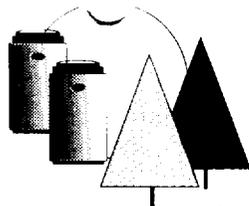


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April 2, 1999

REQUEST FOR EXEMPTION TO 10 CFR 72.102(f)(1)  
SEISMIC DESIGN REQUIREMENT  
DOCKET NO. 72-22/TAC NO. L22462  
PRIVATE FUEL STORAGE FACILITY  
PRIVATE FUEL STORAGE L.L.C.

Private Fuel Storage L.L.C. (PFS) hereby transmits the attached request for exemption in accordance with 10 CFR 72.7, "Specific Exemptions." The purpose of the exemption request is to change the methodology for calculating the design earthquake for the Private Fuel Storage Facility (PFSF) from a deterministic approach to a probabilistic, risk-informed approach. 10 CFR 72.102(b) requires ISFSI sites west of the Rocky Mountain Front to evaluate seismicity by the techniques of 10 CFR 100 Appendix A, which PFS has done. 10 CFR 100 Appendix A uses a deterministic approach for determining the safe shutdown earthquake at the site of a nuclear power plant, also referred to as the design earthquake (DE). 10 CFR 72.102(f)(1) states "For sites that have been evaluated under the criteria of Appendix A of 10 CFR part 100, the DE must be equivalent to the safe shutdown earthquake (SSE) for a nuclear power plant." PFS requests exemption from the requirements of 10 CFR 72.102(f)(1) which specify that the design earthquake at the PFSF site, which is west of the Rocky Mountain Front, be equivalent to the safe shutdown earthquake for a nuclear power plant calculated using the deterministic methods of 10 CFR 100 Appendix A. PFS requests use of a probabilistic seismic hazard analysis along with consideration of risk to establish the design earthquake at the PFSF.

The use of probabilistic techniques and a risk-informed approach are compatible with the direction provided by the Commission on Direction Setting Issue 12, "Risk-Informed, Performance-Based Regulation", as well as that reflected in the Commission's adoption of probabilistic approaches for the geological and seismic siting of more sensitive nuclear power plants. The analysis provided by PFS relies on widely accepted probabilistic seismic hazard analysis techniques that are consistent with the recent seismic design requirements providing for probabilistic seismic analysis in Parts 50 and 100 that apply to new nuclear power plants, and in Part 60 that applies to the disposal of high-level radioactive wastes in geologic repositories. In

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addition, the relative risk of the PFSF warrants a design earthquake with lower peak ground accelerations than that calculated using the 10 CFR 100 Appendix A methodology.

The detailed exemption request is attached, which sets forth the basis for changing from deterministic to a probabilistic risk-informed methodology for establishing the design earthquake. Also attached is the report (by Geomatrix Consultants, Inc.) presenting the results of applying the probabilistic seismic hazard analysis methodology to the PFSF site.

Upon approval of the exemption request, PFS commits to the submittal of PFSF site specific storage cask stability analyses for the HI-STORM and TranStor storage casks on the concrete storage pads to quantify the degree of cask sliding or tipping movement, if any, that would result from the new design earthquake. In addition, the storage pads and Canister Transfer Building will be reanalyzed, or the existing design confirmed to be conservative, for the new design earthquake.

Should you have any questions concerning this exemption request, please contact myself at 608-787-1236 or our project director, Mr. John Donnell, at 303-741-7009.

Sincerely,



John D. Parkyn, Chairman  
Private Fuel Storage L.L.C.

Attachments

cc:

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# REQUEST FOR EXEMPTION TO 72.102(f)(1) SEISMIC DESIGN REQUIREMENT FOR THE PRIVATE FUEL STORAGE FACILITY

## BACKGROUND

The purpose of this submittal is to change the methodology for calculating the design earthquake for the Private Fuel Storage Facility (PFSF) from a deterministic approach to a probabilistic, risk-informed approach. The design earthquake presented in the PFSF SAR was calculated in accordance with the requirements of 10 CFR 72.102. 10 CFR 72.102(b) requires ISFSI sites west of the Rocky Mountain Front to evaluate seismicity by the techniques of 10 CFR 100 Appendix A. 10 CFR 100 Appendix A uses a deterministic approach for determining the safe shutdown earthquake at the site of a nuclear power plant, also referred to as the design earthquake (DE). 10 CFR 72.102(f)(1) states "For sites that have been evaluated under the criteria of Appendix A of 10 CFR part 100, the DE must be equivalent to the safe shutdown earthquake (SSE) for a nuclear power plant."

