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

Final Report

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Executive Summary

The Nuclear Regulatory Commission (NRC) is amending its siting and design requirements in 10 CFR Part 72 for dry cask modes of storage of (1) spent nuclear fuel in an independent spent fuel storage installation (ISFSI) and (2) spent nuclear fuel and solid high-level radioactive waste in a monitored retrievable storage installation (MRS). For this document, the term "ISFSI" is used to include both dry cask ISFSI and MRS facilities, as appropriate. The Commission is not revising 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 Commission is not revising 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 facilities.

The Commission considered a number of options to change the siting and design requirements in Part 72. This Regulatory Analysis (RA) is part of the Commission's analysis of the options considered.

In its proposed rule (67 FR 47745, July 22, 2002), the Commission proposed the following changes:

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 a nuclear power plant (NPP), to address uncertainties in the seismic hazard analysis by using appropriate analyses, such as a probabilistic seismic hazard analysis (PSHA) or other suitable sensitivity analyses, for determining the design earthquake ground motion (DE). All other new specific-license applicants for dry cask storage facilities would have the option of complying with the proposed requirement to use a PSHA or other suitable sensitivity analyses to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation.

2. Allow new ISFSI applicants to use a DE appropriate for and commensurate with the risk associated with an ISFSI (§ 72.103). Regulatory Guide 3.73 (RG 3.73, draft was DG-3021), "Site Evaluations and Design Earthquake Ground Motion for Dry Cask Independent Spent Fuel Storage and Monitored Retrievable Storage Installations," accompanying the final rule, recommended a DE with a mean annual probability of exceedance of 5E-4, which is lower than the current level for the safe shutdown earthquake (SSE) of an NPP, for ISFSI applications.

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

The changes are consistent with the Commission's strategic goals in that

– The rule would increase NRC's effectiveness and efficiency by reducing the number of exemption requests that would need to be submitted by the applicants and reviewed by NRC.

– This rule would maintain safety by selecting the DE level to be commensurate with the risk associated with an ISFSI.

– The changes to the DE level are considered risk-informed, consistent with NRC policy to develop risk-informed regulations.

– This rule would increase realism by enabling ISFSI applicants to use a state-of-the-art approach (PSHA or suitable sensitivity analyses) to more accurately characterize the seismicity of a site as opposed to the current deterministic approach which does not account for uncertainties in seismic data and interpretations.

The Commission considered four options for this rulemaking:

Option 1.

No Action. The siting requirements for new dry cask ISFSIs would continue to conform to the existing requirements of §§ 72.102.

Option 1 would maintain the current siting requirements for new dry cask ISFSI specific-license applicants. Thus, relative to existing requirements, no values or impacts would result from Option 1, but the benefits (values) to be derived from the other options would remain unrealized.

Option 2.

Require new Part 72 specific-license applicants to conform to the geologic and seismic siting criteria in § 100.23 (PSHA or suitable sensitivity analyses) in lieu of the criteria in Appendix A to Part 100 (deterministic approach).

Under this option, the cost for complying with Part 72 requirements would increase by approximately $100,000 per applicant to conduct a PSHA or suitable sensitivity analyses instead of using the current deterministic approach. Assuming one applicant per year the annual cost is $100,000. NRC would incur costs associated with development of guidance and revisions to existing documents, such as the Standard Review Plan and related materials, estimated at approximately $24,640 as a one time cost. NRC would also incur costs associated with the review of the PSHA, estimated to be $12,320 annually. However, value would be provided by adoption of this option because Part 72 requirements would be more compatible with similar requirements for NPPs, thus improving regulatory efficiency. Further, this option may provide improvements in knowledge, which could result in improvements in regulatory and policy requirements.

Option 3.

Require new Part 72 specific-license applicants to conform to § 100.23 in lieu of Appendix A to Part 100, and also give them the option to use a graded approach (design of structures, systems, and components to different levels based on their importance to safety) to seismic design of the ISFSI.

Option 3 would require new specific-license applicants to comply with § 100.23 (use a PSHA or suitable sensitivity analyses), as well as provide the option for using a graded approach to seismic design for SSCs. The requirement to comply with § 100.23 is the same as described in section 3.3.2 of this analysis for Option 2. Therefore, the estimate of values and impacts to specific licensees and NRC is the same as described under Option 2, which would result in additional costs to specific-license applicants of $100,000 per year. In some cases, ISFSI specific-license applicants have sought exemptions from the design requirements contained in § 72.102, considering site characteristics and other factors. This option would reduce or

eliminate the need for these exemption requests by reducing the DE level for certain SSCs. Assuming that one new specific-license applicant would have submitted an exemption request each year, the estimated savings would be $150,000 per year under Option 3. Further, under Option 3, reducing the DE for certain SSCs would result in savings by reducing analytical costs and certain capital costs. NRC would realize cost savings associated with reviewing the exemption request. The total cost for NRC staff to review a single exemption request is estimated to be approximately $18,480 per year under Option 3.

The overall effect of Option 3 would be a cost savings to new specific-license applicants. The amount of these savings, however, is highly site-specific, depending on site characteristics, and the specified DE level.

Option 4.

(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 a nuclear power plant, to address uncertainties in the seismic hazard analysis by using appropriate analyses, such as a PSHA or other suitable sensitivity analyses, for determining the DE. All other new specific-license applicants for dry cask storage facilities would have the option of complying with the proposed requirement to use a PSHA or other suitable sensitivity analyses to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation.

(2) Maintain the present Part 72 requirement of using a single-level DE, but allow for the use of a lower DE that is commensurate with the lower level of risk associated with the potential accident scenarios for ISFSIs. RG 3.73, accompanying the final rule, recommends a DE with a mean annual probability of exceedance of 5E-4 for ISFSI applications. This recommended level is lower than the present level of approximately 1E-4 (equivalent to the SSE for an NPP).

The values and impacts associated with Option 4 are similar to those for Option 3. The advantage of Option 4 over Option 3 is simply that under Option 4, no SSCs would be required to be designed to withstand a DE with a mean annual probability of exceedance of 1E-4 (equivalent to the SSE of an NPP), resulting in lower analytical and certain capital costs.

The overall effect of Option 4 would be a cost savings to new specific-license applicants. The amount of these savings, however, is highly site-specific, depending on site characteristics, and the specified DE level.

Options Summary

Under Options 2 through 4, public and occupational health would be improved because the seismic hazard would be better characterized by using state-of-the-art methods to address uncertainties in seismic data and interpretations.

Option 4 was determined to be the most preferable based on professional judgment and limited quantitative analysis because it (1) improves effectiveness and efficiency of the NRC regulatory process by eliminating the need for applicants to request exemptions from §§ 72.102(a), 72.102(b), and 72.102(f)(1), and the need for NRC to review the exemption requests; (2) reduces unnecessary regulatory burden for the applicant or specific licensee by potentially reducing the required DE level to account for the lower risk associated with ISFSI facilities; (3) would not result in significant overall additional implementation or operation costs to NRC and

applicants, and (4) supports the implementation of NRC's risk-informed approach to regulation.

Additional Change

The Commission also proposed a change to § 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. This change is an additional modification, separate from the changes considered in the options above.

NRC would 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 (CoC) under § 72.212(b)(i)(A).

1.0 Introduction

The NRC is amending its siting and design requirements in 10 CFR Part 72 for dry cask modes of storage of (1) spent nuclear fuel in an ISFSI and (2) spent nuclear fuel and solid high-level radioactive waste in a MRS. For this document, the term "ISFSI" is used to include both ISFSI and MRS facilities, as appropriate. The Commission is not revising 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 Commission is not revising 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 gained in licensing these facilities.

The Commission considered four options to change the siting and design requirements in Part 72. In its proposed rule (67 FR 47745) NRC proposed to adopt Option 4 (described in detail in sections 2.5 and 3.3.4 of this document). The purpose of this RA is to evaluate the costs and benefits associated with the regulatory changes considered by the Commission, including public comments received on the proposed rule. This document presents background material, describes the objectives of the rule, outlines the alternatives considered, and evaluates the values and impacts of the action and alternatives.

