

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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BEFORE THE ATOMIC SAFETY AND LICENSING BOARDOFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

In the Matter of:

Docket No. 72-22-ISFSI

PRIVATE FUEL STORAGE, LLC
(Independent Spent Fuel
Storage Installation)

ASLBP No. 97-732-02-ISFSI

January 16, 2002

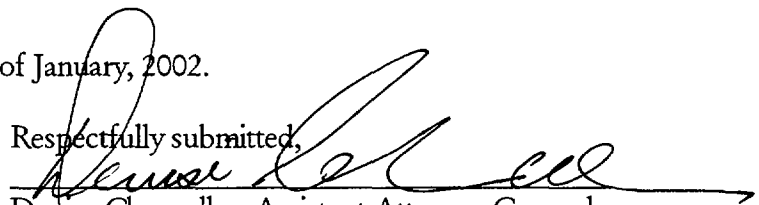
JOINT SUBMITTAL OF UNIFIED GEOTECHNICAL
CONTENTION, UTAH L AND UTAH QQ

In accordance with the Licensing Board's direction in LBP-01-39, slip op at 33 (December 26, 2001), LBP-02-01, slip op. at 8 (January 9, 2002), and the Board's Orders of December 26, 2001 and January 9, 2002, counsel for the Applicant, the Staff and the State have consulted and arrived at a restatement of the geotechnical issue. The end result is a Unified Geotechnical Contention (Utah L and Utah QQ), which is attached hereto.

The parties will be prepared to discuss, at the pre-hearing conference on January 17, 2002, any questions the Licensing Board may have with regard to the Unified Geotechnical Contention.

DATED this 16th day of January, 2002.

Respectfully submitted,


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CERTIFICATE OF SERVICE

I hereby certify that a copy of JOINT SUBMITTAL OF UNIFIED
GEOTECHNICAL CONTENTION, UTAH L AND UTAH QQ was served on the
persons listed below by electronic mail (unless otherwise noted) with conforming copies by
United States mail first class, this 16th day of January, 2002:

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Denise Chancellor
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Unified Consolidated Contentions Utah L and Utah QQ (Geotechnical)

The Applicant has not demonstrated the suitability of the proposed independent spent fuel storage installation (ISFSI) site because the License Application and the Safety Analysis Report do not adequately address site and subsurface investigations necessary to determine geologic conditions, potential seismicity, ground motion, soil stability and foundation loading; and

The Applicant's site specific investigations, laboratory analyses, characterization of seismic loading, and design calculations, including redesign of cement-treated soil (or soil cement) fail to demonstrate that a) the newly revised probabilistic seismic hazard design basis ground motions have been adequately and consistently applied to the Canister Transfer Building ("CTB"), storage pads, and their foundations; b) PFS's general design approach, including the redesign of soil cement, for the CTB, storage pads, or storage casks can safely withstand the effects of earthquakes; and c) the foundation design of the CTB, storage pads, and the underlying soils, or the stability of the storage casks, are adequate to safely withstand the newly revised probabilistic seismic hazard design basis ground motions (10 CFR §§ 72.102(c), (d); 72.122(b)),

in that:

A. Surface Faulting.

1. The Applicant's approach to surface faulting is neither integrated nor comprehensive and is inadequate to assess surface rupture at the site in that:
 - a. The Applicant has not used soil velocity data obtained from its seismic cone penetration tests in order to convert the seismic reflection data to show depth of marker beds.
 - b. The Applicant's conclusion that the structural grain of the valley runs northwest does not account for the east-west Pass Canyon and the topographic embayment at the east-west trending Rydalch Pass.
 - c. The Applicant has failed to collect any seismic tie lines perpendicular to the east-west lines shot in 1998 in order to correlate the 1998 lines among themselves or with the Geosphere and GSI lines, nor are the placement and number of seismic lines adequate to determine the length and projected locations of the East or West faults and other unnamed faults.

B. Ground Motions.

1. The Applicant's failure to adequately assess ground motion places undue risk on the public and the environment and fails to comply with 10 CFR § 72.102(c) in that:
 - a. The Applicant has not conducted a fully deterministic seismic hazard analysis that meets the requirements of 10 CFR Part 100 Appendix A.

C. Characterization of Subsurface Soils.

1. Subsurface Investigations

The Applicant has not performed the recommended spacing of borings for the pad emplacement area as outlined in NRC Reg. Guide 1.132, "Site Investigations for Foundations of Nuclear Power Plants, Appendix C."