Recently, the NRC has revised its regulations (10 CFR Parts 50 and 100) to permit calculation of the design earthquake at new nuclear power plants based on probabilistic seismic hazard analysis (PSHA) methodology, instead of the deterministic methodology presented in 10 CFR 100 Appendix A. The NRC issued Regulatory Guide 1.165 (Reference 1) to provide guidance on PSHA methodology. In addition, the NRC recently amended 10 CFR Part 60 to permit use of probabilistic, risk-informed methodology in designing for hazards (including seismic) at the high-level radioactive waste geologic repository.

While the NRC has indicated that it plans to amend 10 CFR 72.102 to permit use of PSHA methodology and a risk-informed approach to calculate the DE at ISFSI sites, it is unlikely that the rulemaking will be completed before issuance of the PFSF license. Therefore, PFS is requesting an exemption from 10 CFR 72.102(f)(1), which requires that the DE at an ISFSI be equivalent to the SSE for a nuclear power plant. The exemption would permit the DE at the PFSF to be calculated using the more recent PSHA methodology, in accordance with the guidance in Regulatory Guide 1.165, and applying the risk-informed approach of 10 CFR Part 60.

PFS has determined that there is an adequate safety basis for an exemption to the requirements of 10 CFR 72.102(f)(1), supported by a site-specific radiological risk analysis, as discussed below. The exemption would be consistent with Commission policy and regulations applicable to other facilities (i.e. nuclear power plants and high level waste geologic repositories) that carry greater risk than a Part 72 facility. Considering the minor radiological consequences of accidents analyzed at the PFSF, PFS considers that the present Part 72 requirement for calculating the design earthquake is an unnecessary regulatory

burden. PFS considers that the use of probabilistic techniques and a risk-informed approach are compatible with the direction provided by the Commission on Direction Setting Issue 12, "Risk-Informed, Performance-Based Regulation" (Reference 2).

The probabilistic, risk-informed approach for establishing the PFSF DE described below is based on calculating the magnitude of a seismic event with a recurrence interval of 1,000 years. Use of a 1,000 year recurrence interval is justified in the PSHA based on dose consequences of accidents at the PFSF and consideration of relative risk, discussed below.

## DISCUSSION

10 CFR 72.102(b) requires ISFSI sites west of the Rocky Mountain front, such as the PFSF site, to have seismicity evaluated by the techniques of Appendix A of 10 CFR Part 100, also known as a deterministic seismic hazard analysis (DSHA). PFS has evaluated seismicity of the PFSF site in accordance with 10 CFR 100 Appendix A. Appendix A calculates, based on site-specific investigations, the largest credible earthquake likely to affect a site, regardless of the probability of this event through time. Section 72.102(f)(1) states, "For sites that have been evaluated under the criteria of Appendix A of 10 CFR Part 100, the design earthquake must be equivalent to the safe shutdown earthquake (SSE) for a nuclear power plant." In this context, "DE" and "SSE" refer to the design peak ground acceleration (PGA), with an appropriate response spectrum, caused by the largest credible earthquake.

PFS performed a DSHA in accordance with the requirements of 10 CFR 72.102(f)(1), to calculate the magnitude of the design earthquake at the PFSF, as discussed in the PFSF SAR. PFSF SAR (Rev. 2) Section 3.2.10.1.1 describes the results of this methodology, indicating that the DSHA for the PFS site yields resultant PGA values for an SSE of 0.67 g in two directions of the horizontal plane and 0.69 g in the vertical plane, with an appropriate response spectrum.

Recent highly detailed seismological studies have found additional faulting in the vicinity of the PFSF site (Reference 3). If these faults were accounted for in the DSHA, the resulting PGA values would be slightly higher (approximately 10%) than those presently published in the SAR. The PSHA that is proposed to establish the DE at the PFSF, as discussed in the following paragraphs, does account for these faults.

When 10 CFR Part 72 was first promulgated in 1980, ISFSIs were largely envisioned to be spent fuel pools or single, massive dry storage structures. A DE equivalent to a nuclear power plant SSE seemed appropriate for these facilities, given the potential accident scenarios. Furthermore, for ISFSIs to be located at a nuclear power plant, the DE value was readily available without additional site

characterization work, save the geotechnical investigation at the specific ISFSI location. However, an ISFSI storing spent fuel in dry casks is inherently less hazardous and less vulnerable to earthquake-initiated accidents than is an operating nuclear power plant (Reference 4).