1.1 Background

In 1980, the Commission added 10 CFR Part 72 to its regulations to establish licensing requirements for the storage of spent fuel in an ISFSI (45 FR 74693, November 12, 1980). Subpart E of Part 72 contains siting evaluation factors that must be investigated and assessed with respect to the siting of an ISFSI, including a requirement for evaluation of geological and seismological characteristics. The original regulations envisioned these facilities as spent fuel pools or single, massive dry storage structures. The regulations required seismic evaluations equivalent to those for an NPP when the ISFSI is located in the western U.S. (approximately 104^0 west longitude) or in areas of known seismic activity in 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 designs, the regulation required a site-specific investigation to establish site suitability commensurate with the specific requirements of the proposed ISFSI. The Commission explained that for ISFSIs which do not involve massive structures, such as dry storage casks and canisters, the required DE 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 Part 72 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. Because the deterministic approach does not

explicitly recognize uncertainties in geoscience parameters, 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. Yet Appendix A to Part 100 does not allow this application.

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:

– The limitations in data and geologic and seismic analyses and the rapid accumulation of knowledge in the geosciences have required considerable latitude in judgment. The inclusion of detailed geoscience assessments in Appendix A has caused difficulties for applicants and the Commission by inhibiting the use of needed judgment and flexibility in applying basic principles to new situations.

– Various sections of Appendix A are subject to different interpretations. For ISFSI applications, some sections in the Appendix do not provide sufficient information for implementation. As a result, the Appendix has been the source of licensing delays and debate.

In 1996, the Commission 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 placed a new § 100.23 in the regulations requiring that the uncertainties in seismic hazard analysis in determining the SSE be addressed through appropriate analyses, such as a PSHA or suitable sensitivity analyses in lieu of Appendix A. This approach takes into account the shortcomings in the earlier siting requirements and is based on developments in the field over the past two decades. Further, regulatory guides have been used to address implementation issues. For example, the Commission provided guidance for nuclear power plant 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." However, the Commission 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 amending the seismological and geological requirements of 10 CFR Part 72 for siting and design of a dry cask ISFSI or MRS. The proposed rule and the announcement on the availability of the draft Regulatory Guide, DG-3021, were published for public comment on July 22, 2002 (Ref. 4.2). The amendments to the regulations include the use of PSHA or other suitable sensitivity analyses in evaluating the hazards to the ISFSI or MRS facility due to an earthquake, instead of the deterministic methods of 10 CFR 100 Appendix A of the current Part 72 regulations.

Unlike the regulations for a new NPP, the Part 72 amendments include limited use of the PSHA or suitable sensitivity analyses in evaluating the ISFSI or MRS facility hazards due to an earthquake. Only a specific-license applicant for a dry cask storage ISFSI or MRS facility at a site not co-located with an NPP, in either the western U.S., or in areas of known seismic activity in the eastern U.S. must use the PSHA or suitable sensitivity analyses, to address uncertainties in determining the DE. For all other specific-license applicants for a dry cask storage ISFSI or

MRS facility the use of the PSHA or suitable sensitivity analyses is optional. The applicant can use the design criteria for the most recent NPP (if applicable), or the current regulations applicable to locations in the eastern U.S. of a standardized DE described by an appropriate response spectrum anchored at 0.25 g. Thus, the amendments related to the use of the PSHA or suitable sensitivity analyses would apply only to a few sites in the western U.S. The amendments are not applicable to licensees operating an ISFSI under a Part 72 general license anywhere in the U.S.

As an additional minor change, NRC would amend § 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. 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 changes would 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.

1.2 Objectives of the Rulemaking

Part 72 currently requires siting and design of ISFSI facilities in accordance with requirements that were established for the licensing of NPPs. The changes to Part 72 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 state-of-the-art improvements in the geosciences and earthquake engineering, and (3) make the regulations more risk-informed.

The objectives of this 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 a nuclear power plant, to address uncertainties in the seismic hazard analysis by using appropriate analyses, such as a PSHA or other 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 other suitable sensitivity analyses to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation (§ 72.103).

2. Allow ISFSI applicants to use a DE appropriate for and commensurate with the risk associated with an ISFSI.

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

2.0 Identification and Analysis of Alternative Approaches

NRC considered three changes to its seismological and geological siting and design regulations for ISFSI applications.

(1) The first change considered the plausibility of requiring new 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, to address uncertainties in the seismic hazard analysis by using appropriate analyses, such as a PSHA or other suitable sensitivity analyses, for determining the DE. All other new specific-license applicants for dry cask storage facilities would have the option of complying with the proposed requirement to use a PSHA or other suitable sensitivity analyses to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation (§ 72.103).

The existing approach for determining a DE for an ISFSI, 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 safe shutdown earthquake ground motions 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 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.

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 Commission 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 Commission 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 or suitable sensitivity analyses. Consequently, methods other than probabilistic methods such as sensitivity analyses may be adequate for some sites to account for uncertainties. The Commission believes that certain new applicants for ISFSI specific licenses, as described in section 3.2, must also account for these uncertainties instead of using the Appendix A to Part 100.
NRC staff will review the application using all available data including insights and information from previous licensing experience. Thus, the approach requires thorough regional and site-

specific geoscience investigations. Results of the regional and site-specific investigations must be considered in application of 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 regional studies without detailed information on any specific location. 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 also must incorporate local site geological factors such as stratigraphy and topography and account for site-specific geotechnical properties in establishing the DE. In order to incorporate local site factors and advances in ground motion attenuation models, ground motion estimates are determined using the procedures outlined in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Reactors", Section 2.5.2, "Vibratory Ground Motion."

(2) The second change would allow applicants to use a DE appropriate for and commensurate with the risk associated with an ISFSI.

ISFSIs and MRS facilities have been designed for earthquakes based on the same risk as for an NPP. The current Part 72 regulations for an ISFSI or an MRS facility require that for sites that have been evaluated under the criteria of Appendix A of Part 100, the DE must be equivalent to the SSE for an NPP. Recently, the regulations for NPPs were changed from the deterministic criteria of Appendix A of Part 100 to the probabilistic seismic hazard analysis methods or suitable sensitivity analyses to account for uncertainties in determining the ground motion used in the seismic design of structures, systems and components (10 CFR 100.23, and Appendix S to 10 CFR Part 50). There is a need, therefore, to change Part 72 to allow the use of the PSHA and make the design earthquake level commensurate with the risk to public health and safety. This change is explained 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.

The Commission endorses the use of risk-informed, performance-based approaches for regulating nuclear material and high-level waste licensees.[1] In the Commission's Strategic Assessment and Rebaselining initiative, one of the Direction-Setting Issues (DSIs) was Risk-Informed, Performance-Based Regulation (DSI-12).

Radiological risks to the public result from a release of radioactive materials and their dispersal to the environment. To protect the public from the radiological risk, Part 72 requires that the SSCs in an ISFSI or MRS facility be classified as important to safety, if they have the function of protecting public health and safety from undue risk and preventing damage to the spent fuel during handling and storage.

[1] The Commission's endorsement of the use of risk-informed approaches to regulation are described in the following three documents: (1) "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities; Final Policy Statement, 60 FR 42622, August 16, 1995;" (2) "Framework for Risk-Informed Regulation in the Office of Nuclear Material Safety and Safeguards, SECY-99-100, March 31, 1999;" and (3) "Staff Requirements - SECY-99-100, from Annette Vietti-Cook, Secretary to the Commission, June 28, 1999."

The Dry Cask Storage Systems (DCSSs) for ISFSIs or MRSs, approved under Part 72 regulations, are typically self-contained massive concrete or steel structures, weighing approximately 100 to 180 tons when fully loaded. There are very few, if any, moving parts. The dry cask storage systems consist of free-standing vertical casks with a diameter ranging from 88 inches to 132 inches and a height to diameter ratio of 1.6 to 2.1, or a concrete Vault/Module type (NUHOMS cask storage systems). The spent-fuel is contained in a steel sealed canister for both types of storage systems.

