RAS 2771

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI
	)	

APPLICANT'S MOTION TO STRIKE PORTIONS OF STATE OF UTAH'S RESPONSE TO APPLICANT'S MOTION FOR SUMMARY DISPOSITION OF UTAH CONTENTION L

Applicant Private Fuel Storage L.L.C. ("Applicant" or "PFS") hereby moves to strike certain portions of the State of Utah's ("State") "Response to Applicant's Motion for Summary Disposition on Utah Contention L" dated January 30, 2001 ("Response") and supporting materials because they raise issues beyond the scope of the admitted contention. In addition, some of the issues the State raises were the subject of already dismissed contentions, or are separate issues that have been certified to the Commission and are pending before it.[1]

I. BACKGROUND

On April 22, 1998, the Atomic Safety and Licensing Board ("Licensing Board" or "Board") admitted Utah Contention L ("Utah L") into this proceeding. Private Fuel Storage L.L.C. (Independent Spent Fuel Storage Installation), LBP-98-7, 47 NRC 142, 191, 253 (1998). The contention asserts that:

> The Applicant has not demonstrated the suitability of the proposed ISFSI site because the License Application and SAR do not adequately address site and subsur-

[1] Because of their volume, the materials that PFS is moving to strike are identified through overstriking in Appendix A.

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SECY-02

face investigations necessary to determine geologic conditions, potential seismicity, ground motion, soil stability and foundation loading.

The State proffered four bases in support of Utah L.[2] Basis 1 questions the adequacy of PFS's investigation of the facility's site to identify capable faults. Contentions at 80-82. Basis 2 claims that the site could be subject to greater ground motion "due to spatial variations in ground motion amplitude and duration because of near surface traces of potentially capable faults." Id. at 82-83. Basis 3 challenges the adequacy of PFS's investigation of subsurface soil conditions at the site. Id. at 83-92. Basis 4 raises the potential presence of collapsible soils beneath the site. Id. at 92-95.[3]

After discovery was taken by the parties, PFS filed a motion for summary disposition seeking the dismissal of Utah L in its entirety.[4] The State's Response in opposition seeks to defeat the motion by, inter alia, raising issues that are outside the scope of the admitted contention. (Some of the issues have also been previously raised and dismissed by the Board, or are pending before the Commission.) Hence the instant motion to strike.

II. DISCUSSION

A. A Motion to Strike is the Appropriate Vehicle for Dismissing Irrelevant Portions of a Response to a Motion for Summary Disposition

It is well established that a motion to strike is the appropriate means of excluding from the record parts of a response to a motion for summary disposition where such parts contain irrelevant matters. See, e.g., Houston Lighting and Power Co. (Allens Creek Nuclear Generating Station, Unit 1), LBP-81-34, 14 NRC 637, 676-78 (1981); see also 10 C.F.R. §§ 2.718(c) and (e), 2.743(c) (a board has authority to regulate the conduct of the proceeding

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[2] State of Utah's Contentions on the Construction and Operating Licence Application by Private Fuel Storage, LLC for an Independent Fuel Storage Facility, Nov. 23, 1997 ("Contentions") at 80-95.

[3] The State is no longer pursuing Basis 4.

[4] Applicant's Motion for Summary Disposition of Utah Contention L (Dec. 30, 2000) ("Summary Disposition Motion").

and to exclude irrelevant evidence). As discussed below, the Response seeks to raise issues that are outside the scope of Utah L, and which therefore must be stricken.

B. The State Improperly Invokes an Ongoing Geologic Investigation that PFS has not Even Completed

The State argues that summary disposition of Utah L should not be granted because PFS intends to submit new information concerning certain geotechnical issues in March 2001.[5] Two of the State's witnesses assert, in declarations filed with the Response, that the opinions expressed in their depositions regarding geotechnical matters regarding the PFS site have "been reinforced due to PFS's decision that it must perform additional geotechnical and foundation evaluations."[6] However, the geotechnical data that PFS intends to submit to the NRC do not relate to any of the geotechnical issues raised in Utah L and the declarants' reference to the ongoing investigation should be stricken as irrelevant.

The new data to be submitted relate to the shear and pressure wave velocity profiles for the site.[7] Use of the new data may require changes to the Safety Analysis Report and to the Environmental Report,[8] but the new data and the resulting analyses will have no impact on the matters asserted in Utah L.[9] Further, as discussed below, the issues that the State's witnesses claim are related to the new data are in fact outside Utah L's scope.

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[5] Response at 7-8, 16; State of Utah's Statement of Disputed and Relevant Material Facts (Jan. 30, 2001) ("Statement of Disputed Facts") ¶1.

[6] Declaration of Dr. Steven F. Bartlett ("Bartlett Dec.") ¶8; Declaration of Dr. Farhang Ostadan ("Ostadan Dec.") ¶7.

[7] Letter from John D. Parkyn to Mark Delligatti, dated Dec. 22, 2000.

[8] Id.

[9] See Declaration of Dr. Robert Y. Youngs, Att. C to Summary Disposition Motion ("Youngs Dec.") ("Youngs Dec.") ¶¶8, 9. The NRC Staff agrees. See NRC Staff's Response to Applicant's Motion for Summary Disposition of Utah Contention L (Geotechnical)" (Jan. 30, 2001) at 10, n.13 (". . . based on PFS' description of the additional work it intends to perform, the Staff believes that PFS' additional geotechnical work does not relate to the issues raised in Contention Utah L . . . ."); see also, Affidavit of Goodluck I. Ofoegbu, attached to NRC Staff's Response, ¶16.

Since the new data are still in the process of being collected and have not been reported and the results of their use would not be relevant to the issues raised in Utah L, any references to such data[10] for purposes of avoiding summary disposition of Utah L is inappropriate and speculative, and should be stricken.

