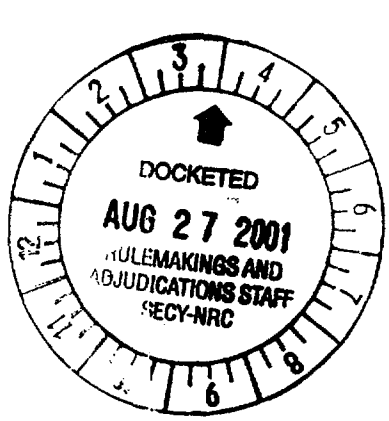
RAS 3333

STATE OF UTAH

OFFICE OF THE ATTORNEY GENERAL



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August 23, 2001

Emile L. Julian, Assistant for
Rulemakings and Adjudications
Rulemakings and Adjudications Staff
Office of the Secretary
U.S. Nuclear Regulatory Commission
11555 Rockville Pike, One White Flint North
Mail Stop: O16G15
Washington, D.C. 20555

Re: In the Matter of Private Fuel Storage, LLC, Docket 72-22
Exhibits Containing PFS-Claimed Confidential Information

Dear Mr. Julian;

Enclosed are Exhibits 3 (Recommended Bidders List dated 12/8/00) and 5 (excerpts from a letter from Mr. Cooper, Stone & Webster to Mr. Parkyn, PFS dated 11/15/00) to State of Utah's Second Request to Modify the Bases of Late-filed Contention Utah QQ in Response to More Revised Calculations from the Applicant (August 23, 2001). Both documents are claimed by Private Fuel Storage, LLC, to contain confidential information.

While the State disagrees that these exhibits should be considered confidential, the State requests that the NRC treat them as confidential documents and withhold them from public scrutiny pending a review by PFS of its confidentiality claim.

Please contact me with any questions at (801) 366-0286.

Sincerely,

Denise Chancellor,
Assistant Attorney General

Enclosure: as stated
cc: PFS Docket 72-22-ISFSI Service List, without enclosure

Template = SECY-041

SECY-02

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket No. 72-22-ISFSI
PRIVATE FUEL STORAGE, LLC (Independent Spent Fuel Storage Installation)	)	ASLBP No. 97-732-02-ISFSI
	)	August 23, 2001

STATE OF UTAH'S SECOND REQUEST TO MODIFY THE BASES OF LATE-FILED CONTENTION UTAH QQ IN RESPONSE TO MORE REVISED CALCULATIONS FROM THE APPLICANT

On May 16, 2001, pursuant to 10 CFR § 2.714 and the Board's April 26, 2001 Order, the State sought admission of late-filed Contention Utah QQ, Seismic Stability ("Utah QQ")[1], based on a number of revised calculations submitted to the NRC accompanying PFS License Application Amendment No. 22 ("Amendment 22"). On June 19, 2001, in response to revised calculations it received from PFS and upon which Utah QQ is based, the State filed its First Request to Modify the Bases of Utah QQ. On July 30, 2001, the State received from PFS another revision to the same set of revised Stone & Webster calculations that precipitated the State's First Modification Request. In addition, on August 8, 2001, the State received a copy of a Holtec letter related to Holtec's site-specific ISFSI pad evaluation at PFS. Because of these further calculation revisions which relate back to Amendment 22, the State finds that it must again modify the bases of Utah QQ.

PFS's response to "Missing Information Identified by the NRC Staff During the

[1] The State recognizes that Utah QQ has not been admitted and in this Second Modification Request, the use of the term "Utah QQ" is for convenience only.

Acceptance Review" was submitted to the NRC on July 20, 2001 and received by the State on July 23, 2001. In its July 27, 2001 cover letter transmitting the revised calculations to NRC, PFS says that the calculations have been updated to incorporation the information provided to NRC on July 20, 2001. Until the State received the actual revised calculations, it was not possible for the State's experts to thoroughly review the recent round of changes PFS was proposing to the NRC. The revised Stone & Webster calculations at issue are: (1) *Stability Analyses of Cask Storage Pads*, Cal. No. 05996.01-G(B)-04, Revision 9; and (2) *Stability Analyses of Canister Transfer Building*, Cal. No. 05996.01-G(B)-13, Revision 6. PFS submitted the Holtec calculation to NRC on August 7 as "Commitment Resolution Letter # 37."

This Second Modification Request is supported by the Declarations of Dr. Steven Bartlett and Dr. Farhang Ostadan, attached hereto as Exhibits 1 and 2, respectively.

DISCUSSION

The revised Stone & Webster calculations and the additional information from Holtec do not satisfy the concerns raised by the State in Utah QQ or the State's First Modification Request. In particular, results from PFS's soil cement testing program have not been presented in the revised calculations. Furthermore, there are significant errors in Stone & Webster's calculation of inertial force, simplified Newmark sliding block analysis, and dynamic active lateral earth pressure. In addition, both Stone & Webster and Holtec in their calculations rely on ideal conditions and unproven assumptions.

A. PFS's Soil-Cement Testing Program

PFS's analyses of the Canister Transfer Building ("CTB") and storage pads still rely upon assumed values notwithstanding that in Revision 9 to Cal. No. G(B)-04, *Stability*

Analyses of Cask Storage Pads at p. 8, PFS states that it has "revised units weights of soil cement to reflect measured values obtained from ongoing laboratory testing program." Cal. No. G(B)-04 fails to address PFS's soil testing program with any specificity or data from the PFS testing program. PFS's analyses of the pads and CTB are incomplete without the soil test data results incorporated into stability calculations. Bartlett Dec. ¶ 5.