The U.S. Nuclear Regulatory Commission recognized this reduced vulnerability in the initial Part 72 "Statements of Consideration," and stated that the DE for cask and canister technology need not be as high as a nuclear power plant SSE: "For ISFSIs which do not involve massive structures, such as dry storage casks and canisters, the required design earthquake will be determined on a case-by-case basis until more experience is gained with licensing these types of units" (45 FR 74697).

Both the HI-STORM and TranStor canisters that will be stored at the PFSF are new "multi-purpose" canisters designed for transport as well as storage, which by virtue of their rugged design are less vulnerable to earthquake initiated accidents. Their rugged design is demonstrated to be capable of withstanding stresses resulting from a 30 ft drop of the transport cask, required by 10 CFR 71.73, as well as the hypothetical storage cask tipover accident. Seismic accelerations impose relatively low stresses on the canisters in comparison with those associated with the cask drop and tipover accidents.

On January 10 1997, 10 CFR Parts 50 and 100 were revised to allow the use of the probabilistic seismic hazard assessment (PSHA) methodology to address uncertainties inherent in determining nuclear power plant seismic design values. These revisions were accomplished through the addition of 10 CFR 100.23 and Part 50, Appendix S. The PSHA method considers the frequency, as well as magnitude, of earthquakes that may affect a site. Rather than base seismic design on the largest ground motion likely to ever affect a site, a PSHA derives a site-specific hazard curve showing ground motion level versus annual probability of exceedence or, inversely, ground motion return period. The NRC issued Regulatory Guide 1.165 to provide guidance on calculation of the DE using PSHA techniques.

Since 10 CFR 72.102 currently requires that seismicity be evaluated by the deterministic techniques of Appendix A of Part 100, applicants for ISFSI licenses are not able to utilize the improvements promulgated in the amendments to Part 100 and must follow the rules that applied to nuclear power plants before these amendments. In the proposed rulemaking for Part 72 (Reference 5) however, the staff has proposed to modify the Part 72 seismic requirement to a level commensurate with the risks of cask and canister ISFSIs by providing for the use of PSHA methodology.

In addition, the seismic design philosophy in 10 CFR Part 60 for high-level waste repository surface facilities (also known as the Design Basis Event (DBE) rulemaking) is based on a PSHA. On January 3, 1997, the definitions of design

basis event and important-to-safety in Part 60 were revised to allow a probabilistic, risk-informed approach in designing for hazards (including seismic) at a geologic repository, with two design levels based on risk (61 FR 64257). This set an NRC precedent by accepting a risk-informed approach in licensing an above-ground facility (preclosure operations area of the high level waste repository) intended to temporarily store spent nuclear fuel quite similar to an ISFSI licensed under 10 CFR 72. For seismic events, the staff has accepted a two-tier approach toward designing Part 60 structures, systems, and components (SSCs). This approach is summarized in the following quotes from the NRC staff.

In SECY-98-126, Reference 5, concerning the NRC's rulemaking for geological and seismological characteristics for siting and design of dry cask ISFSIs under 10 CFR 72, the NRC staff states under Option 3, its preferred option for amending Part 72, the following related to the Part 60 design basis event rulemaking:

"The specific approach proposed for dry cask ISFSI systems, structures, and components would be comparable to the 10 CFR Part 60 graded approach to design ground motion for SSCs of pre-closure facilities. This graded approach would allow the structures, systems, and components of dry cask ISFSIs to be designed to either Frequency-Category-1 design basis events or Frequency-Category-2 design basis events, depending upon their importance-to-safety. For seismic events, the 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 10 CFR Part 60. In this approach, Frequency-Category-1 design basis ground motion refers to a mean annual probability of exceedance of 1.0E-03, which corresponds to a 1,000-year return period. Frequency-Category-2 design basis ground motion refers to a mean annual probability of exceedance of 1.0E-04, which corresponds to a 10,000-year return period."