C. The State Improperly Tries to Expand the Scope of Basis 2

Basis 2 of Utah L is very limited in scope. It alleges one specific deficiency in the determination of ground motion for the site i.e., the failure to take into account spatial variations in ground motion amplitude and duration because of the near surface effects of capable faults, using the methodology of Sommerville et al.[11] The State, however, improperly seeks to avoid summary disposition by raising a host of other matters beyond the scope of Basis 2.

To expand the scope of Basis 2 beyond the application of the Sommerville model, the State first argues that Basis 2 is "framed by the wording of Contention L,"[12] implying that a contention can be read as enlarging the reach of a basis beyond what the text of the basis conveys. This is incorrect.[13] Such an interpretation of the interplay between contentions and bases in Commission proceedings would render the use of bases meaningless.[14]

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[10] See, Response at 7-8; 16; Statement of Disputed Facts ¶1; Declaration of Dr. Walter J. Arabasz ("Arabasz Dec.") ¶7; Ostadan Dec. ¶7, Bartlett Dec. ¶8.

[11] See, Summary Disposition Motion at 9-10.

[12] Response at 11.

[13] It is axiomatic that a contention must be supported by bases that are set out with specificity. 10 CFR § 2.714(b). In admitting Utah L, the Board framed the scope of the contention "as supported by bases establishing a genuine material dispute adequate to warrant further inquiry." LBP-98-7, supra, 47 NRC at 191. The State now inappropriately tries to use the broad language of the contention to expand the bases underlying it. This is impermissible under Commission rules: where a contention is made up of a general allegation which, standing alone, would not be admissible under 10 CFR § 2.714(b), plus one or more alleged bases for the contention set forth with reasonable specificity, the scope of the matters in controversy is limited by the specific alleged bases set forth in the contention. Illinois Power Co. (Clinton Power Station, Unit 1), LBP-81-61, 14 NRC 1735, 1737 (1981).

[14] The purposes of the basis requirements of 10 C.F.R. § 2.714 are "(1) to assure that the contention in question raises a matter appropriate for adjudication in a particular proceeding, (2) to establish a sufficient foundation for the contention to warrant further inquiry into the subject matter addressed by the assertion and, (3) to put the other parties sufficiently on notice 'so that they will know at least generally what they will have to

Footnote continued on next page

Second, the State claims that "Basis 2 consists of two parts," the first relating to the Sommerville model and the second relating to "PFS's failure to adequately assess ground motion in compliance with 10 CFR § 72.102(c)."[15] The so-called second part of Basis 2 is simply its last sentence, which states: "[f]ailure to adequately assess ground motion places undue risk on the public and the environment and fails to comply with 10 CFR § 72.102(c)." However, this sentence relates solely to the consequences of a "[f]ailure to adequately assess ground motion," and does not – as acknowledged by the State's expert witness, Dr. Arabasz – identify any "particular failure" on PFS's part to adequately assess ground motion.[16] The sole inadequacy in PFS's assessment of ground motion identified in Basis 2 is the failure to incorporate near surface effects using the Sommerville methodology. Thus, the State's belated attempt to raise other issues under Basis 2 runs afoul of well established Commission precedent which limits the bounds of a contention to its stated bases.[17]

The specific issues that the State improperly attempts to raise under Basis 2 and which should be stricken include the following:

- In its Response and supporting witness declarations, the State repeatedly asserts that PFS used incorrect values of shear-wave velocity to establish the design basis ground motion (and other design parameters).[18] The State, however, failed to raise any concerns regarding shear-wave velocity data in Utah L and is now trying to make up for its omission by grafting its claims onto Basis 2 (and Basis 3). While Basis 2 deals

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defend against or oppose.'" Vermont Yankee Nuclear Power Corp. (Vermont Yankee Nuclear Power Station), LBP-90-6, 31 NRC 85, 91-92 (1990), footnote and citations omitted.

[15] Response at 12; Statement of Disputed Facts ¶13.

[16] Deposition of Dr. Walter J. Arabasz, Att. E to Summary Disposition Motion ("Arabasz Dep.") at 73-78, 80-81.

[17] Public Service Company of New Hampshire (Seabrook Station, Units 1 and 2), ALAB-899, 28 NRC 93, 97 & n.11 (1988) ("an intervenor 'is bound by the literal terms of its own contention'" and that "[t]he reach of a contention necessarily hinges upon its terms coupled with its stated bases"). See also nn.13 & 14, supra.

[18] Response at 6-7, 13-15, 19-20, 24; Statement of Disputed Facts ¶¶16, 20, 24, 35, 42, 56, 76, 78, 87-88; Arabasz Dec. ¶8; Bartlett Dec. ¶¶10, 17; Ostadan Dec. ¶¶9-13.

with the subject of seismic ground motion, it makes no mention of shear-wave velocity, focusing only on the Sommerville model for addressing near surface effects.[19]

- The State also argues in its Response and supporting witness declarations that PFS did not conduct "a fully deterministic seismic hazard analysis that meets the deterministic requirements of 10 CFR Part 100 Appendix A."[20] Again no mention of these alleged deficiencies is found in Basis 2 or elsewhere in Utah L.

- In its Statement of Disputed Facts, the State asserts that PFS did not determine the depth to bedrock as needed to calculate the design basis ground motion,[21] which is likewise not mentioned in Basis 2 or elsewhere in Utah L.