Furthermore, the contractor chosen by PFS to conduct the soil-cement testing program does not appear to be qualified to conduct the work within the scope set forth by PFS, such as following the standards in 10 CFR Part 21; Part 50 Appendix B; and Part 72 as well as Reg. Guide 1.138, Laboratory Investigations of Soils for Engineering Analysis and Design of Nuclear Power Plants. In fact, near the time PFS awarded the soils testing contract to the lowest bidder, PFS was unaware of any of the recommended bidders' qualifications. *See* Exhibit 3.[2] The State, therefore, disputes the statement in Cal. No. G(B)(13), Revision 6, *Stability Analyses of the CTB*, at 11 that PFS's "entire laboratory testing program is being conducted in full compliance with the Quality Assurance (QA) Category I requirements of the [Engineer Services Scope of Work]." Consequently, any reliance by PFS on its soil testing program will be unsupportable unless and until PFS validates and verifies the quality assurance program under which testing has been performed. Bartlett Dec. ¶ 6. Finally, PFS has no plans to conduct cyclic triaxial or cyclic direct shear testing of the

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[2] Exhibit 3, Recommended Bidders List for the Laboratory Testing of Soil-Cement Mixes, was recently produced to the State by PFS and marked "PFS Confidential Information." While the State disagrees with this designation, it will file Exhibit 3 as a proprietary document, and serve Exhibit 3 separately only on persons entitled to view such information. Bidder No. 5 was awarded the contract.

cement-treated soil samples. Only through these types of tests can the behavior of the cement-treated soil be evaluated under the cyclic loading of the design earthquake. Id. *See* Utah QQ at 6.[3]

B. Inertial Forces and the Rigidity of the Cask-Pad System

In an attempt to correct a fundamental and fatal flaw in its analysis of the inertial forces acting on the native soil, Cal. No. G(B)-04, Rev. 9, makes yet another fundamental and fatal flaw. In Utah's First Request to Modify the Bases of Utah QQ at 4, the State pointed out that PFS failed to use as an input into its analysis the inertial force of the combined mass of the pad and the underlying cement-treated soil. Now, in Revision 9 at p. 8, PFS maintains it has added the inertial force due to the two foot thick layer of soil cement beneath the pad to the sliding stability analysis. PFS, however, incorrectly uses peak ground acceleration to calculate the inertial force in attempting to correct its mistake in Revision 8. By using peak ground acceleration, PFS assumes that the soil cement will act as a rigid body. This is incorrect. The cement-treated soil does not have sufficient stiffness to behave perfectly rigidly under the design earthquake loadings. Bartlett Dec. ¶7.

PFS's insistence on ignoring the effect of the pad and mat foundation flexibility has been a long-standing dispute between PFS and the State.[4] During deposition testimony in

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[3] As noted in Utah QQ at 6: "The most serious safety-related concern is PFS's wide and pervasive attempt to use "soil-cement" as a structural element in the foundation design for the CTB and storage pads without providing sufficient evaluations, testing, calculations and design to demonstrate that the cement-treated soil will perform its intended functions, both under seismic loading and long-term operational conditions."

[4]Even though the dispute about whether the cement-treated soil and pad system will act as a rigid mat is a long standing one, this concept is imbued in many of PFS's calculations

November 2000, Dr. Ostadan and Dr. Bartlett provided a detailed explanation of why the pads and cement-treated soil will not act as a rigid system but would introduce accelerations higher than peak ground accelerations. Bartlett & Ostadan Tr. at 363-65, attached hereto as Exhibit 4. Whether the pads and cement-treated soil would act as a rigid system was also raised by the State in Utah QQ. *See* Utah QQ at 6 and Exhibit 1, Ostadan Dec. ¶ 13. Moreover, the assumption that rigidity can lead to a significant underestimation of the actual dynamic loads led Dr. Ostadan to conclude: "In the stability analysis of the pads, the calculation Stability Analysis of Storage Pads, Calculation No. 05996.02, G(B)-04, Rev. 7 (SWEC), the Applicant has failed to consider the natural frequency of the cask-pad-soil cement system, thus underestimating the seismic loads significantly." Utah QQ, Exhibit 1, Ostadan Dec. ¶ 14.

The questions that must be asked are why PFS persists in using an unproven design concept that raises serious safety concern for the seismic complex ISFSI site and whether PFS has employed persons of sufficient experience and training to understand the complexities involved in analyzing the dynamic loading on cement-treated soil and the underlying native soils. PFS's revision to its calculation of the inertial force acting on the native soils that the State raised in its First Request to Modify Utah QQ is but one example to validate the State's concerns that PFS has conducted an ineffectual seismic stability analyses. PFS is now on its ninth revision to the stability analyses of the storage pad calculations and that analyses is still wrong because, *inter alia*, there is no supportable basis

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and revisions thereto. The State maintains that this issue is encompassed in Utah L, Basis 3, and timely raised in Utah QQ and both Requests to Modify Utah QQ.

for PFS claiming the pads and cement-treated soil will act as a rigid system.