2. Sampling & Analysis

The Applicant's sampling and analysis are inadequate to characterize the site and do not demonstrate that the soil conditions are adequate to resist the foundation loadings from the design basis earthquake in that:

- a. The Applicant has not performed continuous sampling of critical soil layers important to foundation stability for each major structure as recommended by Reg. Guide 1.132 Part C6, Sampling.
- b. The Applicant's design of the foundation systems is based on an insufficient number of tested samples, and on a laboratory shear strength testing program that does not include strain-controlled cyclic triaxial tests and triaxial extension tests.

3. Physical Property Testing for Engineering Analyses

- a. The Applicant has not adequately described the stress-strain behavior of the native foundation soils under the range of cyclic strains imposed by the design basis earthquake.
- b. The Applicant has not shown by case history precedent or by site-specific testing and dynamic analyses that the cement-treated soil will be able to resist earthquake loadings for the CTB and storage pad foundations as required by 10 CFR § 72.102(d).
- c. The Applicant has not considered the impact to the native soil caused by construction and placement of the cement-treated soil, nor has the Applicant analyzed the impact to settlement, strength and adhesion properties caused

by placement of the cement-treated soil.

- d. The Applicant has not shown that its proposal to use cement-treated soil will perform as intended – i.e., provide dynamic stability to the foundation system – and the Applicant has not adequately addressed the following possible mechanisms that may crack or degrade the function of the cement-treated soil over the life of the facility:
 - (i) shrinkage and cracking that normally occurs from drying, curing and moisture content changes.
 - (ii) potential cracking due to vehicle loads.
 - (iii) potential cracking resulting from a significant number of freeze-thaw cycles at the Applicant's site.
 - (iv) potential interference with cement hydration resulting from the presence of salts and sulfates in the native soils.
 - (v) cracking and separation of the cement-treated soil from the foundations resulting from differential immediate and long-term settlement.
- e. The Applicant has unconservatively underestimated the dynamic Young's modulus of the cement-treated soil when subjected to impact during a cask drop or tipover accident scenario. This significantly underestimates the impact forces and may invalidate the conclusions of the Applicant's Cask Drop/Tipover analyses.

D. Seismic Design and Foundation Stability.

The Applicant, in its numerous design changes and revisions to the calculations, has failed to demonstrate that the structures and their foundations have adequate factors of safety to sustain the dynamic loading from the proposed design basis earthquake, and does not satisfy 10 CFR § 72.102(c) or (d) or § 72.122(b)(2) in the following respects:

1. Seismic Analysis of the Storage Pads, Casks, and Their Foundation Soils

The Applicant has not demonstrated adequate factors of safety against overturning and sliding stability of the storage pads and their foundation system for the design basis earthquake (DBE) as outlined by NUREG-75/087, Section 3.8.5, "Foundation," Section II.5, *Structural Acceptance Criteria*, because of the following errors and unconservative assumptions made by the Applicant in determining the dynamic loading to the pads and foundations:

- a. In spite of proximity to major active faults, the Applicant's calculations

unconservatively assume that only vertically propagating in-phase waves will strike the pads, casks and foundations, and fail to account for horizontal variation of ground motion that will cause additional rocking and torsional motion in the casks, pads and foundations.

- b. The Applicant's calculations incorrectly assume that the pads will behave rigidly during the design basis earthquake. The assumption of rigidity leads to:
 - (i) Significant underestimation of the dynamic loading atop the pads, especially in the vertical direction.
 - (ii) Overestimation of foundation damping.
- c. The Applicant has failed to provide a realistic evaluation of the foundation pad motion with cement-treated soil under and around the pads in relation to motion of the casks sliding on the pads in that Applicant's evaluation ignores:
 - (i) the effect of soil-cement around the pads and the unsymmetrical loading that the soil-cement would impart on the pads once the pads undergo sliding motion,
 - (ii) the flexibility of the pads under DBE loading, and
 - (iii) the variation of the coefficient of sliding friction between the bottom of the casks and the top of the pads due local deformation of the pad at the contact points with the cask.
- d. The Applicant has failed to consider lateral variations in the phase of ground motions and their effects on the stability of the pads and casks.
- e. The Applicant's calculations for cask sliding do not address the frequency dependency of the spring and damping values used to model the foundation soils.
- f. The Applicant has failed to consider the potential for cold bonding between the cask and the pad and its effects on sliding in its calculations.
- g. The Applicant has failed to analyze for the potential of pad-to-pad interaction in its sliding analyses for pads spaced approximately five feet apart in the longitudinal direction.
- h. In an attempt to demonstrate cask stability, the Applicant's calculations use only one set of time histories in its non-linear analysis. This is inadequate because:

- (i) Nonlinear analyses are sensitive to the phasing of input motion and more than one set of time histories should be used.
 - (ii) Fault fling (*i.e.*, large velocity pulses in the time history) and its variation and effects are not adequately bounded by one set of time histories.
- i. Because of the above errors, omissions and unsupported assumptions, the Applicant has failed to demonstrate the stability of the free standing casks under design basis ground motions. Thus, the Applicant's analyses do not support the Applicant's conclusions that excessive sliding and collision will not occur or that the casks will not tip over. 10 CFR § 72.122(b)(2) and NUREG-1536 at 3-6.