- Finally, the State makes reference in its Response and supporting documents to its November 9, 2000, "Request for Admission of Late-Filed Modification to Basis 2 of Utah Contention L," in which it challenges the Staff's grant of Applicant's exemption request to perform a probabilistic seismic hazard evaluation using a 2,000-year return period earthquake. On January 31, 2001, the Board certified to the Commission, pursuant to 10 C.F.R. § 2.718(i), whether the State's November 9, 2000 contention should be subject to further litigation in this proceeding,[22] and Commission action is pending. Clearly, the State's proposed contention is a separate issue, not part of Utah L. Thus, as noted above, all claims that the proposed new contention provides a rationale for denying summary disposition of Utah L are inappropriate and should be stricken.[23]

D. The State Tries to Expand the Scope of Basis 3 by Raising Irrelevant Design Issues

The State raises in its Response a number of issues under Basis 3 regarding the seismic analysis and design of foundations. All of these issues are, however, outside the scope

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[19] Similarly, Basis 3, which as discussed further below addresses the characterization of subsurface soils, also has nothing to do with shear-wave velocity. The only place in Basis 3 where shear wave data is mentioned is in a discussion of the importance of conducting dynamic testing of in situ samples in a stress or strain controlled manner, because "[t]hese data [from dynamic testing] are essential in order to correlate with the field seismic profiling (shear wave determination) for use in the analysis of the seismic response of buildings and their contents, and to determine the potential for soil collapse." Contentions at 86. Clearly, the focus of the discussion on Basis 3 is not on the collection or use of shear wave data, but the ability to correlate dynamic soil test results with such data.

[20] Response at 12; Statement of Disputed Facts ¶¶14; Arabasz Dec. ¶7.

[21] Statement of Disputed Facts ¶56.

[22] Memorandum and Order (Rulings on Admissibility of Late-Filed Modification of Contention Utah L, Geotechnical, Basis 2; Referring Rulings and Certifying Question Regarding Admissibility), LBP-01-3 (January 31, 2001), slip op. at 22.

[23] See n. 10, supra.

of Basis 3, which concerns the correct characterization and determination of soil properties. In addition, some of the issues have already been dismissed from this proceeding, but the State is attempting to "sneak them in" through the Utah L backdoor.

1. The State's Attempt to Include in Utah L Contentions on Canister Transfer Building, Cask and Pad Stability and Holtec's Calculations has Already been Rejected with Respect to Contentions EE and GG

On December 23, 1997, the State filed a "Request for Consideration of Late-Filed Contentions EE and FF" ("EE Request"). Proposed Contention EE asserted that "[t]he Applicant has failed to demonstrate that storage casks and pads will remain stable during a seismic event."[24] The basis for Contention EE was an attack on Holtec's cask stability analysis, wherein the State asserted that the "Holtec analysis is inadequate to support the safety of the Applicant's proposed design during a seismic event at the PFS facility."[25] The State went on to list a series of alleged deficiencies in the Holtec analysis, including assertions that the analysis oversimplifies the behavior of dynamic loads, uses improper seismic time histories, rests on a faulty assumption that the concrete pad will remain rigid, and others.[26] The Board rejected as untimely the State's request to introduce Contention EE.[27]

By filing Contentions EE and GG separately as late-filed contentions, the State implicitly acknowledged that the issues raised in them were outside the scope of Utah L, which

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[24] EE Request at 4. On January 8, 1998, the State also filed a "Request for Consideration of Late-Filed Contention GG" ("GG Request"). Contention GG largely paralleled Contention EE, but addressed the seismic stability of the TransStor casks, similarly contending, "[t]he Applicant has failed to demonstrate that the TranStor storage casks and the pads will remain stable during a seismic event . . . ." GG Request at 4.

[25] EE Request at 5.

[26] EE Request at 5-12.

[27] LBP-98-7, supra, 47 NRC at 207-09. While not needing to rule on the merits of Contention EE because of its untimeliness, the Board noted that most of the issues raised in Contention EE (which are essentially the same as those raised in the Response with respect to the Holtec analysis) would have been inadmissible on the merits, had they been timely raised. Id. at 209, n. 25. Likewise, the Board rejected the request to introduce most of Contention GG. Id. at 210-11.

the State had submitted previously. Yet, having had these contentions dismissed, the State now tries to resurrect the claims it sought to advance in them by portraying the claims as issues relating to the soils investigation, rather than attacks on Holtec's analyses and design. The State and its witnesses repeat exactly the same criticisms of the Holtec analyses and design that were dismissed when raised in Utah EE;[28] the arguments made in the Response, as well as in the declarations of State witnesses Ostadan and Bartlett,[29] are taken directly from Utah EE.[30] Indeed, a simple comparison of Contention EE and the State's Response shows that the issues now asserted by the State and its witnesses in opposing summary disposition of Utah L were raised and dismissed in Utah EE. Therefore, the State's references to these already rejected issues[31] are improper and should be stricken.

2. The State Seeks to Raise Many Out-of-Scope Issues

In its Response and supporting witness declarations, the State attempts to insert into Basis 3 issues having nothing to do with the subject of Basis 3, i.e., the "characterization of subsurface soils," specifically "a. subsurface investigations," "b. sampling and analysis," and "c. physical property testing for engineering analysis."[32] The new allegations are in fact de-

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[28] For example, while the State tries to portray its discussion of cask and pad stability as PFS "inaccurately or inadequately characteriz[ing] the basis for the selection of samples or conducted relevant tests to determine the soil's physical characteristics due to anticipated loading or the duration of loading during a seismic event," (Response at 26) this prefatory language is immediately followed by its real goal – reviving the State's attack on Holtec's analysis – "The Holtec calculation . . . creates numerous and significant concerns that affect the entire design package." Id. at 27.

[29] Response at 18-19, 23-27; Ostadan Dec. ¶¶21-26; Bartlett Dec. ¶21.

