISFSIs and by providing a new § 72.103, the revised rule is intended to preclude the need for exemption requests from new specific-license applicants.

The new requirements in § 72.103 parallel the requirements in § 72.102. However, new specific-license applicants for sites located in either the western U.S. or in the eastern U.S. in areas of known seismic activity, and not co-located with an NPP, for dry cask storage applications, on or after the effective date of this rule, will be required to address the uncertainties in seismic hazard analysis by using a PSHA or sensitivity analyses instead of using the deterministic methods of Appendix A to Part 100 without sensitivity analyses. Applicants located in either the western U.S. or in areas of known seismic activity in the eastern U.S., and co-located with an NPP, have the option of using the PSHA methodology or suitable sensitivity analyses for determining the DE, or using the existing design criteria for the NPP. This change to require an understanding of the uncertainties in the determination of the DE will make the regulations compatible with 10 CFR 100.23 for NPPs and will allow the

geological and seismological criteria for ISFSI or MRS dry cask storage facilities to be risk-informed.

New § 72.103(a)(1) provides that sites located in eastern U.S. and not in areas of known seismic activity, will be acceptable if the results from onsite foundation and geological investigation, literature review, and regional geological reconnaissance show no unstable geological characteristics, soil stability problems, or potential for vibratory ground motion at the site in excess of an appropriate response spectrum anchored at 0.2 g. Section 72.103(a)(1) will parallel the requirements currently included in § 72.102(a)(1).

New § 72.103(a)(2) provides that applicants conducting evaluations in accordance with § 72.103(a)(1) may use a standardized DE described by an appropriate response spectrum anchored at 0.25 g. These requirements parallel the requirements currently included in § 72.102(a)(2). Section 72.102(a)(2) provides an alternative to determine a site-specific DE using the criteria and level of investigations required by Appendix A to Part 100. New § 72.103(a)(2) also provides, as an alternative, that a site-specific DE may be determined by using the criteria and level of investigations in new § 72.103(f). Section 72.103(f) is a new provision that requires certain new ISFSI or MRS license applicants to address uncertainties in seismic hazard analysis by using appropriate analyses, such as a PSHA or suitable sensitivity analyses, in determining the DE instead of the current deterministic approach in Appendix A to Part 100.

New § 72.103(a)(2) also provides that if an ISFSI or MRS is located at an NPP site, the existing geological and seismological design criteria for the NPP may be used instead of PSHA techniques or suitable sensitivity analyses because the risk due to a seismic event at an ISFSI or MRS is less than that of an NPP. If the existing design criteria for the NPP is used and the

site has multiple NPPs, then the criteria for the most recent NPP must be used to ensure that the seismic design criteria used is based on the latest seismic hazard information at the site.

New § 72.103(b) provides that applicants for licenses for sites located in either the western U.S. or in the eastern U.S. in areas of known seismic activity, must investigate the geological, seismological, and engineering characteristics of the site using the PSHA techniques or suitable sensitivity analyses of new § 72.103(f). If an ISFSI or MRS is located at an NPP site, the existing geological and seismological design criteria for the NPP may be used instead of PSHA techniques or suitable sensitivity analyses because the risk due to a seismic event at an ISFSI or MRS is less than that of an NPP. If the existing design criteria for the NPP is used and the site has multiple NPPs, then the criteria for the most recent NPP must be used to ensure that the seismic design criteria used is based on the latest seismic hazard information at the site.

New § 72.103(c) is identical to § 72.102(c). Section 72.103(c) requires that sites, other than bedrock sites, must be evaluated for the liquefaction potential or other soil instability due to vibratory ground motion. This is to ensure that an ISFSI or MRS will be adequately supported on a stable foundation during a seismic event.

New § 72.103(d) is identical to § 72.102(d). Section 72.103(d) requires that site specific investigation and laboratory analysis must show that soil conditions are adequate for the proposed foundation loading. This is to ensure that an ISFSI or MRS will be adequately supported on a stable foundation during a seismic event.

New § 72.103(e) is identical to § 72.102(e). Section 72.103(e) requires that in an evaluation of alternative sites, those which require a minimum of engineered provisions to correct site deficiencies are preferred, and that sites with unstable geologic characteristics should be avoided. This is to ensure that sites with minimum deficiencies are selected and

that an ISFSI or MRS will be adequately supported on a stable foundation during a seismic event.