C. Newmark Block Sliding Analysis

Revision 9 to Cal. G(B)-04 presents a hypothetical sliding case where resistance to sliding is based on frictional resistance along the base of the pads and the cement-treated soil. Bartlett Dec. ¶ 9. The subsequent analyses appear to be in response to NRC Staff's concern where the Staff would not permit the use of cohesion between the underlying soil and the bottom of the storage pads unless PFS modified the pad design to incorporate structural key elements at the bottom of the pads. *See* Excerpts of a letter from Jerry Cooper, Stone & Webster to John Parkyn, PFS, dated November 15, 2000, attached as Exhibit 5.[5] PFS precluded the use of structural key elements (shear keys) because the increased stiffness of the pads would affect Holtec's cask tipover analyses and delay licensing, id., and opted not to change the pad and foundation design.

In Revision 9 to Cal. G(B)-04, PFS presents analyses for the hypothetical case for sliding without cohesion and included cases with and without the buttressing effect of the cement treated soil. Bartlett Dec. ¶ 9. The factors of safety against sliding for the no cohesion cases ranged from 0.26 to 1.01 in G(B)-04 Rev. 9, depending on the various assumptions regarding geometry and buttressing. Id. There are several concerns with these hypothetical cases. First and foremost, PFS suggests that even though the factors of safety are less than 1.1, the Newmark analysis can be used to estimate the deformations. Id. This is

[5] Like Exhibit 3, Exhibit 5 was recently obtained in discovery from PFS and is marked "PFS Confidential." Again the State disagrees with this designation but will serve Exhibit 5 as a proprietary filing.

not consistent NUREG-75/087, Section 3.5.5, "Foundation." and Section II.5, "Structural Acceptance Criteria," which allows a recommended minimum factor of safety against sliding failure of 1.1 for extreme environmental conditions. NUREG-75/087 does not have provisions for deformation analyses to be used to satisfy the sliding evaluations for extreme environmental conditions such as earthquakes. Id. Moreover, PFS has not calculated or presented what constitutes "acceptable deformation" from sliding of the pads in its design criteria. Thus, there is no basis to judge what constitutes "acceptable deformation." Id.

There are other errors and unconservative assumptions in PFS's simplified Newmark sliding block analyses. First, the deformations analyses presented are very simplistic and have numerous errors and unconservative assumptions. Again, PFS has erroneously assumed the pads will behave in a rigid manner and incorrectly uses peak vertical ground acceleration in calculating the maximum resistance coefficient. Bartlett Dec. ¶ 10. Second, PFS has not considered the potential for unsymmetrical sliding, which will produce larger displacement than those calculated in Cal. G(B)-04, Revision 9. Id. Third, the design basis earthquake ground motion for the PFS site may be significantly different than those from which Newmark based his analyses. The design charts in Newmark are applicable for peak horizontal ground acceleration normalized to 0.5 g whereas the design basis ground motion for this site is approximately 0.7 g. Id. Fourth, PFS has not justified that the earthquakes used in the Newmark analysis are similar to the design basis earthquake in amplitude, frequency and phasing of the ground motion and whether the Newmark events incorporate near source effects, such as fling. Id.

D. Other Incorrect Calculations in the Pad Stability Analyses

Revision 9 to G(B)-04 also revised the calculation of the dynamic active lateral earth pressure but the revised calculation is still incorrect. Bartlett Dec. ¶ 8. The revised calculation fails to recognize the potential for pad-to-pad interaction, an issue raised by the State in Utah QQ at 10, and an issue that still remains unaddressed by PFS in Revision 9. Id.

E. Canister Transfer Building Sliding Stability Analyses

The *CTB Sliding Stability Analyses*, Cal. G(B)-13, Revision 6, does not shed any light onto the issues raised by the State in Utah QQ. Ostadan Dec. ¶¶ 7 and 8. In Cal. G(B)-13, Revision 6, Stone and Webster used soil cement to show additional resistance that is available for the stability of the building without regard to the actual behavior of the soil cement under tensile stresses; separation caused by vibration of the building; and the impact of settlement, as calculated in Cal. G(B)-13, on the integrity of the soil cement around the CTB. Such loading will indeed cause cracking and separation of the soil cement and invalidate the assumptions used in the stability analyses of the CTB. Ostadan Dec. ¶ 8.

F. Holtec's New Cask Sliding Calculation

PFS submitted further calculations by Holtec in response to NRC's concern that the storage pads can slide on the soil by about six inches. PFS Commitment Resolution Letter # 37 dated August 7, 2001.[6] The new Holtec calculation is over-simplified and incorrect. The calculation incorporates nonlinear soil springs under the storage pad to allow sliding of

[6]In Commitment Resolution Letter # 37 PFS responded to NRC question/comment: "PFS should provide a basis for the conclusions contained within the SAR that the storage casks do not tip over, collide, nor slide off the storage pad during the seismic event, taking into consideration the potential movement of the cask storage pads of up to 6"."

the pad and it attempts to show that the casks are still stable even though the pad can slide by as much as six inches. Ostadan Dec. ¶ 9. The concerns expressed by Dr. Ostadan in his Declaration ¶ 11(a) through (f) in support of Contention Utah QQ still apply to the revised calculation. Id. ¶ 9. In addition, Holtec assumed an idealized and favorable condition to model the sliding of the pad over the soil. Id. ¶ 10. It has simply ignored the effect of soil-cement around the pad and the unsymmetric loading that the soil-cement will impart on the pad once the pad undergoes sliding movement. The cement- treated soil will create an active and a passive side. The cracking and potential crushing of the soil-cement on the passive side and separation of the soil cement on the active side due to lack of tensile capacity of soil cement will impart unbalanced forces on the pad and severely impact the stability of the casks on the pads. Id.