[30] For example, witness Ostadan opines that "Holtec also incorrectly assumed that the pad is rigid" (Ostadan Dec. ¶ 24), echoing the State's contention basis that "[a]nother unreasonable and oversimplified assumption by Holtec is that . . . [the] concrete pad will remain rigid" (EE Request at 8). Similarly, Ostadan asserts, "Holtec's nonlinear analysis may be sensitive to phasing of the input motion and thus multiple time histories should be used" (Ostadan Dec. ¶22), which is a condensed version of Contention EE's basis that "one cannot tell from the Holtec Seismic Report whether the interaction of the three independent components of the seismic time histories has been properly and conservatively evaluated" (EE Request at 7).

[31] Statement of Disputed Facts ¶¶90-92, 94-95; Ostadan Dec. ¶¶20-29; Bartlett Dec. ¶ 21.

[32] Contentions at 83-92.

sign contentions well outside the scope of Utah L. They relate to how structures at the PFS facility (the storage casks, the cask foundation pads, and the Canister Transfer Building ("CTB") foundation) will behave in the presence of earthquake-induced forces. The soil parameters which are the subject of Basis 3 provide inputs into the computation of the earthquake forces acting on these structures, but the sufficiency of the design to meet earthquake forces is a wholly separate issue which is outside the scope of Utah L.[33]

The improperly raised new issues include:

a. The nature of the stresses imparted by earthquake waves on the soil-cement mat beneath the cask storage pads[34]

b. The possibility and effect of cracks forming on soil cement[35]

c. The distribution of shear stresses on soil cement mat foundations[36]

d. The pad foundation sliding analysis and the ability of the shear key around the CTB to develop resisting forces against sliding[37]

e. The alleged failure by PFS to integrate the geotechnical analyses and designs by various disciplines[38]

f. The effects of "cold bonding", "fling", and "incline waves" on the foundations[39]

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[33] The following statements from the Declaration of Dr. Ostadan exemplify the type of issue that the State is seeking to raise: "Holtec has a very bold philosophy that the cask will side [sic] on the pad in a controlled manner during a large earthquake. There is no other redundancy built into Holtec's expected design. But such a bold assumption is negated by the potential that cold bonding between the cask and the pad may occur over time. When two bodies (casks and pad) with each cask having a weight of approximately 350 kips are in contact, some local deformation and redistribution of stresses may occur at the points of contact which would create a bond, and this would not allow the cask to slide on the pad or move smoothly during an earthquake. Thus, Holtec's assumption that sliding will reduce the seismic forces is incorrect. In this instance, the seismic loads would be greater than assumed and it is questionable whether the soils beneath the pad will have the capacity to sustain that additional load. Bartlett & Ostadan Tr. 365-368, 370." Ostadan Dec. ¶26. Clearly, the State is attempting to entangle the litigation of whether the properties of the subsurface soils have been adequately determined (the subject of Basis 3) with a host of issues going to whether the seismic loads imparted on structures and their foundations are properly accounted for in the design.

[34] Response at 18; Statement of Disputed Facts ¶62; Bartlett Dec. ¶¶22-23.

[35] Response at 20; Statement of Disputed Facts ¶¶63, 64; Bartlett Dec. ¶¶22-24.

[36] Statement of Disputed Facts ¶64; Bartlett Dec. ¶22.

[37] Statement of Disputed Facts ¶77; Ostadan Dec. ¶28.

[38] Response at 23; Statement of Disputed Facts ¶84, Ostadan Dec. ¶8, 19-20.

g. The seismic response of structures important to safety[40]

h. Holtec's analysis of the pad-cask system[41]

i. The "bold" nature of the Holtec cask design, and its lack of "redundancy"[42]

j. The parameters used in performing the foundation loading stability analyses[43]

k. The number of time histories and other aspects of the soil-structure interaction analyses[44]

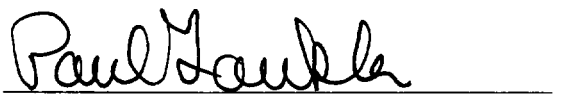
l. The assumptions used in analyzing the potential overturning of the CTB.[45]

These allegations are clearly directed at the analysis and design of the site's structures, not at the properties of the soils. They are not found in Basis 3. Accordingly, they are outside the scope of Utah L and should be stricken from the Response and its supporting materials.

III. CONCLUSION

For the foregoing reasons, PFS respectfully requests the Board to strike the specified matters raised by the State in its Response as improper.

Respectfully submitted,



Jay E. Silberg
Ernest L. Blake, Jr.
Paul A. Gaukler
Matias F. Travieso-Diaz
SHAW PITTMAN
2300 N Street, N.W.
Washington, DC 20037
Counsel for Private Fuel Storage L.L.C.

Dated: February 9, 2001

[39] Response at 19, 23, 26; Statement of Disputed Facts ¶¶85, 92, 94; Ostadan Dec. ¶¶17, 19, 22; Bartlett Dec. ¶21.

[40] Statement of Disputed Facts ¶86; Bartlett Dec. ¶¶20-22.

[41] Response at 18-19, 25-26; Statement of Disputed Facts ¶¶90-94; Ostadan Dec. ¶¶21-27.

[42] Response at 18, 26; Statement of Disputed Facts ¶92; Ostadan Dec. ¶26.

[43] Response at 23-26; Statement of Disputed Facts ¶93; Ostadan Dec. ¶¶23-27.

[44] Response at 25-26; Statement of Disputed Facts ¶¶35, 94; Ostadan Dec. ¶¶17-18.

[45] Response at 27; Statement of Disputed Facts ¶95; Ostadan Dec. ¶¶28, 29.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

CERTIFICATE OF SERVICE

I hereby certify that copies of "Applicant's Motion to Strike Portions of State of Utah's Response to Applicant's Motion for Summary Disposition of Utah Contention L" were served on the persons listed below (unless otherwise noted) by e-mail with conforming copies by U.S. mail, first class, postage prepaid, this 9th day of February 2001.