In SECY-98-071, Reference 6, regarding DOE's request for an exemption from the deterministic seismic design requirements of 10 CFR 72.102(f)(1) for an ISFSI that would store TMI-2 spent fuel at INEEL, the NRC staff states:

"With the Part 60 Design basis event rulemaking, NRC adopted a graded approach similar to DOE Standard 1020 for natural hazard characterization and design. The Design basis event rulemaking defined a framework for two SSC design categories for repository surface facilities. For seismic events, the staff has accepted DOE's approach of designing SSCs with failure consequences within the public dose limit of 10 CFR 20.1301(a)(1), 1 mSv (100 mrem), to withstand the 1000-year return period mean ground motion. Meanwhile, SSCs with higher potential accident doses must be designed to withstand the 10,000-year return period mean ground motion."

PFS proposes to apply this same approach to establishing the DE at the PFSF. A detailed site specific seismic evaluation of the PFSF was performed, in accordance with the NRC's guidance in Regulatory Guide 1.165. This is compatible with the NRC's current requirements for establishing the DE at a new nuclear power plant site, and in keeping with the staff's plans for establishing DEs at dry cask storage ISFSIs in the future.

Applying the PSHA methodology of Regulatory Guide 1.165, the design earthquake was calculated at the PFSF site for a recurrence interval of 1,000 years. The attached report, prepared by Geomatrix Consultants, Inc., documents the results of this calculation. PFS proposes that the DE for the PFSF be calculated based on PSHA methodology for the 1,000 year recurrence interval, based on consideration of the relative risk associated with this event.

The bounding consequences of a major seismic event at the PFSF using the HISTORM and TranStor systems technology are limited by a storage cask tipover event, although this would only occur at a ground motion well above the 0.67g horizontal and 0.69 g vertical PGA values presented in PFSF SAR (Rev. 2) Section 3.2.10.1.1. While cask tipover is not a credible event at the PFSF, the canisters are designed to withstand the stresses resulting from a non-mechanistic cask tipover event with no breach and no release of radioactive material from inside the canister. Hypothetical cask tipover accidents are analyzed in Section 8.2.6 of the PFSF SAR (Rev. 2).

PFS analyses of hypothetical, non-mechanistic accidents, beyond the design basis, involving leakage from the canisters calculate off-site doses well below the 0.05 Sv (5 rem) whole body dose limit of 10 CFR 72.106(b). In its second round RAI response letter (Reference 7), PFS presented an analysis of the effects of such a beyond-design basis accident involving failure of a SSC important to safety in which a canister is postulated to leak continuously for 30 days under hypothetical accident conditions with 100% of the fuel rod cladding assumed to have failed, in accordance with the NRC's Interim Staff Guidance-5. The response to RAI 7-1 shows that the total effective dose equivalent (TEDE) from this accident to an off-site individual was calculated to be 74.9 mrem. This analysis conservatively assumed that the individual was continuously located at the PFSF owner controlled area boundary for 30 days. The dose from this hypothetical accident condition, for which no credible mechanism has been identified, is not only well below the 0.05 Sv (5 rem) siting evaluation factor of 10 CFR 72.106(b), but also below the 100 mrem public dose limit of 10 CFR 20.1301(a)(1). The results of this accident analysis will be incorporated into a future revision to the PFSF SAR Section 8.2.7, replacing the hypothetical canister breach accident which will be removed from the SAR in accordance with the NRC's Interim Staff Guidance-3.

This 74.9 mrem TEDE represents the maximum dose from any accident analyzed for the PFSF that will be in the PFSF licensing basis. Based on the NRC's risk-informed policy for establishing the DE stated in the above SECY documents, the 1,000 year seismic recurrence interval is appropriate and conservative for use at the PFSF since worst-case accident consequences are below the 10 CFR 20.1301(a)(1) public dose limit of 100 mrem.

This recurrence interval is the same as that selected by the DOE for preclosure seismic design of important-to-safety SSCs for Frequency-Category 1 design basis events at the Yucca Mountain high level waste geologic repository in Reference 8, which the NRC staff accepted. As stated by the DOE in Reference 8, use of a 1,000 year recurrence interval represents a conservative translation of the qualitative frequency description of Frequency-Category 1 design basis events in 10 CFR 60, i.e., "events that are reasonably likely to occur regularly, moderately frequently, or one or more times before permanent closure of the geologic repository operations area." The use of a 1,000 year recurrence interval would be similarly conservative for the PFSF. In addition, the license for the PFSF will be for 20 years with the potential for license renewal for another 20 years per 10 CFR 72.42, or up to 40 years, which is a shorter duration than the 150 years considered in Reference 8 (Section 3.1.1) for the Yucca Mountain preclosure facility.