New § 72.103(f) describes the steps required for seismic hazard analysis to determine the DE for use in the design of structures, systems, and components of an ISFSI or MRS. The scope of site investigations to determine the geological, seismological, and engineering characteristics of a site and its environs is similar to § 100.23 requirements. Unlike § 72.102(f), which requires the use of the deterministic method of Appendix A to Part 100, new § 72.103(f) requires evaluating uncertainty in seismic hazard analysis by using a probabilistic method, such as the PSHA, or suitable sensitivity analyses, similar to § 100.23 requirements for an NPP.

New § 72.103(f)(1) requires that the geological, seismological, and engineering characteristics of a site and its environs must be investigated in sufficient scope and detail to permit an adequate evaluation of the proposed site and to determine the DE. These requirements track existing requirements in § 100.23(c).

New §§ 72.103(f)(2)(i) through (iv) specify criteria for determining the DE for the site, the potential for surface tectonic and nontectonic deformations, the design basis for seismically induced floods and water waves, and other design conditions. In particular, § 72.103(f)(2)(i) provides that a specific-license applicant must address uncertainties in seismic hazard analysis by using appropriate analyses, such as a PSHA or suitable sensitivity analyses, for determining the DE. Sections 72.103(f)(2)(ii) through (iv) track the corresponding requirements in § 100.23(d).

Finally, the new § 72.103(f)(3) provides that regardless of the results of the investigations anywhere in the continental U.S., the DE must have a value for the horizontal

ground motion of no less than 0.10 g with the appropriate response spectrum. This provision is identical to the requirement currently included in § 72.102(f)(2).

Section 72.212 Conditions of general license issued under § 72.210.

Section 72.212(b)(2)(i)(B) is revised to require general licensees to address the dynamic loads of the stored casks in addition to the static loads. The requirements are changed because during a seismic event the cask experiences dynamic inertia loads in addition to the static loads, which are supported by the concrete pad. The dynamic loads depend on the interaction of the casks, the pad, and the foundation. Consideration of the dynamic loads, in addition to the static loads, of the stored casks will ensure that the pad would perform satisfactorily during a seismic event.

The new paragraph also requires consideration of potential amplification of earthquakes through soil-structure interaction, and soil liquefaction potential or other soil instability due to vibratory ground motion. 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 a vibratory motion due to an earthquake may affect the cask stability, and thus must be addressed.

The changes to § 72.212 are intended to require that general licensees perform appropriate load evaluations of cask storage pads and areas to ensure that casks are not placed in an unanalyzed condition. Similar requirements currently exist in § 72.102(c) for an ISFSI specific license and are now in § 72.103(c).

VIII. Criminal Penalties

For the purpose of Section 223 of the Atomic Energy Act (AEA), the Commission is issuing this final rule to amend 10 CFR Part 72 under one or more of sections 161b, 161i, or 161o of the AEA. Willful violations of the rule will be subject to criminal enforcement.

IX. Agreement State Compatibility

Under the "Policy Statement on Adequacy and Compatibility of Agreement State Programs" approved by the Commission on June 30, 1997, and published in the Federal Register on September 3, 1997 (62 FR 46517), this rule is classified as Compatibility Category "NRC." Compatibility is not required for Category "NRC" regulations. The NRC program elements in this category are those that relate directly to areas of regulation reserved to the NRC by the AEA of 1954, as amended (AEA), or the provisions of Title 10 of the Code of Federal Regulations. Although an Agreement State may not adopt program elements reserved to the NRC, it may wish to inform its licensees of certain requirements via a mechanism that is consistent with the particular State's administrative procedure laws, but does not confer regulatory authority on the State.

X. Voluntary Consensus Standards

The National Technology Transfer Act of 1995 (Pub. L. 104-113) requires that Federal agencies use technical standards that are developed or adopted by voluntary consensus standards bodies unless the use of such a standard is inconsistent with applicable law or

otherwise impractical. In this final rule, the NRC is presenting amendments to its regulations in 10 CFR Part 72 for the geological and seismological criteria of a dry cask independent spent fuel storage facility to make them commensurate with the risk of the facility. This action does not constitute the establishment of a standard that establishes generally applicable requirements.

XI. Finding of No Significant Environmental Impact: Availability

The Commission has determined under the National Environmental Policy Act of 1969, as amended, and the Commission's regulations in Subpart A of 10 CFR Part 51, that this rule is not a major Federal action significantly affecting the quality of the human environment and therefore an environmental impact statement is not required.