G. Paul Bollwerk III, Esq., Chairman Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: GPB@nrc.gov

Dr. Jerry R. Kline
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: JRK2@nrc.gov and kjerry@erols.com

Dr. Peter S. Lam
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: PSL@nrc.gov

[☒] Susan F. Shankman
Deputy Director, Licensing & Inspection
Directorate, Spent Fuel Project Office
Office of Nuclear Material Safety & Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

[☒] By U.S. mail only.

Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Attention: Rulemakings and Adjudications Staff
e-mail: hearingdocket@nrc.gov
(Original and two copies)

✉ Adjudicatory File
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Catherine L. Marco, Esq.
Sherwin E. Turk, Esq.
Office of the General Counsel
Mail Stop O-15 B18
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
e-mail: pfscase@nrc.gov

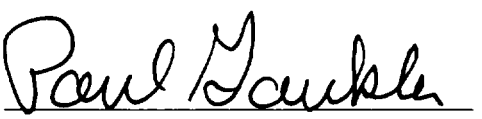
Denise Chancellor, Esq.
Assistant Attorney General
Utah Attorney General's Office
160 East 300 South, 5th Floor
P.O. Box 140873
Salt Lake City, Utah 84114-0873
e-mail: dchancel@state.UT.US

John Paul Kennedy, Sr., Esq.
Confederated Tribes of the Goshute Reservation and David Pete
1385 Yale Avenue
Salt Lake City, Utah 84105
e-mail: john@kennedys.org

Joro Walker, Esq.
Land and Water Fund of the Rockies
2056 East 3300 South, Suite 1
Salt Lake City, UT 84109
e-mail: joro61@inconnect.com

Diane Curran, Esq.
Harmon, Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street, N.W., Suite 600
Washington, D.C. 20036
e-mail: dcurran@harmoncurran.com

Danny Quintana, Esq.
Skull Valley Band of Goshute Indians
Danny Quintana & Associates, P.C.
50 West Broadway, Fourth Floor
Salt Lake City, Utah 84101
e-mail: quintana@xmission.com



Paul A. Gaukler

✉ By U.S. mail only.

APPENDIX A

State of Utah Summary Disposition Response, Statement of Material Facts, and Declarations of Arabasz, Bartlett and Ostadan with Overstriking of Material Subject to PFS Motion to Strike

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
	)	January 30, 2001

STATE OF UTAH'S RESPONSE TO APPLICANT'S MOTION FOR SUMMARY DISPOSITION OF UTAH CONTENTION L

Pursuant to the Licensing Board's Order of January 4, 2001 and 10 CFR § 2.749, the State responds to the Applicant's December 30, 2000 Motion for Summary Disposition of Utah Contention L. This response also includes the State of Utah's Statement of Disputed and Relevant Material Facts ("Material Facts"), and is supported by the Declarations of Dr. M. Lee Allison, Dr. Walter J. Arabasz, Dr. Steven Bartlett, and Dr. Farhang Ostadan, attached hereto as exhibits 1-4, respectively.

Applicant's Motion for Summary Disposition is not warranted because there are still genuine issues of material fact relevant to the contention, and under 10 CFR § 2.749 the Applicant is not entitled to summary disposition as a matter of law.

Background

The Board admitted Contention Utah L[1] in its entirety. Contention L generally asserts "[t]he Applicant has not demonstrated the suitability of the proposed ISFSI site because the License Application and SAR do not adequately address site and subsurface investigations necessary to determine geologic conditions, potential seismicity, ground motion, soil stability and foundation loading." State's Contentions on the Construction and Operating License Application by Private Fuel Storage, LLC for an Independent Spent Fuel Storage Facility (November 23, 1997) ("State's Contentions") at 80.

Utah L and its bases are founded on 10 CFR Part 72, including the requirement to analyze seismicity using deterministic methodology, as required by 10 CFR Part 100, Appendix A. Most of the procedural background relating to Contention Utah L involves PFS's request to be exempted from complying with Part 72 and Part 100 Appendix A.

On April 2, 1999, the Applicant applied for an exemption from the requirements of 10 CFR § 72.102(f)(1), requesting approval to conduct a probabilistic seismic hazard analysis instead of a deterministic analysis as required by Part 72.[2] In

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[1] Contention Utah L and its bases were admitted in their entirety by the Licensing Board in LBP-98-7, 47 NRC 142, 191, 253, *aff'd on other grounds,* CLI-98-13, 48 NRC 26 (1998).

[2] Request for Exemption to 10 CFR 72.102(f)(1), Seismic Design Requirement, Docket No. 72-22/Tac No. L22462, Private Fuel Storage, Private Fuel Storage L.L.C, addressed to Mark Delligatti at NRC's Spent Fuel Project Office.

response to the Applicant's exemption request, the State made three attempts to amend Utah L by modifying Basis 2 to require either the use of a probabilistic seismic hazard analysis with a return period of 10,000 years as required by NRC's Rulemaking Plan, SECY-98-126,[3] or compliance with the deterministic approach currently required by 10 CFR 72.102(f)(1). The State's first two attempts, one[4] filed after PFS's exemption request, and the other[5] filed after the Staff issued its first Safety Evaluation Report ("SER") (December 15, 1999), were dismissed by the Board as not being ripe because the Board held that the State must wait until the Staff officially made its decision whether to grant the exemption request.[6] The State filed its third request to modify Basis 2 on November 9, 2000[7] after the Staff had issued its final SER (October 6, 2000). The State also requested that the Board certify the question to the Commission if the Board finds it does not have jurisdiction over PFS's exemption request. State's 3rd

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[3] "Rulemaking Plan: Geological and Seismological Characteristics for Siting and Design of Dry Cask Independent Spent Fuel Storage Installations, 10 CFR Part 72," SECY-98-126 ("Rulemaking Plan").