In sum, it is clear that PFS has not formulated a sound design concept that can properly include the real behavior of the cement-treated soil on the seismic response and stability of the cask-pad system. Id. ¶ 11. PFS is result oriented in whether it incorporates soil-treated cement into its calculations - it uses and ignores it on an as-needed basis. *See* Id.

LATE FILED FACTORS:

The State meets the 10 CFR § 2.714(a) late-filed factors for the Second Request to Modify the Bases of Contention Utah QQ.

Good Cause: Given the Board's recent procedural pronouncement that the State filed an "omission" contention that was corrected by a brief statement in the Staff's Draft Environmental Impact Statement, the State wants no misapprehension by the Board that the latest revised seismic stability calculations by PFS constitute a correction of the defects that

State has outlined in Utah QQ or its First Modification Request. *See* LBP-01-23,slip op. at 10-11. Thus compelled to amend the basis of Utah QQ, the State has good cause for late-filing this Second Modification Request.[7] First, the Modification Request is timely because it is being filed twenty-four days from receipt of the two revised seismic stability analyses calculations for the pads and CTB and within about two week of receipt of the revised Holtec calculation. Second, the revised calculations raise additional safety concerns that were not evident in the revisions upon which Utah QQ is based. Third, the revised calculations attempt to address some issues raised in Utah QQ and the First Modification Request but fail to do so; these failed attempts are discussed in this Second Modification Request and supporting declarations. Fourth, the safety issues raised in both Utah QQ and the Modification Requests are significant and compelling. Therefore, the State has good cause for late-filing this Request.

Availability of Other Means for Protecting the State's Interests: The State has no means, other than this proceeding, of protecting its interests. PFS has offered no proof of concept that its novel use of cement-treated soil will provide the required stability to the CTB, storage pads or casks and a hearing before the Board is the only impartial forum in which the State may raise this issue.

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[7] In response to the State's First Request to Modify Utah QQ, PFS claims the modifications "are in most cases a rehash of the issue that the State is seeking to raise in Proposed Utah QQ." PFS Response at 10 (July 3, 2001). Even assuming the issues in this modification request are a "rehash" of longstanding technical disputes between the State and PFS, given the Board's ruling on Summary Disposition of Contention Utah Z, the State feels compelled to modify contentions and their bases in response to revised PFS calculations, so as to urge the Board to rule on the merits of the State's contentions.

Development of a Sound Record: Utah QQ and the two Modification Requests are not merely legal arguments by counsel but are based on technical support by the State's experts. *See* LBP-01-03, 53 NRC 84, 2001 WL 124984 at *9. In many instances, the State's technical critique of PFS's seismic analyses has prompted NRC Staff to raise the same questions with PFS. *See e.g.*, Exhibit 5. Moreover, the State's critique has pointed out the fallacies in PFS's unproven design concept, *i.e.*, PFS's notion that if it uses enough cement-treated soil under and around the CTB and storage pads PFS can still retain its original design and overcome a thirty-five percent increase in ground motions at the site.

The State's contention and modification requests present genuine and particularized concerns and satisfy the purpose of NRC's strict contention rule to focus the hearing process on real disputes susceptible of resolution in an adjudication and are sufficiently detailed to put the parties in this proceeding on notice of the State's specific grievances. Duke Energy Co. (Oconee Nuclear Station, Units 1, 2 and 3), 49 NRC 328, 334 (1999).

The State's experts have already demonstrated that they will assist in developing a sound record on the seismic issues in this proceeding. *See e.g.*, Declarations in support of the State's Response to Summary Disposition of Utah L, and in support of admission of Utah QQ. Together Drs. Steven Bartlett, Farhang Ostadan and James Mitchell have expertise in the disciplines needed to analyze and challenge the seismic stability analyses of the storage pads and CTB, such as soil structure interaction, dynamic analyses, soil strengths and properties, and the use of soil cement and cement-treated soil. The disciplines in which the State's experts have many years of professional training, experience and expertise are, thus far, lacking in the technical support evinced in PFS's seismic stability analyses. PFS is now

on revision 9 of the pad seismic stability analyses and revision 6 of the CTB seismic stability analyses. Critical issues still have not been addressed or resolved. Unless the Board allows the State to participate in developing the seismic record in this proceeding, a significant and important level of objective seismic expertise and knowledge will be muted.

The declarations of the State's experts in support of Utah QQ and the two Requests to Modify Utah QQ are detailed relative to the specific seismic calculations PFS has presented to date.[8] Not only do these declarations provide a "real clue" about admission of the contention and modification requests, *see e.g.*, Staff Response to Utah's First Request to Modify Utah QQ at 14 (July 3, 2001), but they are also as detailed as can reasonable be expected as to the scope of the experts' testimonies given PFS's lack of supporting data and the unrelenting revisions PFS continues to make to its seismic stability analyses. Any suggestion that this factor should be weighed against the State is unwarranted. This is PFS's project and it is up to PFS to adequately describe and support its design concept. The State is unable to otherwise summarize proposed expert testimony until PFS provides proof of its novel soil-treated cement design concept.