The critical element for protection against radiation release is the sealed canister containing the spent fuel assemblies. The requirements in Part 72 in Subparts E, Siting Evaluation Factors, and F, General Design Criteria, ensure that the dry cask storage designs are very rugged and robust. The dry cask storage system design dimensions, such as thickness of various members are governed by radiological shielding, thermal, and potential drop accidents during handling of the cask. Effects of natural phenomena such as earthquakes, tornadoes, floods etc. are insignificant contributors to the stresses in various cask components, but are required to be considered for the cask stability. The cask stability parameters are the rigid body displacements and the rotations about the cask base on the pad. Cask rigid body displacements and rotations are calculated to evaluate the potential for a cask tip-over event, and a cask-to-cask impact. Even if it is demonstrated that a cask would not tip-over, the effects of a cask tip-over event on the cask's structural integrity are evaluated to meet the requirements of § 72.106(b) for limiting the radioactive release dose to 5 rem to protect public health and safety. If a cask-to-cask impact is likely to occur, the cask structural integrity is evaluated to meet the § 72.106(b) requirements.

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 using coupled non-linear finite-element analyses for a range of earthquakes.[2, 3, 4, 5] Site specific properties at three ISFSI facilities, two on the West coast, and one on the East coast were considered in the analyses. The analyses were performed for artificial earthquakes to match the DE for a plant and Regulatory Guide 1.60 spectra, and real earthquake records with maximum peak ground acceleration varying from 0.15 g to 1.5 g. The purpose of the studies was to determine the stability of the free-standing dry cask storage systems during an earthquake.

Based on the results of the analyses, 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, defined as the mean

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[2] "Seismic Analysis of HI-STORM 100 Casks at Private Fuel Storage Facility, Rev. 1," Luk, V. et al., Sandia National Laboratories, Albuquerque, NM, June 28, 2001.

[3] "Seismic Analysis of Three Module Rectangular Trans-Nuclear West Module/cask," Luk, V. et al., Sandia National Laboratories, Albuquerque, NM, December 21, 2001.

[4] "Seismic Analysis Report on HI-STORM 100 Casks at Private Fuel Storage Facility, Rev. 1," Luk, V. et al., Sandia National Laboratories, Albuquerque, NM, March 31, 2001.

[5] "Dynamic Soil-Structure Interaction Analysis of a Storage-Cask Foundation Design," Ofoegbu, G. I., Gute, G. D., Center for Nuclear Waste Regulatory Analyses, San Antonio, TX, October, 2002.

probability of exceedance level of 1E-4. Additionally, the parametric studies indicated that the dry cask storage systems have significant margins against the 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 the cask and MPC would remain structurally integral, and radioactivity from spent fuel would not be released to the environment.

In addition to the dry casks containing the spent fuel, the ISFSI or MRS facility includes a reinforced concrete building. The building is generally referred to as the Canister Transfer Building, and is considered as important to safety because the building is used for transferring the multi-purpose steel sealed canister (MPC), containing the spent fuel assemblies, from the transfer cask to the storage cask. The building is designed using the same load combinations, acceptance criteria, and design code, as for NPP safety related seismic Category I buildings. The considered amendments do not change the load combinations or the acceptance criteria for the design of the building. As a result of using these criteria, a building designed to DE can withstand a greater level earthquake without failing to perform its function. Using a minimum margin of safety of 1.5 and using the Hazard Curves for spectral acceleration at 0.1 second period, the building designed for a DE with a mean annual probability of exceedance of 5E-4, as proposed in RG 3.73, can withstand an earthquake with a return period of approximately 4,000 years in New York City, and 25,000 years in San Francisco, CA.

Consequences of a failure of the Canister Transfer Building during an earthquake magnitude greater than the DE, were analytically evaluated to determine if the failure of the crane and the handling system, and resulting drop of the cask and the crane, would damage the MPC of the HI-STORM 100 system.[6] Based on the evaluation, NRC concluded that the MPC would not be damaged and release radioactivity to the environment.

Additionally, for the Canister Transfer Building, the combined probability of the occurrence of a seismic event and operational failure that leads to a radiological release is much smaller than the individual probabilities of either of these events. This is because the handling building and crane are used for only a fraction of the licensed period of an ISFSI or MRS and for only a few casks at a time. Moreover, dry cask ISFSIs are expected to handle only sealed casks and not individual fuel assemblies. Therefore, the potential risk of a release of radioactivity caused by failure of the cask handling or crane during a seismic event is small.

Based on the above, the staff has concluded that the dry cask storage systems for an ISFSI or MRS facility are inherently robust structures because of the design requirements other than for an earthquake there are no adverse consequences due to operation of a dry cask ISFSI or MRS facility during an earthquake.

Since there are no adverse consequences to public health and safety at a dry cask ISFSI or MRS facility during an earthquake of a magnitude equivalent to the NPP SSE or greater, one can conclude that the current Part 72 regulations requiring the DE to be equivalent to the SSE for an NPP are excessive, and not performance-based or risk-informed. Therefore, there is a need to determine an appropriate minimum level of earthquake for a dry cask ISFSI or MRS facility, consistent with the criteria for the design of structures in industrial facilities, to verify

[6] "Analysis of Dry Cask Drop Scenarios onto a Reinforced Concrete Floor," Braverman, J., et al., Brookhaven National Laboratory, April 24, 2002.

cask/foundation stability and the Canister Transfer Building design/stability during an earthquake.

To determine an appropriate reasonable value of the mean annual probability of exceedance of an earthquake (the reference probability), or a mean return period, for a dry cask ISFSI or MRS facility, NRC staff reviewed the current guidelines contained in Regulatory Guide 1.165 for a nuclear power plant, the U. S. Department of Energy (DOE) guidelines in DOE-1020-2002,[7] and the International Building Code-2000,[8] and considered the public comments received in response to the proposed rule.

For the siting of a new nuclear power plant, Regulatory Guide 1.165 recommends the reference probability of 1E-5/yr, as the "median" annual probability of exceeding the SSE. The "median" annual probability of exceedance of 1E-5 is approximately equal to a "mean" annual probability of exceedance for the SSE, at sites in the Continental Eastern United States (CEUS). Because the uncertainty associated with the seismic hazard evaluations at sites in the Western United States (WUS) is less than at CEUS sites, "mean" values normally are closer to "median" values at the WUS sites. Thus, choosing a "mean" annual probability of exceedance of 1E-4 would be consistent with the "mean" hazard level associated with the "mean" hazard levels of nuclear power plants in the CEUS, but choosing a "median" annual probability of exceedance of 1E-5 would not be. Based on the recent work in NUREG/CR-6728,[9] the staff has determined that the use of a "mean" annual probability of exceedance for the reference probability of the seismic hazard is an appropriate method for the design of an ISFSI or MRS facility.

(3) The third change would require that the design of cask storage pads and areas at ISFSIs adequately account for dynamic loads in addition to static loads.

The Commission proposed a change to clarify that 10 CFR Part 72 general licensees must perform both static and dynamic analyses for new ISFSIs after the effective date of the rule to ensure that casks are not placed in an unanalyzed condition. The change would state that the design of cask storage pads and areas must adequately account for dynamic loads (in addition to static loads). For example, dynamic effects can cause soil-structure interactions that could amplify ground motion to the point that the acceleration on the casks is greater than the DE acceleration, or soil liquefaction could cause unacceptable pad and foundation settlement. Accounting for dynamic loads in the analysis of ISFSI pads and areas would ensure that the pad continues to support the casks during seismic events.

The specific options considered were:

Option 1. No Action. The siting requirements for new dry casks ISFSIs would continue to conform to the existing requirements of § 72.102.

Option 2. Require new Part 72 specific-license applicants, for sites located in either the western U.S., or in the eastern U.S. in areas of known seismic activity, to comply with the requirements of § 100.23 in lieu of § 72.102(f) which requires the use of Appendix A to Part 100. All other new specific-license applicants for dry cask storage facilities would have the

[7] "Natural Phenomena Hazards Design Evaluation Criteria for Department of Energy Facilities, DOE-STD-1020-2002, U.S. Department of Energy, January, 2002.

[8] "International Building Code 2000," International Code Council, 2002.

[9] ""Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk-Consistent Ground Motion Spectra Guidelines," NUREG/CR-6728, October, 2001.

option of complying with the proposed requirement to use § 100.23 to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation Appendix A to Part 100.