[4] *See* State's Motion Requiring Applicant to Apply for Rule Waiver Under 10 CFR § 2.758(b) or in the Alternative Amendment to Utah Contention L (April 30, 1999).

[5] *See* State's Request for Admission of Late-filed Modification to Basis 2 of Contention Utah L (January 26, 2000).

[6] *See* LBP-99-21, 49 NRC 431 (1999) (the Board also denied State's motion requiring PFS to apply for the rule waiver); and LBP-00-15, 51 NRC 313 (2000).

[7] *See* State's Request for Admission of Late-filed Modification to Basis 2 of Contention Utah L (November 9, 2000) ("State's 3rd Utah L Modification Request").

Utah L Modification Request at 5-6. The Board has not yet ruled on the State's request.

LEGAL STANDARD

Pursuant to 10 CFR § 2.749, a party is entitled to summary disposition if "there is no genuine issue as to any material fact" and the party "is entitled to a decision as a matter of law." Id. at (d). The burden of proving entitlement to summary disposition is on the movant.[8] Because the burden of proof is on the proponent, "the evidence submitted must be construed in favor of the party in opposition thereto, who receives the benefit of any favorable inferences that can be drawn."[9] Furthermore, if there is any possibility that a litigable issue of fact exists or any doubt as to whether the parties should be permitted or required to proceed further, the motion must be denied.[10] Summary judgment may also be denied or continued if the opposing party demonstrates in its affidavits that it cannot present facts essential to justify its opposition.[11]

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[8] Advanced Medical Systems, Inc. (One Factory Row, Geneva, Ohio 44041), CLI-93-22, 38 NRC 98, 102 (1993).

[9] Sequoyah Fuels Corp. and General Atomics Corp. (Gore, Oklahoma Site Decontamination and Decommissioning Funding), LBP-94-17, 39 NRC 359, 361, *aff'd* CLI-94-11, 40 NRC 55 (1994).

[10] General Electric Co. (GE Morris Operation Spent Fuel Storage Facility), LBP-82-14, 15 NRC 530, 532 (1982).

[11] 10 C.F.R. § 27.49(c); Long Island Lighting Co. (Shoreham Nuclear Power Station, Unit 1), CLI-86-11, 23 NRC 577 (1986). *See also* Cleveland Electric

ARGUMENT

I. The PFS ISFSI Site Is One of Great Geologic Complexity and PFS Has Not Conducted an Integrated and Unified Approach to Its Geologic Investigation and Analysis of the Site.

The PFS site is one of great geologic complexity. The site lies within the western boundary of the Intermountain Seismic Belt (ER (Rev. 5) 2-6.23); it is approximately nine km west the Stansbury fault, an acknowledged capable fault (Coppersmith Dec. ¶¶ 3 & 13) that dips to the west and is projected beneath the PFS site. ER (Revs. 2&4) at 2.6-1 and -2. During its 1998 site investigation, PFS's contractor, Geomatrix, discovered two formerly unknown capable faults, informally named the East Fault (.09 km east of the site) and the West Fault (2 km west of the site). Id. at 2.6-2. In addition, there are other seismogenic faults in the Skull Valley region, notable the Springline Fault to the north and the East Cedar Mountain Fault to the west. Coppersmith Dec. ¶ 13.

PFS's initial investigation of the site in 1996 was very preliminary. PFS conducted approximately 24 borings in the pad emplacement area and access road and PFS's contractor, Geosphere, did some seismic refraction and reflection work. ER at

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Illuminating Co (Perry Nuclear Power Plant, Units 1 and 2) ALAB-443, 6 NRC 741, 755 (1977): "[S]ummary disposition is a harsh remedy. It deprives the opposing litigant of the right to cross-examine the witness, which is perhaps at the very essence of an adjudicatory hearing. In such circumstances – even in administrative proceedings where the rules of evidence may be relaxed – it is important that a movant for summary disposition be required to hew strictly to the line set out by our Rules of Practice."

2.6-9 (Rev. 2) and 12 (Rev. 7). Another contractor, Geomatrix Consultants, Inc., conducted a more detailed geotechnical investigation in 1998. In reviewing Geosphere's work, Geomatrix expressed concerns about the resolution of the seismic survey and associated uncertainties with respect to the depth to bedrock and the shear wave velocity profile beneath the site. *See* letter from Kevin Coppersmith, Geomatrix, to John Donnell, Stone & Webster (February 20, 1997), attached hereto as Exhibit 5.

Geomatrix claims that its geologic investigation of the PFS site was "comprehensive and integrated." *See* Coppersmith Dec. ¶¶ 7, 8-10. But it was neither, and as a result, the site has not been adequately characterized. ~~For example, from the Geosphere seismic refraction data, PFS assumed an average velocity in the soil profile to be 750 ft/sec. In 1999, PFS (through yet another contractor, Cone Tec) conducted seismic cone penetration tests ("SCPT") at the site. The SCPT data contradicts the seismic refraction data because it shows a velocity profile in the uppermost soil layer to be approximately 540 ft/sec. *See* SAR Fig. 2.6-28. Yet, Geomatrix and other PFS contractors have used the higher velocity data as input to their seismic analysis of the site and have ignored the lower SCPT velocity data. By ignoring the difference in velocity data, PFS's contractors have inadequately and inappropriately analyzed the seismic conditions at the PFS site. *See* Section V below. The State's experts, Dr. Steven Bartlett and Dr. Farhang Ostadan testified about these issues in detail during their November 2000 depositions. *See* Bartlett & Ostadan Tr., attached hereto as~~