The Commission concluded, based on an environmental assessment, that no significant environmental impact would result from this rulemaking. 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 and, during normal operations, the conditions required for the release and dispersal of significant quantities of radioactive materials are not present. There are no high temperatures or pressures present 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 after it has decayed for more than one year before storage in an ISFSI or MRS and the low inventory of volatile radioactive materials readily available for release to the environs. The long-lived

nuclides present in spent fuel are tightly bound in the fuel materials and are not readily dispersible. The short-lived volatile nuclides, such as I-131, are no longer present in aged spent fuel stored at an ISFSI or MRS. Furthermore, even if the short-lived nuclides were present during an event of a fuel assembly rupture, the canister surrounding the fuel assemblies would confine these nuclides.

The standards in Part 72 Subparts E "Siting Evaluation Factors," and F "General Design Criteria," ensure that the dry cask storage designs are very rugged and robust. The casks must maintain structural integrity during a variety of postulated non-seismic events, including cask drops, tip-over, and wind driven missile impacts. These non-seismic events challenge cask integrity significantly more than seismic events. Therefore, the casks have substantial design margins to withstand forces from a seismic event greater than the design earthquake.

Hence, the seismically induced radiological risk associated with an ISFSI or MRS is less than the risk associated with an NPP.

The determination of the environmental assessment is that there will be no significant environmental impact due to the rule changes because the same level of safety would be maintained by the new requirements, taking into account the lesser risk from an ISFSI or MRS.

The NRC requested public comments on the environmental assessment for this rule.

XII. Paperwork Reduction Act Statement

This final rule amends information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq). These requirements were approved by the Office of Management and Budget, approval number 3150-0132.

Because the rule will reduce existing information collection requirements, the public burden for these information collections is expected to be decreased by 55 hours per licensee. This reduction includes the time required for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the information collection. Send comments on any aspect of these information collections, including suggestions for further reducing the burden, to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet electronic mail at INFOCOLLECTS@NRC.GOV; and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0132), Office of Management and Budget, Washington, DC 20503.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

XIII. Regulatory Analysis

The Commission has prepared a Regulatory Analysis (RA) entitled: "Regulatory Analysis of Geological and Seismological Characteristics for Design of Dry Cask Independent Spent Fuel Storage Installations." The RA examines the costs and benefits of the alternatives considered by the Commission. The RA 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.

XIV. Regulatory Flexibility Certification

In accordance with the Regulatory Flexibility Act of 1980 (5 U.S.C. 605(b)), the Commission certifies that this rule does not have a significant economic impact on a substantial number of small entities. This rule affects applicants for a Part 72 specific license, and general licensees on or after the effective date of the rule for an ISFSI or MRS. These companies do not generally fall within the scope of the definition of "small entities" set forth in the Regulatory Flexibility Act or the Small Business Size Standards set out in regulations issued by the Small Business Administration at 13 CFR Part 121.

XV. Backfit Analysis

The NRC has determined that the backfit rule, 72.62, does not apply to the changes in §§ 72.9, 72.102, and 72.103 because they do not involve any provisions that would impose backfits as defined in the backfit rule. Therefore, a backfit analysis is not required for these provisions.

Section 72.212(b)(2)(i)(B) currently requires evaluations of static loads of the stored casks for design of the cask storage pads and areas (foundation). The revision to this section will require general licensees also to address the dynamic loads of the stored casks. 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 in the event of an earthquake.

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 motion. 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. The soil liquefaction and instability during a vibratory motion due to an earthquake may affect the cask stability.

The changes to § 72.212(b)(2)(i)(B) will impact procedures required to operate an ISFSI and, therefore, implicate the backfit rule. The changes will require that general licensees perform appropriate analyses to assure that the cask seismic design bases bound the specific site seismic conditions, and that casks are not placed in an unanalyzed condition. Therefore, these changes are necessary to assure adequate protection to occupational or public health and safety. Although the Commission is imposing this backfit because it is necessary to assure adequate protection to occupational or public health and safety, the changes to § 72.212 will not actually impose 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 general licensees to 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 tornado loads, be evaluated to meet the cask design bases. Because the general licensees currently evaluate dynamic loads for evaluating

the casks, pads and areas, the changes to § 72.212(b)(2)(i)(B) will not actually require any general licensees presently operating an ISFSI to re-perform any written evaluations previously undertaken.

XVI. Small Business Regulatory Enforcement Fairness Act

In accordance with the Small Business Regulatory Enforcement Fairness Act of 1996, the NRC has determined that this action is not a major rule and has verified this determination with the Office of Information and Regulatory Affairs of OMB.

List of Subjects In 10 CFR Part 72

Administrative practice and procedure, Criminal penalties, Manpower training programs, Nuclear materials, Occupational safety and health, Penalties, Radiation protection, Reporting and recordkeeping requirements, Security measures, Spent fuel, Whistleblowing.