Option 3. Require new Part 72 specific-license applicants, for sites located in either the western U.S., or in the eastern U.S. in areas of known seismic activity, to comply with the requirements of § 100.23 in lieu of § 72.102(f) which requires the use of Appendix A to Part 100. All other new specific-license applicants for dry cask storage facilities would have the option of complying with the proposed requirement to use § 100.23 to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation Appendix A to Part 100. This option further requires the use of a graded approach to seismic design of the ISFSI SSCs.

Option 4. (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 a nuclear power plant, to address uncertainties in the seismic hazard analysis by using appropriate analyses, such as a PSHA or other suitable sensitivity analyses, for determining the DE. All other new specific-license applicants for dry cask storage facilities would have the option of complying with the proposed requirement to use a PSHA or other suitable sensitivity analyses to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation (§ 72.103).

(2) Maintain the present Part 72 requirement of using a single-level DE, but with a lower DE that is commensurate with the lower level of risk associated with the potential accident scenarios for ISFSIs. RG 3.73, accompanying this final rule, recommends a DE with a mean annual probability of exceedance of 5E-4, which is lower than the current level for the SSE of an NPP, for ISFSI applications.

Additional Proposed Change. The Commission also proposed a change to § 72.212(b)(2)(i)(B) that would require general licensees to evaluate both static and dynamic loads for new ISFSIs. This proposed change is an additional modification, separate from the changes proposed in the options above.

2.1 Comparison of Options

This section compares the requirements of the options considered. These options differ with regard to seismological and geological siting criteria and estimation of the DE for ISFSIs, and whether single-level DEs will be used in evaluating the design of ISFSI SSCs. As noted above, requirements for consideration of dynamic loads in the design of cask storage pads and areas may be promulgated along with any option. A summary of the requirements of the considered options is provided in Table 2-1.

Table 2-1. Comparison of Requirements Under Considered Options

Option	Seismic Siting Criteria, DE Definition	DE for Systems, Structures, and Components (SSCs)
1. (No Action)	Current § 72.102. Sites in the western U.S. do seismic analysis as required by Appendix A to Part 100. In the eastern U.S., use Appendix A analysis or DE with response spectrum anchored at 0.25g ground motion. If Appendix A is used at any site, DE is defined as the SSE for an NPP.	Current § 72.102.
2	Applicant must conform to § 100.23, requiring PSHA or suitable sensitivity analyses in lieu of Appendix A to Part 100, or other options compatible with the existing regulation.	Current § 72.102.
3	Applicant must conform to § 100.23, requiring PSHA or suitable sensitivity analyses in lieu of Appendix A to Part 100, or other options compatible with the existing regulation.	Require applicants to use graded approach to seismic design of SSCs. Similar to Parts 60 and 63; Category 1 event annual probability = 1E-3, Category 2 event annual probability = 1E-4.
4	Applicant must comply with new § 72.103 requiring use of PSHA or suitable sensitivity analyses in lieu of Appendix A to Part 100, or other options compatible with the existing regulation.	Single level DE for SSCs or other options compatible with the existing regulation.

2.2 Option 1: No-Action Alternative

Under Option 1, new specific-license applicants for dry cask ISFSIs would continue to meet the existing requirements of § 72.102. As noted in section 1, currently, ISFSI applicants at sites in the western U.S. or in areas of known seismic activity in the eastern U.S. must perform deterministic site seismic evaluations as prescribed in Appendix A to Part 100. ISFSIs located in the eastern U.S. and not in areas of known seismic activity may use a standardized DE (peak ground acceleration of 0.25 g) if justified by sufficient geological investigations and literature review. For any application in which the methods in Appendix A are used, the DE for the ISFSI must be no less than the SSE for an NPP. Under the No-Action alternative the current requirement for static analysis of cask storage pads would also be retained. This approach does not consider uncertainties in the seismic hazard assessment, is not risk-informed, and may not be cost effective.

2.3 Option 2: Require New Part 72 Specific-license Applicants to Conform to § 100.23 in Lieu of Appendix A to Part 100

This option would require specific-license applicants located in either the western U.S., or in the eastern U.S. in areas of known seismic activity, to comply with the requirements of § 100.23 in lieu of § 72.102(f) which requires the use of Appendix A to Part 100. All other new specific-license applicants for dry cask storage facilities would have the option of complying with the proposed requirement to use § 100.23 to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation. This would bring the seismic site evaluation requirements for ISFSIs into conformance with the updated requirements for NPPs. By accepting the use of a PSHA methodology or suitable sensitivity analyses in § 100.23, the Commission has 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 Commission, in promulgating § 100.23 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 or suitable sensitivity analyses such as seismic sources, the recurrence of earthquakes within a seismic source, the maximum magnitude of earthquakes within a seismic source, and engineering estimation of earthquake ground motion.

The Commission notes that while strict adherence to the requirements in Appendix A for determining the DE for the ISFSI (equivalent to an NPP SSE) will be removed, those applicants for ISFSIs, co-located with existing nuclear power plant sites, would be allowed to use all of the geophysical investigation information obtained from the original licensing process (which used the Appendix A requirements), in verifying that all applicable seismic data are considered in determining the design basis. The benefit of this option is that it would be a conforming change to Part 100 for evaluating geological and seismological criteria. It should be noted that under this option, the extent of site investigations and characterization remains the same as required in Part 100. Regulatory Guide 1.165, "Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion," was developed to provide general guidance on procedures acceptable to the staff for satisfying the requirements of § 100.23 for NPPs. This guidance would be considered acceptable for ISFSIs.

This option retains the § 72.102(f)(1) requirement that the DE for ISFSIs be equivalent to the SSE for an NPP. Thus, while improving the technical requirements for site seismic analysis, this option is still not risk-informed, in that the same DEs are defined for the much less hazardous ISFSIs as for NPPs. Finally, this option requires evaluation of dynamic, as well as static, loads of cask storage pads and areas.

2.4 Option 3:

(1) Require New Part 72 Specific-license Applicants to Conform to § 100.23 in lieu of Appendix A to Part 100

(2) Provide new Part 72 applicants the option to use a graded approach to seismic design for ISFSI SSCs.

This option is the same as Option 2, except that it would also require applicants to use a graded approach to developing seismic design criteria for SSCs. The specific approach proposed for dry cask ISFSIs would be comparable to the Parts 60 and 63 graded approach to design

ground motion for SSCs of pre-closure facilities (§ 60.2). In general, a graded approach to design requires those SSCs whose failure would result in greater accident consequences to use higher design requirements for phenomena such as earthquakes and tornadoes (Category 2 event). Similarly, those SSCs whose failure would result in lesser consequences due to normal operations would be designed to less stringent requirements (Category 1 event). For seismic design considerations of the Yucca Mountain site, the NRC staff has accepted the approach described in DOE Topical Report YMP/TR-003-NP, Rev. 2, Preclosure Seismic Design Methodology for a Geologic Repository at Yucca Mountain, pertaining to Part 63. In this approach Category 1 design basis ground motion refers to a mean annual probability of exceedance of 1E-3. Category 2 design basis ground motion refers to a mean annual probability of exceedance of 1E-4.

Individual SSCs that are required to maintain the annual dose within the regulatory limits of 10 CFR Part 20 would be designed to a Frequency Category 1 design earthquake. Other SSCs needed to be functional to prevent the dose limit of 5 rem from being exceeded at the controlled area boundary due to a seismic event, would be designed to a Frequency Category 2 design earthquake. Thus, the seismic design of the SSCs would be commensurate with their importance to safety.

By requiring uncertainties in seismic hazard analysis to be addressed using a PSHA or suitable sensitivity analyses in determining the DE for ISFSIs, and the use of a graded approach to defining seismic criteria for SSCs, Option 3 sets siting and design criteria that are much more risk-informed than Options 1 and 2, and are more flexible than the proposed requirements in Option 2. Although considered suitable for a high-level waste repository at the Yucca Mountain site, this option, would be more complex to implement than Option 2 and, as discussed in Section 4, would not achieve a meaningful risk reduction for ISFSIs compared to the approach defined in Option 4. Finally, like Option 2, this option also requires evaluation of dynamic, as well as static, loads of cask storage pads and areas.