Representation by Another Party: The State is the only party to this proceeding who has challenged the Applicant's seismic analysis of the Skull Valley site, and thus, the State's interests in this matter are not and will not be represented by any other party.

Broadening of Issues or Delay of the Proceeding: The hearings in this proceeding have been deferred from November - December 2001 and because of space

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[8] The State's experts will testify consistent with their declarations. *See* Bartlett Dec ¶ 4 and Ostadan Dec. ¶ 6.

availability occasioned by the February 2002 Olympic Games, the hearings will probably not take place until well after February 2002. At this time, it is unknown whether the admission of Utah's Second Request to Modify Utah QQ will delay the proceedings.

To the extent that litigation of this issue may broaden the proceeding, it is through no fault of the State. PFS continues to created a moving target in an attempt to correct mistakes in response to declarations by the State's experts in previous filings on Utah QQ.

CONCLUSION

The State respectfully requests the Board admit this modified basis to Utah QQ.

DATED this 23rd day of August, 2001.

Respectfully submitted,

Denise Chancellor, Assistant Attorney General
Fred G Nelson, Assistant Attorney General
Connie Nakahara, Special Assistant Attorney General
Diane Curran, Special Assistant Attorney General
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CERTIFICATE OF SERVICE

I hereby certify that a copy of STATE OF UTAH'S SECOND REQUEST TO MODIFY THE BASES OF LATE-FILED CONTENTION UTAH QQ IN RESPONSE TO MORE REVISED CALCULATIONS FROM THE APPLICANT, except Exhibits 3 and 5 which are being served separately as a proprietary filing, was served on the persons listed below by electronic mail (unless otherwise noted) with conforming copies by United States mail first class, this 23rd day of August, 2001:

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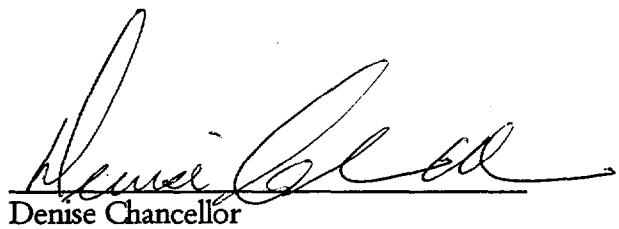


Denise Chancellor
Assistant Attorney General
State of Utah

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket No. 72-22-ISFSI
PRIVATE FUEL STORAGE, LLC (Independent Spent Fuel Storage Installation)	)	ASLBP No. 97-732-02-ISFSI
	)	August 23, 2001

DECLARATION OF DR. STEVEN F. BARTLETT

I, Dr. Steven F. Bartlett, hereby declare under penalty of perjury and pursuant to 28 U.S.C. § 1746, that:

1. I am an Assistant Professor in the Civil and Environmental Engineering Department of the University of Utah, where I teach undergraduate and graduate courses in geotechnical engineering and conduct research. I hold a B.S. degree in Geology from Brigham Young University and a Ph.D. in Civil Engineering from Brigham Young University. I am a licensed professional engineer in the State of Utah.

2. My Declaration in support of State of Utah's Request for Admission of Late-filed Contention Utah QQ (Seismic Stability) (May 16, 2001) was filed on May 16, 2001; and my Declaration in support of State of Utah's Request to Modify the Bases of Late-filed Contention Utah QQ in Response to Further Revised Calculations from the Applicant was filed June 19, 2001. I also prepared a declaration in support of State of Utah's Response to Applicant's Motion for Summary Disposition of Utah Contention L, filed on January 30, 2001. Information about my qualifications can be found in my May 16, 2001 and January 30, 2001 declarations.

3. In addition to the documents described in my previous declarations, I have reviewed the following:
   a. Stability Analyses of Cask Storage Pads, Cal. No. 05996.01-G(B)-04, Revision 9 (Stone & Webster).
   b. Stability Analyses of Canister Transfer Building, Cal. No. 05996.01-G(B)-13, Revision 6 (Stone & Webster).
   c. Holtec letter dated August 8, 2001, related to Holtec's site-specific ISFSI pad evaluation and submitted to NRC by PFS on August 7 as "Commitment

Resolution Letter # 37."

4. I provide this declaration in support of the State of Utah's Second Request to Modify the Bases of Late-filed Contention Utah QQ, which is based on the calculations referenced in ¶ 3 above. If admitted, I am prepared to offer testimony consistent with this declaration.

5. The Applicant's dynamic stability analyses continue to rely on assumed values. In addition, results from the soil cement test program have not been presented in calculations. The calculations for seismic stability of the pads and the Canister Transfer Building ("CTB") are incomplete without these test data results. Moreover, there is a critical omissions in the Applicant's testing program because PFS has no plans to conduct cyclic triaxial or cyclic direct shear testing of the cement-treated soil samples. Only through these types of tests can the behavior of the cement-treated soil be evaluated under the cyclic loading of the design earthquake.

6. PFS states that its testing program will be conducted in compliance with Quality Assurance Category I. Cal. No. G(B)(13), Rev 6 at 11. I disagree with this statement. It appears to me that PFS did not pre-qualify bidders for the soil-cement testing program. *See* Exhibit 3. In addition, I am not aware of any Utah soil testing firms that have had prior experience in performing testing according to the requirements of Quality Assurance Category I.