~~Exhibit 6, Ostadan Dec. ¶¶ 12-13, Bartlett Dec. ¶ 17.~~

~~A seismic investigation is usually phased, and each subsequent phase tries to resolve issues from the preceding phase. Bartlett & Ostadan Tr. 92. PFS's approach, however, has been to isolate each study by discipline without adequate mechanisms or procedures in place to share and use data consistently across disciplines. *See e.g.*, Trudeau & Chang Tr., attached hereto as Exhibit 7, at 145-198. This led to a non-comprehensive and non-integrated study of the site.~~ At times PFS appears to have conducted work merely to satisfy questions raised by NRC without evaluating how that work fitted into the overall investigation. In the subsurface investigation, for example, the borings conducted in 1998 were PFS's lead investigative tool. When PFS conducted its SCPT test, it appeared to be in response to questions from NRC instead of being part of a comprehensive and integrated study.[12]

~~At last, PFS seems to have recognized it has not conducted a "comprehensive and integrated" seismic investigation. On December 11, 2000, PFS advised the NRC that test data previously collected at the PFS site "may not have been fully integrated into the geotechnical assessment of the site." Letter from John Parkyn, PFS, to Mark Delligatti, NRC (December 11, 2000), attached hereto as Exhibit 8. PFS submitted to NRC a follow-up letter on December 22, 2000, advising that the omitted data "will~~

[12] Testifying about the SCPT data, Dr. Bartlett stated: "I'm not sure I get a sense in reading the documents why some things were being done and why they were doing additional borings and investigations, other than just to satisfy a few questions from the NRC." Bartlett & Ostadan Tr. 92.

~~have an impact to the project licensing basis" and require a license amendment to reflect "changes in the PFS [facility] design basis ground motion and dynamic stability analyses based on new shear and pressure wave velocity profiles being developed for the site." Letter from John Parkyn to Mark Delligatti (December 22, 2000), attached hereto as Exhibit 9.~~

~~NRC Staff recognized the importance to safety of PFS's proposed additional analyses relating to the geophysical characterization of the site. The NRC has advised PFS that PFS's proposed amendment to its SAR will delay NRC's issuance of the final Environmental Impact Statement and will necessitate additional documentation of NRC's safety conclusions reached in the SER or a supplement to the SER. Letter from E. William Brach, NRC, to John Parkyn (January 19, 2000), attached hereto as Exhibit 10. As discussed in the following sections, the new analysis being conducted by PFS has a significant and direct impact on Contention L.~~

II. PFS Has Not Conducted Its Surface Faulting Study in a Comprehensive or Integrated Manner, Thereby Creating Gaps in the Data and Unreliable Interpretative Results.

The State has designated experts for various portions of Contention L. Dr. Allison is the State's expert for Basis 1 (seismic reflection and capable faults); Dr. Arabasz for Basis 2 (seismic hazard analysis); and Drs. Bartlett (geotechnical and soils analysis) and Ostadan (soils and soil structure interaction) for Basis 3.[13] Each is

[13] *See* State's Objections and Response to Applicant's Second Set of Discovery Requests with respect to Groups II and III Contentions (June 28, 1999) at 7; Objections

eminently qualified to testify as an expert on the matters that are the subject of their respective declarations, each with extensive experience and education on those matters. *See* Allison Dec. ¶¶ 1-3, Arabasz Dec. ¶ 1, Bartlett Dec. ¶¶ 1-3, and Ostadon Dec. ¶¶ 1-4.

PFS attempts to paint the State's experts with too broad a brush by suggesting that any unresolved issues in Contention L are based on subjective belief or unsupported supposition. PFS Motion at 3-4. As support for this statement, which attempts to impugn all the State's experts, PFS cites to the Coppersmith Declaration ¶¶ 27-31, 46. The cited declaration, however, relates only to certain issues raised by Dr. Allison. It has no relationship whatsoever to any of the other three State experts. Moreover, PFS's disagreement with Dr. Allison's conclusions are not grounds for disqualifying him as an expert. The Supreme Court has dismissed concerns about the new, more lenient Federal Rule of Evidence 702 resulting in admission of faulty science by noting that "[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence." Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S 579, 596 (1993). As the Fifth Circuit has noted, "the trial court's role as gatekeeper is not intended to serve as a replacement for the adversary system." U.S. v. 14.38 Acres of Land Situated in Leflore County, Missisipi, 80 F.3d 1074, 1078 (5th Cir.

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and Responses to Applicant's Fourth Set of Discovery Requests to Intervenors State of Utah and Confederated Tribes (Jan. 31, 2000) at 4.

1996).

Furthermore, PFS inappropriately tries to claim the expertise of State's witness, Dr. Arabasz, as a proponent that PFS has satisfied Contention L, Basis 1.[14] In an attempt to shore up the surface faulting aspect of Geomatrix's study, PFS claims that Dr. Arabasz has endorsed Geomatrix's work. *See e.g.*, PFS Motion at 6-8. During his deposition, however, Dr Arabasz testified that his careful review of the Geomatrix report was restricted to vibratory ground motion hazard and that his familiarity with Basis 1 is cursory. Arabasz Tr., excerpts attached hereto as Exhibit 11, at 34-36[15]; PFS Exh. E at 96-97, and 109. Further, Dr. Arabasz testified that he has expertise relevant to surface faulting, but that aspect of Contention L had been assigned to Dr. Allison and he deferred the issue to him. Exh. 11 (Arabasz Tr.) at 35.

PFS's claims that it has used an integrated approach to evaluate both the vibratory ground motion and surface fault displacement are wrong. PFS Material Facts ¶ 4. PFS has not used the soil velocity data obtained from seismic cone penetration tests in order to convert the seismic reflection data to show depth of marker beds, such as the Promontory soil and key geologic horizons within the Lake Bonneville

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[14] PFS's attempt to rely on Dr. Arabasz's expertise directly contradicts PFS's broad, generalized and unsupported claim that the opinions of the State's technical experts are not based on reasoned scientific or technical judgment. PFS's wants to have it both ways: confer expert status on the State's witnesses when they agree with PFS's position but disrepute them when they challenge PFS's position.