2.5 Option 4:

(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 a nuclear power plant, to address uncertainties in the seismic hazard analysis by using appropriate analyses, such as a PSHA or other suitable sensitivity analyses, for determining the DE. All other new specific-license applicants for dry cask storage facilities would have the option of complying with the proposed requirement to use a PSHA or other suitable sensitivity analyses to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation.

(2) Maintain the present Part 72 requirement of using a single-level DE, but with a lower DE that is commensurate with the level of risk associated with an ISFSI. Regulatory guide 3.73, accompanying the proposed rule, recommended a DE with a mean annual probability of exceedance of 5E-4, which is lower than the current level for the SSE of an NPP, for ISFSI applications.

Option 4 would require that:

(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, would be required to address uncertainties in the seismic hazard analysis by using appropriate analyses, such as a PSHA or other 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 eastern U.S., and co-located with an NPP, would have the option of using a PSHA methodology or suitable sensitivity analyses for addressing uncertainties in seismic hazard analysis in determining the DE, or using the existing design criteria for the NPP. 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 eastern U.S., except in areas of known seismic activity, would have the option of using a PSHA methodology or suitable sensitivity analyses for addressing uncertainties in seismic hazard analysis in determining the DE, or using the standardized DE described by an appropriate response spectrum anchored at 0.25 g (subject to the conditions in proposed § 72.103(a)(1)), or using the existing design criteria for the most recent NPP (if applicable); and

(4) The proposed changes regarding the use of a PSHA methodology or suitable sensitivity analyses for addressing uncertainties in seismic hazard analysis for determining the DE are not applicable to a general licensee at an existing NPP operating an ISFSI under a Part 72 general license anywhere in the U.S.

Option 4 would also maintain the present Part 72 requirement of using a single DE for defining ISFSI SSC seismic design criteria, but with a lower ground motion that is commensurate with the level of risk associated with ISFSIs. RG 3.73, accompanying the final rule, recommends a DE with a mean annual probability of exceedance of 5E-4, which is lower than the current level for the SSE of an NPP, for ISFSI applications. Seismic design criteria for Part 72, when originally issued in 1980, were based on the nuclear plant requirements, and require a DE with a mean annual probability of exceedance of approximately 1E-4. Part 72 regulations classify ISFSI facility SSCs based on their importance to safety. SSCs, whose function is to protect the public health and safety from undue risk, and prevent damage to the spent fuel during handling and storage, are classified as important to safety. These SSCs are evaluated for a single level of DE as an accident condition event only (§ 72.106).

In the Statement of Considerations accompanying the initial Part 72 rulemaking, the NRC recognized that the storage of spent fuel is a low risk operation when compared to a nuclear power plant (45 FR 74697; November 12, 1980). Factors that result in lower radiological risk at an ISFSI or MRS compared to a nuclear power plant include the following:

- In comparison with an NPP, an operating ISFSI or MRS is a relatively simple 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 nuclear power plant. After the spent fuel is in place, an ISFSI or MRS is essentially a static operation.

- 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.

- 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 Commission believes that the seismically induced radiological risk associated with an ISFSI or MRS is significantly less than the risk associated with a nuclear power plant.

2.6 Dynamic Loads and Soil Stability

Changes to § 72.212(b)(2)(i)(B) are also needed to communicate that general licensees must evaluate both static and dynamic loads for designing new ISFSIs after the effective date of the rule to ensure that casks are not placed in an unanalyzed condition. This proposed change would be included with any of the Options 2-4. The change would state that the design of cask storage pads and areas must adequately account for dynamic loads (in addition to static loads). For example, dynamic effects can cause soil-structure interactions that could amplify ground motion to the point that the acceleration on the casks is greater than the DE acceleration, or that soil liquefaction could cause unacceptable pad and foundation settlement. Evaluation of dynamic loads of cask pads and areas would ensure that the pad, which may be considered as failed in a seismic event, could continue to support the casks without placing them in an unanalyzed condition.

2.7 Consideration of Performance-Based Approaches

The rule was reviewed to determine the extent to which the rule satisfies the regulatory framework (NUREG-1614, Vol. 2, Part 1, page 45) for implementing the performance-based approaches based on high-level guidelines staff provided to the Commission in SECY-00-191, “High-Level Guidelines for Performance-Based Activities,” September 1, 2000.

The guidelines in SECY-00-191 can be applied to regulatory activities, to identify and assess the use of performance-based regulatory approaches, instead of prescriptive criteria to assure safety performance. Four high-level viability guidelines of SECY-00-191 were evaluated for ISFSI or MRS facility performance during a seismic event as follows: (1) measurable parameters to monitor acceptable performance exist or can be developed by specifying the failure modes of SSCs important to safety; (2) objective criteria to assess performance exist or can be developed, such as the cask stability and ability of the handling facility to continue to function; (3) licensee flexibility in meeting the established performance criteria exists or can be developed; and (4) a framework exists or can be developed such that even if the performance criteria are not met, the probability of an immediate safety concern would be low.

Examples of the measurable performance parameters for SSCs important to safety in an ISFSI are stability against (1) soil liquefaction during vibratory motion; and (2) cask sliding and resulting displacements, during an earthquake. These SSCs have significant margins of safety during a seismic event, as discussed earlier in this section. Because of the significant safety margins, the rule thus allows the applicants flexibility to choose the most suitable design to meet the performance attributes.

The viability guidelines also incorporate the concept that the licensee can and will take corrective action if a significant decrease occurs in the level of confidence that adequate margins are being maintained. The rule in combination with other provisions of 10 CFR Part 72 allows verification of design margins by post-earthquake inspections, and corrective actions, as necessary. Therefore, it is concluded that the rule can be issued with assurance that licensees will have flexibility in implementing the requirements and the rule meets the regulatory framework outlined in SECY-00-191 and accomplishes the safety objectives in a cost effective manner.

3.0 Analysis of Values and Impacts

This chapter examines the values and impacts expected to result from NRC's rulemaking. It is divided into three main sections. Section 3.1 identifies attributes that are and are not expected to be affected by the rulemaking. Section 3.2 describes how values and impacts were analyzed. Section 3.3 examines the projected values and impacts associated with the considered changes to revise the siting and design requirements for ISFSIs.

The NRC rulemaking would amend 10 CFR Part 72 to require certain specific-license applicants for a dry cask storage facility to address uncertainties in the seismic hazard analysis by using appropriate analyses, such as a PSHA or other suitable sensitivity analyses, for determining the DE. The rule would also allow the ISFSI or MRS applicants to use a DE appropriate for and commensurate with the risk associated with an ISFSI or MRS, and require that the designs of cask storage pads and areas adequately account for dynamic loads. Each of the considered changes would result in certain values and/or impacts. Thus, the values and impacts of the Commission's rulemaking as a whole consist of the sum of all values and impacts associated with each of the considered changes. For many of the affected attributes, the values and impacts are expected to be negligible. Some of these values and impacts are difficult to estimate due to high levels of variability and the site-specific nature of the activity, and therefore have not been quantified in this analysis.

3.1 Identification of Affected Attributes

This section identifies and describes the factors within the public and private sectors that the regulatory alternatives considered (discussed in Section 2) are expected to affect. These factors were classified as "attributes," using the list of potential attributes provided in Chapter 5 of *Regulatory Analysis Technical Evaluation Handbook*.[10] Each attribute listed in Chapter 5 was evaluated, and the basis for selecting those attributes expected to be affected by the potential action is presented in the balance of this section.

Affected Attributes

– Industry Implementation -- The regulatory options considered would result in implementation costs and savings to industry. Use of a PSHA or suitable sensitivity analyses, while new to the regulation of ISFSIs, is expected to result in increased analytical costs to specific licensees compared to the current costs for using a deterministic approach. Use of a risk-informed approach to site design, whether the graded approach described in Option 3, or the single DE approach described in Option 4, would result in some minimal reduction in capital costs, because SSCs could be designed to a lower level DE than currently required. The advantage of Option 4 over Option 3 is that under Option 4, specific licensees would not be required to design any SSCs to withstand a DE as high as the SSE of an NPP. The regulatory change considered to require written evaluations of analysis of dynamic loads would not result in additional costs to general licensees.