7. In the Stability Analysis of Cask Storage Pad, Calculation G(B) 04, Rev. 9, the inertial forces due to the soil cement have been incorrectly calculated. Page 8 of the calculation states: "Added inertial forces due to 2-ft thick layer of soil cement beneath pad to sliding stability analysis."

   The horizontal and vertical earthquake inertial forces are recalculated on p. 21 as the weight of the soil cement times peak horizontal and peak vertical ground acceleration, respectively. This is incorrect. Using peak ground acceleration assumes that the soil cement will act as a rigid body. However, the soil cement does not have sufficient stiffness to behave rigidly in either the vertical or horizontal direction under the design earthquake loadings. In fact the design calculations for the cement-treated limit the static modulus of elasticity to 75,000 psi, so that cask damage does not occur during the hypothetical tip over analysis (Calculation G(B) 04, Rev. 9 pp. 15-16). The soil cement is approximately 5 times less rigid then concrete and will behave as a flexible body under the design earthquake loadings.

The incorrect assumption of soil cement rigidity contained in Cal G(B) 04, Rev. 9, p. 21 is similar to other erroneous rigidity assumptions made by PFS in previous dynamic stability calculations. Contention Utah QQ raised the concern that PFS has ignored the effect of the pad and mat foundation flexibility in their proposed foundation design. Flexibility of the pad and soil cement has the consequence of changing the natural frequency of vibration of the foundation system to a frequency different than that of peak ground acceleration (i.e., zero period); hence, the resulting dynamic loads will be different than those used by PFS. The assumption of rigidity can lead to a significant underestimation of the actual dynamic loads. *See* Ostadan Dec. ¶ 14 attached as Exhibit 1 to Utah's Request for Admission of Late-Filed Contention Utah QQ (Seismic Stability).

Because the dynamic loads acting upon the native clayey soil have not been calculated correctly, the Applicant has not demonstrated the adequacy of the proposed foundation design to resist dynamic sliding.

8. The revised dynamic active lateral earth pressure calculated in Cal. G(B) 04, Rev. 9 is incorrect. Page 8 states "Added clarification of approximations used in calculation of K_{AE} and updated calculation of K_{AE} to remove excess conservatism inherent in the previous use of approximations $\sin(\phi-\theta) \approx 0$ and $\cos(\phi-\theta) \approx 1$."

However, the revised calculation of the dynamic active lateral earth pressure is still incorrect, because it fails to recognize the potential for pad-to-pad interaction. This issue was raised in Utah QQ and is still unaddressed in the revised calculation. I endorse Dr. Ostadan's statement in support of Contention Utah QQ:

> While it has been shown that the effect of soil-structure interaction is important in seismic response of the cask-pad-soil cement system, the effect of pad-to-pad interaction only five feet apart in the longitudinal direction has been ignored. In the stability analysis, the passive resistance for one pad will act as a pushing force on the next pad. This interaction has been totally ignored in the evaluation, thus seriously invalidating the conclusion of the stability of the pads.

Utah QQ, Exhibit 1, Ostadan Dec. ¶ 14.

I, therefore, disagree with the value of the dynamic active earth pressure currently used by the Applicant in Cal. G(B) 04, Rev. 9.

9. The simplified Newmark sliding block analysis presented in the revised calculation G(B) 04, Rev. 9 does not meet regulatory requirements. In the revised calculation G(B) 04-9, the Applicant has added a hypothetical case for the sliding stability of the pads where the resistance to sliding is based only on the frictional resistance along the base of the pads and the soil cement and due to passive resistance. The "hypothetical case" calculates factors of safety against dynamic sliding ranging from 0.26 to 1.01 with most cases having safety factors below 0.5. Cal. G(B) 04, Rev. 9 at 37-40. The highest factor of safety of 1.01 was for a single pad case where full passive resistance of the soil was used. Id. at 40.

From these hypothetical analyses the Applicant concludes:

> These values are less than 1.1; therefore assuming the resistance to sliding is provided only by frictional resistance along the base of the row of pads and soil cement + passive resistance available at the edge of the soil cement, the pads might slide due to the design earthquake.

Cal. G(B) 04, Rev. 9 at 42. However, in the same calculation the Applicant suggests that factors of safety below 1.1 and potential sliding are acceptable.

> "Where the factor of safety against sliding is less than 1 due to the design basis ground motion, the displacements the structure may experience are calculated using the method proposed by Newmark (1965) for estimating displacements of dams and embankments during earthquakes. The magnitude of these displacements are evaluated to assess the impact on the performance of the structure."

Id. *quoting* Storage Facility Design Criteria, Section 4.4.2, Stone and Webster, 2000.

I disagree with the approach that deformation analyses can be used to demonstrate the adequacy of a nuclear safety facility. The allowance for factors of safety below 1.1 for extreme events is not consistent with NUREG-75/087, Section 3.8.5, "Foundation," Section II.5, "Structural Acceptance Criteria which states:

> [T]he recommended minimum factor of safety against overturning or sliding failure from static loads (dead load plus maximum live loads) is 1.5 and due to static loads plus loads from extreme environmental conditions, such as the design basis ground motion, is 1.1.