For the reasons set out in the preamble and under the authority of the Atomic Energy Act of 1954, as amended; the Energy Reorganization Act of 1974, as amended; and 5 U.S.C. 552 and 553; the NRC is adopting the following amendments to 10 CFR Part 72.

PART 72–LICENSING REQUIREMENTS FOR THE INDEPENDENT STORAGE OF SPENT NUCLEAR FUEL, HIGH-LEVEL RADIOACTIVE WASTE, AND REACTOR-RELATED GREATER THAN CLASS C WASTE

1. The authority citation for Part 72 continues to read as follows:

Authority: Secs. 51, 53, 57, 62, 63, 65, 69, 81, 161, 182, 183, 184, 186, 187, 189, 68 Stat. 929, 930, 932, 933, 934, 935, 948, 953, 954, 955, as amended, sec. 234, 83 Stat. 444, as amended (42 U.S.C. 2071, 2073, 2077, 2092, 2093, 2095, 2099, 2111, 2201, 2232, 2233, 2234, 2236, 2237, 2238, 2282); sec. 274, Pub. L. 86-373, 73 Stat. 688, as amended (42 U.S.C. 2021); sec. 201, as amended, 202, 206, 88 Stat. 1242, as amended, 1244, 1246 (42 U.S.C. 5841, 5842, 5846); Pub. L. 95-601, sec. 10, 92 Stat. 2951 as amended by Pub. L. 102-486, sec. 7902, 106 Stat. 3123 (42 U.S.C. 5851); sec. 102, Pub. L. 91-190, 83 Stat. 853 (42 U.S.C. 4332); secs. 131, 132, 133, 135, 137, 141, Pub. L. 97-425, 96 Stat. 2229, 2230, 2232, 2241, sec. 148, Pub. L. 100-203, 101 Stat. 1330-235 (42 U.S.C. 10151, 10152, 10153, 10155, 10157, 10161, 10168).

Section 72.44(g) also issued under secs. 142(b) and 148(c), (d), Pub. L. 100-203, 101 Stat. 1330-232, 1330-236 (42 U.S.C. 10162(b), 10168(c),(d)). Section 72.46 also issued under sec. 189, 68 Stat. 955 (42 U.S.C. 2239); sec. 134, Pub. L. 97-425, 96 Stat. 2230 (42 U.S.C. 10154). Section 72.96(d) also issued under sec. 145(g), Pub. L. 100-203, 101 Stat. 1330-235 (42 U.S.C. 10165(g)). Subpart J also issued under secs. 2(2), 2(15), 2(19), 117(a), 141(h), Pub. L. 97-425, 96 Stat. 2202, 2203, 2204, 2222, 2224, (42 U.S.C. 10101, 10137(a), 10161(h)). Subparts K and L are also issued under sec. 133, 98 Stat. 2230 (42 U.S.C. 10153) and sec. 218(a), 96 Stat. 2252 (42 U.S.C. 10198).

2. In § 72.9, paragraph (b) is revised to read as follows:

§ 72.9 Information collection requirements: OMB approval.

* * * * *

(b) The approved information collection requirements contained in this part appear in §§ 72.7, 72.11, 72.16, 72.22 through 72.34, 72.42, 72.44, 72.48 through 72.56, 72.62, 72.70, through 72.82, 72.90, 72.92, 72.94, 72.98, 72.100, 72.102, 72.103, 72.104, 72.108, 72.120, 72.126, 72.140 through 72.176, 72.180 through 72.186, 72.192, 72.206, 72.212, 72.216, 72.218, 72.230, 72.232, 72.234, 72.236, 72.240, 72.242, 72.244, 72.248.

3. The heading of § 72.102 is revised to read as follows:

§ 72.102 Geological and seismological characteristics for applications before **[insert Effective Date of the Rule]** and applications for other than dry cask modes of storage.

* * * * *

4. A new § 72.103 is added to read as follows:

§ 72.103 Geological and seismological characteristics for applications for dry cask modes of storage on or after **[insert Effective Date of the Rule]**.

(a)(1) East of the Rocky Mountain Front (east of approximately 104^{o} west longitude), except in areas of known seismic activity including but not limited to the regions around New Madrid, MO; Charleston, SC; and Attica, NY; sites will be acceptable if the results from onsite foundation and geological investigation, literature review, and regional geological reconnaissance show no unstable geological characteristics, soil stability problems, or potential for vibratory ground motion at the site in excess of an appropriate response spectrum anchored at 0.2 g.