2. Seismic Analysis of the Canister Transfer Building and its Foundation

The Applicant has not demonstrated adequate factors of safety against overturning and sliding stability of the CTB and its foundation system for the design basis earthquake as outlined by NUREG-75/087, Section 3.8.5, "Foundation," Section II.5, *Structural Acceptance Criteria*, because of the following errors and unconservative assumptions made by the Applicant in determining the dynamic loadings to the CTB and its mat foundation:

- a. The Applicant's calculations incorrectly assume that the CTB mat foundation will behave rigidly during the DBE. The assumption of rigidity leads to:
 - (i) Significant underestimation of the dynamic loading to the mat foundation.
 - (ii) Overestimation of foundation damping.
- b. The Applicant's calculations ignore the presence of a much stiffer, cement-treated soil cap around the CTB. This soil cap impacts:
 - (i) Soil impedance parameters.
 - (ii) Kinematic motion of the foundation of the CTB.
- c. The Applicant's calculations are deficient because they ignore the out-of-phase motion of the CTB and the cement-treated soil cap, which potentially can lead to the development of cracking and separation of the cap around the building perimeter.
- d. The Applicant's calculations unconservatively assume that only vertically propagating in-phase waves will strike the CTB and its foundations, and fail to account for horizontal variation of ground motion that will cause

additional rocking and torsional motion of the CTB and its foundations.

E. Seismic Exemption.

Relative to the PFS seismic analysis supporting its application and the PFS April 9, 1999 request for an exemption from the requirements of 10 C.F.R. § 72.102(f) to allow PFS to employ a probabilistic rather than a deterministic seismic hazards analysis, PFS should be required either to use a probabilistic methodology with a 10,000-year return period or comply with the existing deterministic analysis requirement of section 72.102(f), or, alternatively, use a return period significantly greater than 2000 years, in that:

1. The requested exemption fails to conform to the SECY-98-126 (June 4, 1998) rulemaking plan scheme, i.e., only 1000-year and 10,000-year return periods are specified for design earthquakes for safety-important systems, structures, and components (SSCs) -- SSC Category 1 and SSC Category 2, respectively -- and any failure of an SSC that exceeds the radiological requirements of 10 C.F.R. § 72.104(a) must be designed for SSC Category 2, without any explanation regarding PFS SSC compliance with section 72.104(a).
2. PFS has failed to show that its facility design will provide adequate protection against exceeding the section 72.104(a) dose limits.
3. The staff's reliance on the reduced radiological hazard of stand-alone ISFSIs as compared to commercial power reactors as justification for granting the PFS exemption is based on incorrect factual and technical assumptions about the PFS facility's mean annual probability of exceeding a safe shutdown earthquake (SSE), and the relationship between the median and mean probabilities for exceeding an SSE for central and eastern United States commercial power reactors and the median and mean probabilities for exceeding an SSE for the PFS facility.
4. In supporting the grant of the exemption based on 2000-year return period, the staff relies upon the United States Department of Energy (DOE) standard, DOE-STD-1020-94, and specifically the category-3 facility SSC performance standard that has such a return period, notwithstanding the fact the staff categorically did not adopt the four-tiered DOE category scheme as part of the Part 72 rulemaking plan.
5. In supporting the grant of the exemption based on the 2000-year return period, the staff relies upon the 1998 exemption granted to DOE for the Idaho National Engineering and Environmental Laboratory (INEEL) ISFSI for the Three Mile Island, Unit 2 (TMI-2) facility fuel, which was discussed in SECY-98-071 (Apr. 8, 1998), even though that grant was based on circumstances not present with the PFS

ISFSI, including (a) existing INEEL design standards for a higher risk facility at the ISFSI host site; and (b) the use of a peak design basis horizontal acceleration of 0.36 g that was higher than the 2000-year return period value of 0.30 g.

6. Because (a) design levels for new Utah building construction and highway bridges are more stringent; and (b) the PFS return period is based on the twenty-year initial licensing period rather than the proposed thirty- to forty-year operating period, the 2000-year return period for the PFS facility does not ensure an adequate level of conservatism.