Furthermore, what constitutes acceptable deformation from sliding of the pads has not been calculated or presented by the Applicant in the design criteria.

10. The simplified Newmark (1965) sliding block analysis presented in the revised calculation G(B) 04, Rev. 9 has errors and unconservative assumptions.

First, the vertical earthquake forces are incorrectly calculated. The Applicant has used the peak vertical ground acceleration when calculating N (maximum resistant coefficient). Use of vertical pga assumes rigid behavior. This is an incorrect assumption as discussed by Dr. Ostadan and me during our depositions. *See* Exhibit 4.

Second, the Applicant has not considered unsymmetrical sliding. Newmark (1965) gave solutions for unsymmetrical sliding in the case when the motion takes place with different resistance to sliding in one direction. Unsymmetrical sliding may take place at pads located at the end of the columns or rows and also where there is pad-to-pad interaction. PFS did not consider these cases in their simplified sliding analysis. Newmark (1965) charts show much larger displacements for the case of unsymmetrical sliding.

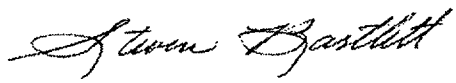
Third, the charts presented in Newmark (1965) have been normalized to pga = 0.5. The design basis earthquake peak ground acceleration is about 0.7 g. The Applicant has not explained the applicability of these charts to the design basis ground motions.

Fourth, Newmark (1965) charts are based on very limited data. The charts were developed from only 4 western U.S. earthquakes. The Applicant has not compared the amplitude, frequency, phasing and velocity pluses in these records to that used for the design basis ground motion at the PFS site. These charts may not be robust enough for design, until these uncertainties are understood and the applicability of these charts to the design basis ground motion.

References

Newmark, N. M. (1965). "Effects of Earthquakes on Dams and Embankments," Fifth Rankine Lecture in Geotechnique Vol. XV, No. 2, June 1965, pp. 139-160.

Executed this 23rd day of August, 2001.

By: 

Steven F. Bartlett, Ph.D., P.E.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket No. 72-22-ISFSI
PRIVATE FUEL STORAGE, LLC (Independent Spent Fuel Storage Installation)	)	ASLBP No. 97-732-02-ISFSI
	)	August 22, 2001

DECLARATION OF DR. FARHANG OSTADAN

I, Dr. Farhang Ostadan, hereby declare under penalty of perjury and pursuant to 28 U.S.C. § 1746, that:

1. I hold a Ph.D. in civil engineering from the University of California at Berkeley. I am a consultant in the field of soil dynamics and geotechnical earthquake engineering. I am also a visiting lecturer at the University of California at Berkeley and teach a graduate course on soil dynamics and soil-structure interaction. My curriculum vitae listing my qualifications, experience, training, and publications has already been filed in this proceeding. *See*, Exhibit No. 2 of the "State's Motion to Compel Applicant to Respond to State's Fifth Set of Discovery Requests" (December 20, 1999).

2. I have more than 20 years experience in dynamic analysis and seismic safety evaluation of above and underground structures and subsurface materials. I co-developed and implemented SASSI, a computer program for seismic soil-structure interaction analysis currently in use by the industry worldwide. I am also the technical sponsor of this program in collaboration with the University of California at Berkeley.

3. I have participated in seismic studies and review of numerous nuclear structures, among them Diablo Canyon Nuclear Station; the NRC/EPRI large scale seismic experiment in Lotung, Taiwan; the large underground circular tunnel for Super Magnetic Energy Storage; General Electric ABWR and SBWR standard nuclear plants; Westinghouse AP600 standard nuclear plant; Tennessee Valley Authority nuclear structures (Browns Ferry, Sequoyah, Watts Bar); and the ITP, RTF, and K-facilities in the Savannah River Site for the Department of Energy. I have published numerous papers in the area of soil structure interaction and seismic design for nuclear and other structures.

4. My Declaration in support of State of Utah's Request for Admission of Late-filed Contention Utah QQ (Seismic Stability) (May 16, 2001) was filed on May 16, 2001. I also prepared a declaration in support of State of Utah's Response to Applicant's Motion for Summary Disposition of Utah Contention L, filed on January 30, 2001.

5. In addition to the documents described in my previous declarations, I have reviewed the following:
   a. Stability Analyses of Cask Storage Pads, Cal. No. 05996.01-G(B)-04, Revision 9 (Stone & Webster).
   b. Stability Analyses of Canister Transfer Building, Cal. No. 05996.01-G(B)-13, Revision 6 (Stone & Webster).
   c. Holtec letter dated August 8, 2001, related to Holtec's site-specific ISFSI pad evaluation and submitted to NRC by PFS on August 7 as "Commitment Resolution Letter # 37."

6. I provide this declaration in support of the State of Utah's Second Request to Modify the Bases of Late-filed Contention Utah QQ, which is based on the calculations referenced in ¶ 5 above. If admitted, I am prepared to offer testimony consistent with this declaration.

7. As a general comment, none of the revised calculations provide any information that addresses the concerns I raised in previous declarations.