– Industry Operation – Use of the PSHA or suitable sensitivity analyses, and design of the facility to the new DE are not expected to affect industry operations. In fact, cost

[10] *Regulatory Analysis Technical Evaluation Handbook*, *Final Report*, NUREG/BR-0184, Office of Nuclear Regulatory Research, January 1997.

reductions may occur because the use of a PSHA or suitable sensitivity analyses will reduce uncertainties in the DE definition, thus reducing potential costs in the case of an earthquake.

– NRC Implementation -- The regulatory options considered would result in NRC implementation costs. Specifically, NRC would incur implementation costs to revise guidance documents, and where applicable, develop new guidance.

– NRC Operation -- The regulatory options considered would result in NRC operation savings resulting from a reduction in the number of exemption requests to the requirements in § 72.102(f)(1) submitted by specific-license applicants.

– Public Health (Accident) -- Reductions in radiation exposures to the public may occur because site seismicity at some sites will be more accurately characterized, thus reducing accident consequences.

– Occupational Health (Accident) -- Reductions in radiation exposures to workers may occur because site seismicity at some sites will be more accurately characterized, thus reducing accident consequences.

– Regulatory Efficiency -- The regulatory options considered, with the exception of Option 1, the No-Action alternative, would be expected to result in enhanced regulatory efficiency by increasing the level of consistency among different regulations.

– Improvements in Knowledge -- The regulatory options considered, with the exception of Option 1, the No-Action alternative, could result in improved data collection and safety evaluations (i.e., less uncertainty) and, consequently, in improvements in regulatory and policy requirements.

Attributes *Not* Affected

– Public Health (Routine) -- No significant changes are expected with respect to routine radiation exposures to the public.

– Occupational Health (Routine) -- Changes to radiation exposures to workers during normal operations are not expected to increase as a result of any of the considered changes.

– Off-site Property -- Effects on off-site property are not expected to be impacted by any of the considered changes.

– On-site Property -- Effects on on-site property (direct and indirect) are not expected to be impacted by any of the considered changes.

– Industry Operation -- The regulatory options considered would not result in any changes to current industry operational practices.

– Other Government -- The regulatory options considered are not expected to affect implementation and operation costs of other government agencies, because siting and

licensing of ISFSIs is carried out solely by NRC staff. U.S. Department of Energy sites may incur costs and costs savings similar to those expected for industry.

– Environmental Considerations -- Effects on the environment, due to changes in accident frequencies and accident consequences are not expected to result from any of the changes considered.

– Safeguards and Security Considerations -- The regulatory options considered are not expected to impact security considerations.

– General Public -- The regulatory options considered are not expected to have any effects on the general public.

– Antitrust Considerations -- The regulatory options considered are not expected to have any antitrust effects.

3.2 Analytical Methodology

This section describes the process used to evaluate values and impacts associated with the regulatory options considered. The *values* (benefits) of the rule include any desirable changes in affected attributes (e.g., reduction in cost burden for design of ISFSI SSCs) while the *impacts* (costs) include any undesirable changes in affected attributes (e.g., increased costs for using PSHA or suitable sensitivity analyses instead of Appendix A to Part 100). As described in Section 3.1, the attributes expected to be affected include the following:

– Industry Implementation
– Industry Operation
– NRC Implementation
– NRC Operation
– Public Health (Accident)
– Occupational Health (Accident)
– Regulatory Efficiency
– Improvements in Knowledge

For many of these attributes, the nature or cause of a value or impact is straightforward. For example, values and impacts associated with the attribute “NRC operations” should result from, respectively, either a decrease or increase in the number of NRC staff hours (or other NRC resources) required to oversee the Part 72 requirements on a day-to-day basis. Similarly, values and impacts associated with the attribute “regulatory efficiency” should result from changes to the overall clarity, consistency, or level of consolidation of applicable regulations. The overall value or impact for some attributes, however, results from the interaction of several influencing factors. For example, a regulatory option that requires the use of a new approach to conducting siting evaluations may result in increased costs for performing the analysis, while at the same time providing better data, resulting in decreased costs for facility design. In this case, it would be the *net effect* of the influencing factors (i.e., analytical costs and capital costs) that would govern whether an overall value or impact would result for several affected attributes, including industry implementation and NRC implementation and operations.

Ideally, a value-impact analysis quantifies these net effects and calculates the overall values and impacts of each regulatory option. This requires a baseline characterization of the universe of potential licensees, including factors such as:

– Number of planned ISFSIs and location;

– Industry costs to prepare § 72.102(f)(1) exemption requests;

– NRC costs to review exemption requests;

– Industry costs of using the present deterministic method;

– Industry costs of using a PSHA or other sensitivity analyses;

– Industry costs of designing SSCs important to safety with a mean annual probability of exceedance of 5E-4;

– Industry costs of designing SSCs important to safety with a mean annual probability of exceedance of 1E-4;

– Industry costs for conducting analyses on storage pads accounting for static loads only; and

– Industry costs for conducting analyses on storage pads accounting for dynamic loads.

NRC reviewed regulatory analyses conducted to support similar rulemakings for 10 CFR Part 100 in an attempt to obtain these data. The documents reviewed include the regulatory analysis prepared to support the proposed rule for Reactor Siting Criteria (57 FR 47802) and for Seismic and Geologic Siting Criteria for Nuclear Power Plants (61 FR 65157). In addition, NRC contacted five experts in the field of ISFSI siting and characterization and design, to solicit input on the values and impacts of the proposed options. NRC also sought data on the costs associated with siting and design of ISFSI facilities from a nuclear energy trade association, and industry representatives from operating nuclear power plants. Further, NRC considered information received during the public comment period on the proposed rule as part of this analysis.

Assumptions

NRC is making certain assumptions with respect to the values and impacts associated with the options considered for this rule.

Option 4 is the only option that considers whether a site is located with an NPP in determining applicability of the proposed requirements (see Table 3-1 below). Options 2 and 3 do not make this distinction.

NRC has estimated the potential universe of facilities that may be affected by the different provisions of the proposed rule. Currently, NRC has issued 10 site specific licenses in the U.S. for storage of spent nuclear fuel. Based on past experience and intelligence gathering, NRC estimates that one new specific license application will be received for approval each year for the foreseeable future. Indications from industry are that in the near future, that the Humboldt Bay (CA), and Owl Creek Energy Project (WY) facilities will apply for a specific license to operate an ISFSI. The estimate of one application per year is expected to be conservative, accounting for the potential that some sites currently planning to operate their ISFSI under a general license may decide to apply for a site specific license after promulgation of the proposed changes.

Nine facilities are presently operating ISFSIs under a general license. NRC is estimating that an additional three facilities per year will choose to operate their ISFSIs under a general license.

Table 3-1: Summary of Applicability for Option 4

DE 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[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 proposed § 72.103(a)(1)).

1. § 72.103 would not apply to general licensees. General licensees must satisfy the conditions given 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.

3.3 Values and Impacts of Regulatory Alternatives Considered

3.3.1 Option 1: No-Action Alternative

Under the no-action alternative (Option 1), NRC would maintain the current siting requirements for new dry cask ISFSI specific-license applicants at current § 72.102. Thus, relative to existing requirements, no values or impacts would result from Option 1, but the benefits (values) to be derived from the other options would remain unrealized.

3.3.2 Option 2: Require new Part 72 specific-license applicants to conform to § 100.23 in lieu of Appendix A to Part 100

Under this option, new Part 72 specific-license applicants, for sites located in either the western U.S., or in the eastern U.S. in areas of known seismic activity, would be required to comply with the requirements of § 100.23 in lieu of § 72.102(f) which requires the use of Appendix A to Part 100. All other new specific-license applicants for dry cask storage facilities would have the option of complying with the proposed requirement to use § 100.23 to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation.