Thus, use of a 1,000 year recurrence interval for the PFSF will be conservative and appropriate. As documented in the attached report prepared by Geomatrix Consultants, Inc., the DE calculated using the methodology of Regulatory Guide 1.165 for the 1,000 year recurrence interval is characterized by 0.40 g horizontal and 0.39 g vertical PGAs.

## CONCLUSION

PFS has completed both a DSHA and a PSHA for the PFSF site. As discussed in Section 8.2.1 of the PFSF SAR (Rev. 2), the current SSE design basis of 0.67g developed by the deterministic method required by 10 CFR 72.102(f)(1) would not result in cask tipover and no radioactivity would be released. Moreover, even if a cask tipover did occur there is no credible scenario under which the canister confinement barrier would be breached and radioactivity would be released. Based on this absence of radiological consequences from any credible seismic event and the minor radiological consequences from hypothetical beyond-design basis accidents, the present Part 72 requirement for an ISFSI DE is considered an unnecessary regulatory burden. A PSHA was performed using the methodology permitted by 10 CFR 100.23 and 10 CFR 50 Appendix S for new nuclear power plants, applying the guidance of Regulatory Guide 1.165 (documented in the attached report prepared by Geomatrix Consultants, Inc.), resulting in the DE with a 1,000-year recurrence interval to be 0.40 g horizontal and 0.39 g vertical PGA.

The 1,000-year recurrence interval is justified by the low consequences of a worst-case hypothetical beyond-design basis accident at the PFSF, having dose consequences below the 100 mrem TEDE public dose limit of 10 CFR 20.1301(a)(1). Given the absence of radiological consequences from any credible seismic event, it is considered that application of the probabilistic risk-informed approach for calculating the seismic hazard, that the NRC staff adopted in the Part 60 rulemaking, is adequately conservative for the PFSF. Moreover, the expected life span of the PFSF, 20 years with the potential for renewal for another 20 years per 10 CFR 72.42, justifies use of this ground motion as the DE.

The PFSF DE is calculated in accordance with the latest probabilistic methodology that applies to new nuclear power plants, using the risk-informed approach determined to be acceptable in the Part 60 rulemaking that applies to preclosure facilities of Yucca Mountain, considered to be similar to an ISFSI with dry cask storage. Thus, while reducing regulatory burden, granting the requested exemption from 10 CFR 72.102(f)(1) will still maintain an adequate design margin for seismic events and will not be inimical to public health and safety.

## REFERENCES

1. U.S. NRC Regulatory Guide 1.165, "Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion," March 1997.
2. U.S. NRC Direction Setting Issue 12 of the Commissions Strategic Assessment Issue Paper, release date: September 16, 1996.
3. Geomatrix Consultants, Inc., Fault Evaluation Study and Seismic Hazard Assessment, Private Fuel Storage Facility, Skull Valley Utah; Final Report, February 1999.
4. Hossain, QA. A.H. Chowdhury, M.P. Hardy, K.S. Mark, J.E. O' Rourke, W.J. Silva, J.C. Stepp, and F.H. Swan, III, "Seismic and Dynamic Analysis and Design Considerations for High-Level Nuclear Waste Repositories," J.C. Stepp, ed., American Society of Civil Engineers, New York, New York, 1997.
5. U.S. NRC SECY-98-126, from L. Joseph Callan (EDO) to the Commissioners, "Rulemaking Plan: Geological and Seismological Characteristics for Siting and Design of Dry Cask Independent Spent Fuel Storage Installations, 10 CFR Part 72, dated June 4, 1998.
6. U.S. NRC SECY-98-071, from L. Joseph Callan (EDO) to the Commissioners, "Exemption to 10 CFR 72.102(f)(1) Seismic Design Requirement for Three Mile Island Unit 2 Independent Spent Fuel Storage Installation, dated April 8, 1998.
7. PFS letter J.D. Parkyn to U.S. NRC Director of Office of Nuclear Material Safety and Safeguards, "Response to Request for Additional Information;" dated February 10, 1999.
8. DOE Topical Report YMP/TR-003-NP, Rev. 2, "Preclosure Seismic Design Methodology for a Geologic Repository at Yucca Mountain", August 1997.