(2) For those sites that have been evaluated under paragraph (a)(1) of this section that are east of the Rocky Mountain Front, and that are not in areas of known seismic activity, a

standardized design earthquake ground motion (DE) described by an appropriate response spectrum anchored at 0.25 g may be used. Alternatively, a site-specific DE may be determined by using the criteria and level of investigations required by paragraph (f) of this section. For a site with a co-located nuclear power plant (NPP), the existing geological and seismological design criteria for the NPP may be used. If the existing design criteria for the NPP is used and the site has multiple NPPs, then the criteria for the most recent NPP must be used.

(b) West of the Rocky Mountain Front (west of approximately 104^{o} west longitude), and in other areas of known potential seismic activity east of the Rocky Mountain Front, seismicity must be evaluated by the techniques presented in paragraph (f) of this section. If an ISFSI or MRS is located on an NPP site, the existing geological and seismological design criteria for the NPP may be used. If the existing design criteria for the NPP is used and the site has multiple NPPs, then the criteria for the most recent NPP must be used.

(c) Sites other than bedrock sites must be evaluated for their liquefaction potential or other soil instability due to vibratory ground motion.

(d) Site-specific investigations and laboratory analyses must show that soil conditions are adequate for the proposed foundation loading.

(e) In an evaluation of alternative sites, those which require a minimum of engineered provisions to correct site deficiencies are preferred. Sites with unstable geologic characteristics should be avoided.

(f) Except as provided in paragraphs (a)(2) and (b) of this section, the DE for use in the design of structures, systems, and components must be determined as follows:

(1) *Geological, seismological, and engineering characteristics.* The geological, seismological, and engineering characteristics of a site and its environs must be investigated

in sufficient scope and detail to permit an adequate evaluation of the proposed site, to provide sufficient information to support evaluations performed to arrive at estimates of the DE, and to permit adequate engineering solutions to actual or potential geologic and seismic effects at the proposed site. The size of the region to be investigated and the type of data pertinent to the investigations must be determined based on the nature of the region surrounding the proposed site. Data on the vibratory ground motion, tectonic surface deformation, nontectonic deformation, earthquake recurrence rates, fault geometry and slip rates, site foundation material, and seismically induced floods and water waves must be obtained by reviewing pertinent literature and carrying out field investigations. However, each applicant shall investigate all geologic and seismic factors (for example, volcanic activity) that may affect the design and operation of the proposed ISFSI or MRS facility irrespective of whether these factors are explicitly included in this section.

(2) *Geologic and seismic siting factors.* The geologic and seismic siting factors considered for design must include a determination of the DE for the site, the potential for surface tectonic and nontectonic deformations, the design bases for seismically induced floods and water waves, and other design conditions as stated in paragraph (f)(2)(iv) of this section.

(i) Determination of the Design Earthquake Ground Motion (DE). The DE for the site is characterized by both horizontal and vertical free-field ground motion response spectra at the free ground surface. In view of the limited data available on vibratory ground motions for strong earthquakes, it usually will be appropriate that the design response spectra be smoothed spectra. The DE for the site is determined considering the results of the investigations required by paragraph (f)(1) of this section. Uncertainties are inherent in these estimates and must be addressed through an appropriate analysis, such as a probabilistic seismic hazard analysis (PSHA) or suitable sensitivity analyses.

(ii) Determination of the potential for surface tectonic and nontectonic deformations. Sufficient geological, seismological, and geophysical data must be provided to clearly establish if there is a potential for surface deformation.

(iii) Determination of design bases for seismically induced floods and water waves. The size of seismically induced floods and water waves that could affect a site from either locally or distantly generated seismic activity must be determined.

(iv) Determination of siting factors for other design conditions. Siting factors for other design conditions that must be evaluated include soil and rock stability, liquefaction potential, and natural and artificial slope stability. Each applicant shall evaluate all siting factors and potential causes of failure, such as, the physical properties of the materials underlying the site, ground disruption, and the effects of vibratory ground motion that may affect the design and operation of the proposed ISFSI or MRS.

(3) Regardless of the results of the investigations anywhere in the continental U.S., the DE must have a value for the horizontal ground motion of no less than 0.10 g with the appropriate response spectrum.

5. In § 72.212, paragraph (b)(2)(i)(B) is revised to read as follows:

§ 72.212 Conditions of general license issued under § 72.210.

* * * * *

(b) * * *

(2) * * *

(i) * * *

(B) Cask storage pads and areas have been designed to adequately support the static

and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, and soil liquefaction potential or other soil instability due to vibratory ground motion; and

* * * * *

Dated at Rockville, Maryland, this _____day of _____, 2003.

For the Nuclear Regulatory Commission.

_____
Annette L. Vietti-Cook,
Secretary for the Commission.