Estimate for New ISFSI Specific-license Applicants

Conducting a PSHA analysis to determine the DE will result in new ISFSI specific-license applicants incurring costs, regardless of the site location. As part of the development of the DE, geological and seismological data must be reviewed and updated for any new findings on seismic source activity and ground motion modeling that may impact the DE. Two scenarios were contemplated in estimating the costs of this activity:

Scenario 1: A review of new data suggests that new seismic sources should be postulated and the existing analysis be redone. This would require a determination of the controlling earthquakes and evaluation of the ground motion spectra specific to the site ($150,000 to $250,000).

Scenario 2: The review of new data indicates that new seismic sources need not be postulated and the existing data/analysis could be used. If the existing data and models are considered acceptable (although they may be more than 10 years old), then the determination of controlling earthquakes and the resulting ground motion spectra are relatively straightforward ($50,000 to $100,000).

Under current Part 72 requirements, the DE is developed using the deterministic approach contained in Appendix A to Part 100. The estimated costs associated with developing the DE using this methodology for a new specific-license applicant located in either the western U.S. or in the eastern U.S. in areas of known seismic activity, are approximately $50,000 to $100,000.

Assuming that one new ISFSI specific license application is submitted each year, the increase in cost between the use of a PSHA or suitable sensitivity analyses and Appendix A is estimated to range from $0 to $200,000, or an average of $100,000.

Estimate for NRC

NRC would incur costs associated with development of guidance and revisions to existing documents such as the Standard Review Plan and related materials. It is estimated that these revisions would take approximately two staff-months to complete. Assuming a cost of $77 per hour for staff, and 40 days at 8 hours each, this results in a one time cost of approximately $24,640.

NRC would also incur costs associated with review of the PSHA analysis or suitable sensitivity analyses. NRC estimates that an additional one staff-month would be required to complete a PSHA review or suitable sensitivity analyses versus a deterministic review. Assuming a cost of $77 per hour for staff, and 20 days at 8 hours each, this results in a cost of approximately $12,320 per application. Assuming one new specific license application per year, the estimated additional annual cost for review of a PSHA or suitable sensitivity analyses is $12,320.

Value would be provided by adoption of this option because Part 72 requirements would be more compatible with similar requirements for NPPs, thus improving regulatory efficiency. Further, this option may provide improvements in knowledge, which could result in improvements in regulatory and policy requirements. These values, however, are difficult to evaluate, and therefore have not been quantified in this analysis.

3.3.3 Option 3:

(1) Require new Part 72 applicants to conform to § 100.23 in lieu of Appendix A to Part 100 (Option 2).

(2) Provide new Part 72 applicants the option to use a graded approach to seismic design for ISFSI SSCs.

This option is similar to Option 2 and would also require using a graded approach to seismic design for SSCs. The requirement to comply with § Part 100.23 is the same as described in section 3.3.2 for Option 2 above. Therefore, the estimate of values and impacts to specific licensees and NRC is the same as described under Option 2.

Under this option, new ISFSI specific-license applicants would be required to use a graded approach to seismic design for ISFSI SSCs. In general, a graded approach to design requires those SSCs whose failure would result in greater accident consequences to use higher design requirements for phenomena such as earthquakes and tornadoes. Similarly, those SSCs whose failure would result in lesser accident consequences would be designed to less stringent requirements. This graded approach would be in lieu of § 72.102(f)(1), which requires sites that have been evaluated under the criteria of Appendix A to Part 100 to design structures to a DE that is equivalent to the SSE for an NPP.

Estimate for New ISFSI Specific-license Applicants

Option 3 would require new applicants to comply with § 100.23 as well as provide the option for using a graded approach to seismic design for SSCs. The requirement to comply with § 100.23 (use of PSHA or suitable sensitivity analyses) is the same as described in section 3.3.2 of this analysis for Option 2, which is approximately $100,000 per year. Therefore, the estimate of values and impacts to specific licensees and NRC is the same as described under Option 2, which would result in additional costs to specific-license applicants. The SSCs important to safety in an ISFSI are associated with the storage cask, and include the canister, the canister handling systems, concrete pad supporting the cask, the transfer building supporting the handling systems, and the transfer cask. Other SSCs important to safety may include the pressure monitoring system, protective cover, security lock and wire, etc. and can be designed for a lower level DE. In some cases, ISFSI specific-license applicants have sought exemptions from the design requirements contained in § 72.102, considering site characteristics and other factors. This option would reduce or eliminate the need for these exemption requests by reducing the DE level for certain SSCs. The analytical costs to ISFSI specific-license applicants associated with designing these SSCs can be significant and are highly dependent on the site and the component being qualified. Differences in capital costs of designing electrical and mechanical equipment result primarily from an increase in the anchorage and load path loads and the resulting hardware designs. These cost differences are minimal. Therefore, reducing the DE level of certain SSCs would result in savings by reducing analytical costs and certain capital costs.

NRC estimates that the costs to a specific-license applicant for preparing an exemption request would be approximately $300,000 as a one-time cost. Adoption of Option 3 would negate the need for exemption requests, thereby, resulting in cost savings to specific-license applicants of approximately $150,000 per applicant. Assuming that one new specific-license applicant would

have submitted an exemption request each year, the estimated cost savings would be $150,000 per year.

The overall affect of Option 3 would be a cost savings to new specific-license applicants. The amount of these savings, however, is highly site-specific, depending on site characteristics, and the specified DE level.

Estimate for NRC

NRC is expected to realize minimal costs associated with this option. NRC would incur costs associated with development of guidance and revisions to existing documents. The estimate of values and impacts to NRC are expected to be similar to those described under Option 2, approximately $24,640 as a one time cost for development of guidance and document revision.

NRC would also incur costs associated with review of the PSHA analysis or suitable sensitivity analyses. NRC estimates that an additional one staff-month would be required to complete a PSHA or suitable sensitivity analyses review versus a deterministic review. Assuming a cost of $77 per hour for staff, and 20 days at 8 hours each, this results in a cost of approximately $12,320 per application. Assuming one new specific license application per year, the estimated additional annual cost for review of a PSHA or suitable sensitivity analyses is $12,320.

NRC staff review of exemption requests is estimated to require 240 hours. At a cost of $77 per hour, the total cost for NRC staff to review a single exemption request is estimated to be approximately $18,480. Assuming that one new specific-license applicant would have submitted an exemption request each year, the estimated cost savings is $18,480 per year under Option 3.
Value would be provided by adoption of this option because Part 72 requirements would be more compatible with similar requirements for pre-closure facilities, thus improving regulatory efficiency. These values however are difficult to evaluate, and therefore have not been quantified in this analysis.

3.3.4 Option 4:

(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 a nuclear power plant, to address uncertainties in the seismic hazard analysis by using appropriate analyses, such as a PSHA or other suitable sensitivity analyses, for determining the DE. All other new specific-license applicants for dry cask storage facilities would have the option of complying with the proposed requirement to use a PSHA or other suitable sensitivity analyses to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation.

(2) Maintain the present Part 72 requirement of using a single-level DE, but with a lower DE that is commensurate with the level of risk associated with an ISFSI. RG 3.73, accompanying the final rule, recommends a DE with a mean annual probability of exceedance of 5E-4, which is lower than the current level for the SSE of an NPP, for ISFSI applications.

This option would 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 a nuclear power plant, to address uncertainties in the seismic hazard analysis by using appropriate analyses, such as a PSHA or other suitable sensitivity analyses, for determining the DE. All other new specific-license applicants for dry cask storage facilities would have the option of complying with the proposed requirement to use a PSHA or other suitable sensitivity analyses to address uncertainties in seismic hazard analysis, or other options compatible with the existing regulation.

This option also maintains the present Part 72 requirement of using a single-level DE, but with a lower DE that is commensurate with the level of risk associated with an ISFSI. RG 3.73, accompanying the final rule, recommends a DE with a mean annual probability of exceedance of 5E-4, which is lower than the current level for the SSE of an NPP, for ISFSI applications. For purposes of this analysis therefore, the values and impacts of the proposed change to the DE are estimated using this value.