8. In the Stability Analyses of Canister Transfer Building, Cal. No. 05996.01-G(B)-13, Revision 6, the designer used soil cement to show additional resistance that is available for the stability of the building without regard to the actual behavior of the soil cement under tensile stresses, separation caused by vibration of the building, and the impact of settlement, as calculated in Cal. G(B)-13, on the integrity of the soil cement around the CTB. Such loading will indeed cause cracking and separation of the soil cement and invalidate the assumptions used by the designer in the stability analyses of the CTB. The concerns I raised in ¶ 13 of my Declaration in support of Utah QQ still apply.

9. The new Holtec calculation is over-simplified and incomplete. The calculation incorporates nonlinear soil springs under the storage pad to allow sliding of the pad and it attempts to show that the casks are still stable even though the pad can slide by as much as six inches. The concerns I expressed in my Declaration ¶ 11(a) through (f) in support of Contention Utah QQ still apply to the revised Holtec calculation.

10. Holtec assumed an idealized and favorable condition to model the sliding of the pad over the soil. It has simply ignored the effect of soil-cement around the pad and the unsymmetric loading that the soil-cement will impart on the pad once pad undergoes sliding movement. The cement treated soil will create an active and a passive side. The cracking and potential crushing of the soil-cement on passive side and separation of the soil cement on the active side due to lack of tensile capacity of soil cement will impart unbalanced forces on the pad and severely impact the stability of the casks on the pads.

11. In my opinion it is clear the Applicant has not formulated a sound design concept that can properly include the real behavior of the cement-treated soil on the seismic response and stability of the cask-pad system. In its calculations, the Applicant ignores or uses cement treated-soil on an as-needed basis.

Executed this 22nd day of August, 2001.

By: _____
Farhang Ostadan, Ph.D., P.E.

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Executed this 22nd day of August, 2001.

By: Farhang Ostadan

Farhang Ostadan, Ph.D., P.E.

COPY OF TRANSCRIPT

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of:	Docket No. 72-22-ISFSI ASLBP No. 97-732-02-ISFSI
PRIVATE FUEL STORAGE, LLC	Deposition of:
(Independent Spent Fuel Storage Installation)	**DR. STEVEN F. BARTLETT** and **DR. FARHANG OSTADAN**
	Vol. II

Friday, November 17, 2000 - 8:40 a.m.

Location: Offices of
Parsons, Behle & Latimer
201 S. Main, #1800
Salt Lake City, Utah

Reporter: Vicky McDaniel, RMR
Notary Public in and for the State of Utah

cask to the pad -- and they used computer program SASSI to do that -- they clearly show that the pad is not rigid. In fact, if you look at the displacement that they summarize in a table in that calculation, that is, ICEC calculation, you see quite a bit of variation.

So therefore, that brings up the concern that the Holtec assumption of pad being rigid is most likely not valid, and perhaps adjustment should be made to those soil springs and dampings they have used assuming pad is rigid.

Q. Again, on this question I'm going to display my ignorance that goes back to my first year of college training in statics and dynamics, and that's all I know. I find it hard to understand how a pad that is 30 by 60 feet has a thickness of several feet can be anything but rigid. Could you explain, I mean, conceptually?

A. (Dr. Ostadan) The thickness is two feet, by the way. "Rigid" is a relative term. It depends what you put on it and what loads comes to it. As I indicated, ICEC using the loads coming from Holtec have shown that once these loads are applied to the pad, the displacements vary, and I recall, more than a factor of two and a half from one corner of the pad to the other. It's clearly an indication that this is not acting in a rigid manner.

Q. So your concern that the pad may not be rigid is based on the results of that CEC calculation?

A. (Dr. Ostadan) That's correct.

A. (Dr. Bartlett) Maybe we should continue the impact, then, down to the soils, because that's ultimately where we need to discuss about how those subsequent calculations affected showing the stability of the soils due to sliding.

Q. Would you like to take off on there?

A. (Dr. Bartlett) We saw then because the pad is not rigid, it has a frequency vibration, and as I recall, it was five to eight hertz, somewhere in that order, which means then peak ground acceleration, which it would be applicable for an infinitely rigid system, that were used in the sliding dynamic bearing capacity calculations is not appropriate for the pad system. That one should go to the response spectrum for the particular frequency vibration of this pad and pick off the appropriate accelerations, which will be higher than those which were used by the applicant.

Q. To see if I have a greater understanding of what you said, is it correct to rephrase it very simplistically as saying that the current soil analysis assumes that there's a single peak ground acceleration and you are requesting or suggesting that if you don't

have a rigid pad, the effect of the lost -- the loss of rigidity or the lack of rigidity would introduce vibrations that need to be accounted for?

A. (Dr. Bartlett) Would introduce higher accelerations and peak ground accelerations. Everything has a natural frequency at which it resonates, and for this case it appears to be five to eight hertz. When you go to what's called a response spectrum, it shows the acceleration versus frequency of resonance, and for this case those would be higher values than peak ground accelerations.

Q. Thank you much. It's a good clarification. Could you -- I'm sorry. I keep interrupting you. You were on item 3, I believe.

A. (Dr. Ostadan) Okay, item three.

Q. (By Mr. Travieso-Diaz) On page 61.

A. (Dr. Ostadan) 61. "The Holtec calculation assumes a range in the coefficient of sliding." Okay, the comment here is, and is still valid, that over time cold bonding may develop within the cask and the pad, and it has not -- cold bonding has not been considered in the design. It has been assumed that when and if a major earthquake takes place, casks will slide on impact.

I think -- let me elaborate a bit on this.