Estimate for New ISFSI Specific-license Applicants

The values and impacts associated with Option 4 are similar to those for Option 3. Therefore, the estimate of values and impacts to specific licensees and NRC is the same as described under Option 2 and 3, which would result in additional costs to specific-license applicants of $100,000 per year for addressing uncertainties in seismic hazard analysis. The SSCs important to safety in an ISFSI are associated with the storage cask, and include the canister, the canister handling systems, concrete pad supporting the cask, the transfer building supporting the handling systems, and the transfer cask. Other SSCs important to safety may include the pressure monitoring system, protective cover, security lock and wire, etc. and can be designed for a lower level DE. In some cases, ISFSI specific-license applicants have sought exemptions from the design requirements contained in § 72.102, considering site characteristics and other factors. Option 4 would reduce or eliminate the need for these exemption requests by reducing the DE for SSCs. Under Option 4, it is assumed, for purposes of this regulatory analysis, that all SSCs important to safety would be designed for a DE with a mean annual probability of exceedance of 5E-4. The analytical costs to ISFSI specific-license applicants associated with designing these SSCs can be significant and are highly dependent on the site and the component being qualified. Differences in capital costs of designing electrical and mechanical equipment result primarily from an increase in the anchorage and load path loads and the resulting hardware designs. These cost differences are minimal. Therefore, reducing the DE of certain SSCs would result in savings by reducing analytical costs and certain capital costs.

The advantage of Option 4 over Option 3 is simply that under Option 4, no SSCs would be designed to withstand a DE with a mean annual probability of exceedance of 1E-4 (equivalent to the SSE of an NPP), resulting in lower analytical and certain capital costs.

NRC estimates that the costs to a specific-license applicant for preparing an exemption request would be approximately $300,000 as a one-time cost. Adoption of Option 4 would negate the

need for exemption requests, thereby, resulting in cost savings to specific-license applicants of approximately $150,000 per applicant. Assuming that one new specific-license applicant would have submitted an exemption request each year, the estimated cost savings would be $150,000 per year.

The overall affect of Option 4 would be a cost savings to new specific-license applicants. The amount of these savings, however, is highly site-specific, depending on site characteristics, and the specified DE.

Estimate for NRC

Similar to Option 3, NRC is expected to realize minimal costs associated with this option. NRC would incur costs associated with development of guidance and revisions to existing documents. The estimate of values and impacts to specific licensees and NRC is expected to be similar to those described under Option 3, approximately $24,640 as a one time cost for development of guidance and document revision.

NRC would also incur costs associated with review of the PSHA analysis or suitable sensitivity analyses. NRC estimates that an additional one staff-month would be required to complete a PSHA or suitable sensitivity analyses review versus a deterministic review. Assuming a cost of $77 per hour for staff, and 20 days per month at 8 hours each, this results in a cost of approximately $12,320 per application. Assuming one new specific license application per year, the estimated additional annual cost for review of a PSHA or suitable sensitivity analyses is $12,320.

NRC staff review of exemption requests is estimated to require 240 hours. At a cost of $77 per hour, the total cost for NRC staff to review a single exemption request is estimated to be approximately $18,480 per request. Assuming that one new specific-license applicant submits an exemption request each year, the estimated cost savings is $18,480 per year.

Value would be provided by adoption of this option because Part 72 requirements would be more compatible with similar requirements for pre-closure facilities, thus improving regulatory efficiency. These values however are difficult to evaluate, and therefore have not been quantified in this analysis.

3.3.5 Considering Dynamic Loads

The Commission is also proposing a change to § 72.212(b)(2)(i)(B) to require general licensees to evaluate both static and dynamic loads for new ISFSIs. This proposed change is an additional modification, separate from the changes proposed in the options above.

Estimate for General Licensees

NRC would 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 (CoC) under § 72.212(b)(i)(A).

Estimate for NRC

NRC is not expected to incur any additional costs associated with this change.

3.3.6 Summary of Values and Impacts

Overall, there are costs and costs savings associated with these options. Option 2 would result in a cost increase for conducting the PSHA or suitable sensitivity analyses. Options 3 and 4 would result in net cost savings by reducing analytical and certain capital costs associated with developing the DE. There are no additional costs 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 (CoC) under § 72.212(b)(i)(A).

Table 3-2 provides a summary of the values and impacts associated with each of the options discussed above.

Table 3-2: Summary of Values and Impacts of Options 1 - 4

Option	Use of PSHA or suitable sensitivity analyses		Use of Lower DE		§ 72.212 - Dynamic Loads	
	Industry	NRC	Industry	NRC	Industry	NRC
1- No Action	$0	$0	$0	$0	$0	$0
2	$100,000/yr cost[1] Safety benefit[3]	$24,640 as a one time cost $12,320 cost to review PSHA or suitable sensitivity analyses	$0	$0	$0 Safety benefit[3]	$0
3	$100,000/yr cost Safety benefit[3]	$24,640 as a one time cost $12,320 cost to review PSHA or suitable sensitivity analyses	Capital savings - minimal Analytical savings - substantial Exemption request submittal savings - $150,000/yr[2]	Review of exemption request submittal - $18,480/yr savings	$0 Safety benefit[3]	$0
4	$100,000/yr cost Safety benefit[3]	$24,640 as a one time cost $12,320 cost to review PSHA or suitable sensitivity analyses	Capital savings - minimal Analytical savings - substantial Exemption request submittal savings - $150,000/yr	Review of exemption request submittal - $18,480/yr savings	$0 Safety benefit[3]	$0

[1] Assumes one specific-license applicant each year at an average cost of $100,000 per applicant.
[2] Assumes one exemption request submittal each year.
[3] Public health and safety is being maintained at the current level, or slightly improved.

4.0 Backfit Analysis

The Commission has determined that the backfit rule, § 72.62, does not apply to the considered changes in § 72.9, § 72.102, and § 72.103 because they do not involve any provisions that would impose backfits as defined in § 72.62(a).

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 revisions considered to this section would require general licensees to also 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, would ensure that the cask storage pads and areas would perform satisfactorily during a seismic event.

The revision would 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 (CoC). The soil liquefaction and instability during a vibratory motion due to an earthquake may affect the cask stability.

The considered changes to § 72.212(b)(2)(i)(B) will impact procedures required to operate an ISFSI and; therefore, implicate the backfit rule. The changes would 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 considered 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 proposed changes to § 72.212 would 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 that general licensees perform written evaluations to meet conditions set forth in the cask CoC. These CoCs require that dynamic loads, such as seismic and tornado loads, be evaluated to meet the cask design bases. Since the general licensees currently evaluate dynamic loads for evaluating the casks, pads and areas, the proposed changes to § 72.212(b)(2)(i)(B) would not actually require any general licensees presently operating an ISFSI to re-perform any written evaluations previously undertaken.

5.0 Decision Rationale

For each of the options identified, the values and impacts associated with amending the seismological and geological siting and design criteria in Part 72 have been considered. Option 4 was determined to be the most preferable based on professional judgment and limited quantitative analysis because it (1) improves effectiveness and efficiency of the NRC regulatory process by eliminating the need for applicants to request exemptions from §§ 72.102(a), 72.102(b), and 72.102(f)(1), and the need for NRC to review the exemption requests; (2) reduces unnecessary costs for the applicant or specific licensee by reducing the DE to account for the lower risk associated with ISFSI facilities; (3) would not result in significant overall additional implementation or operation costs to NRC and applicants, and (5) supports the implementation of the NRC's risk-informed approach to regulation. The main advantage of Option 4 over Option 3 is that under Option 4, no SSCs would be designed to withstand a DE with a mean annual probability of exceedance of 1E-4 (equivalent to the SSE of an NPP), resulting in lower analytical and certain capital costs than associated with Option 3. Under Option 4, public health and safety will be maintained at the current level, or be improved.

6.0 Implementation

No impediments to implementation of the recommended alternatives have been identified. NRC has determined, as described in section 4.0, that one change would impose a backfit, as defined in § 72.62(a). 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).

A Regulatory Guide for licensees is required to provide an explanation of the regulatory requirements and methods for complying with the revised requirements for ISFSI site characterization and design.

The estimated resources entailed in the proposed and final rule for this rulemaking are on the order of 3.8 FTEs. These resources will come principally from NMSS, NRR, RES, and OGC. These resources are within FY 2003 budget allocations.

NMSS . . 3.0 FTE
Other . . 0.8 FTE