[15] PFS Exhibit E contains excerpts from Dr. Arabasz's deposition, including pages 4 through 33, and 37 through 45 but Exhibit E does not include pages 34-36.

sequence. Allison Dec. ¶ 7.

PFS's approach has not been comprehensive. PFS asserts that because the structural grain of the valley appears to run northwest, geological structure of other orientations do not need to be determined or investigated. But PFS has ignored the east-west Pass Canyon and the topographic embayment at the east-west trending Rydalch Pass, which are anomalies to the assertions that the structural grain of the valley runs northwest. Allison Dec. ¶ 8.

In another failure to integrate its approach, Geomatrix collected no seismic tie line to correlate the PFS 1998 lines among themselves or with the Geosphere and GSI lines. All of the PFS 1998 lines were shot in an east-west direction; without any perpendicular lines to tie into those east-west lines, Geomatrix's interpretation of the data is unreliable. Nor are the placement and number of seismic lines adequate to determine the length of the East or West faults. Allison Dec. ¶ 9.

III. PFS Has Not Satisfied the Concerns Raised by the State in Basis 2.

PFS considers Basis 2 to be restricted to whether or not PFS employed the Sommerville methodology in its seismic hazard analysis and has threatened to file a motion to strike if the State attempts to raise any other issue under Basis 2. PFS Motion at 9-10 and 10 n. 16.

PFS's reading of Basis 2 is too simplistic. Basis 2 is framed by the wording of Contention L: "The Applicant has not demonstrated the suitability of the proposed

ISFSI site because the License Application and SAR do not adequately address site and subsurface investigations necessary to determine geologic conditions, potential seismicity, ground motion, soil stability and foundation loading." State's Contentions (November 23, 1997) at 80 (*emphasis added*). Basis 2 consists of two parts. The first part relates to the site being subject to ground motions greater than those anticipated due to spatial variation in ground motion amplitude and duration because of near surface traces of potentially capable faults, and the statement is supported by a citation to Sommerville, et al. ~~The second part relates to PFS's failure to adequately assess ground motion in compliance with 10 CFR § 72.102(c). Section 102(c) requires sites, such as the PFS site, to be evaluated for "soil instability due to vibratory ground motion." For sites west of the Rocky Mountain Front, the Applicant must evaluate vibratory ground motion by conducting a deterministic seismic hazard analysis in accordance with Part 100, Appendix A. 10 CFR § 72.102(f)(1). Thus, Basis 2 relates to whether or not PFS has conducted an adequate deterministic seismic hazard analysis.~~

~~PFS has not conducted a fully deterministic seismic hazard analysis that meets the deterministic requirements of 10 CFR Part 100 Appendix A. *See* Staff's Objections and Responses to the "State of Utah's Sixth Set of Discovery Requests Directed to the NRC Staff (Utah Contention L)" (February 14, 2000), Response to Requests for Admissions 1 and 2 at 7-8. *See also* State's Material Facts ¶¶ 13-14.~~

~~The Board should uphold this portion of the State's contention because PFS's~~

~~vibratory ground motion analysis is not in compliance with current Part 72 regulations.~~

For the Board to find that PFS is nonetheless entitled to prevail because the Staff intends to grant PFS an exemption from the deterministic seismic hazard analysis requirements, the Board must find that it has jurisdiction to consider the exemption request. The State finds itself in a procedurally impossible position. The State can show that PFS does not meet the Part 72 deterministic seismic hazard analysis requirements but that is not the standard that will eventually apply to the PFS. The State has attempted to amend Basis 2 on three separate three occasions to address PFS's exemption from Part 72. After the first two attempts, the State was told that it was too early. *See* Background above. The third attempt is still pending before the Board.

As discussed in the following section, PFS's seismic hazard analysis, under any NRC regulatory standard, is inadequate because it does not evaluate conflicting shear wave velocity data in the uppermost soil layer.

IV. PFS's Present Failure to Account for Conflicting Data and Future Revision to Its Design Basis Ground Motion Has Such a Direct and Significant Impact on Basis 2 and Basis 3 that the Board Should Deny PFS's Motion for Summary Disposition.

~~Regardless of whether PFS is required to conduct a deterministic or probabilistic seismic hazard analysis, PFS's seismic hazard analysis is inadequate because it does not evaluate conflicting shear wave velocity data in the uppermost soil layer. *See* Arabasz Dec. ¶ 8; Ostadan Dec. ¶ 9. Geomatrix relied on shear wave~~

velocities of approximately 750 feet per second obtained from the 1996 seismic refraction data. Ostadan Dec. ¶ 9. Later seismic cone penetration testing data show that the mean shear wave velocities in the shallow soil layer are approximately 540 feet per second. Id.

Once the seismic input or design basis ground motion has been developed based on seismicity and geologic conditions at the site, engineers take that motion and apply it in their analysis; the engineer must decide at which point in the soil profile this motion should be introduced (*i.e.* the control point). If the soil profile has a thin soft layer, the design motion should be specified at the top of the competent material at a point just below the soft layer. Ostadan Dec. ¶ 10. Once the proper control point is established, the engineer must then evaluate the effect of the ground motion on the soil profile above the control point. There is, thus, a disciplinary interface between where the seismologist's analysis ends and the engineer's begins.

The State's experts have testified that there are two ways that PFS could correct its failure to evaluate the incompatible soil velocity data. Either Geomatrix could re-analyze its calculations to account for the conflicting data or PFS could introduce the ground motions that Geomatrix developed by putting it in the soil column where the shear wave velocity of 750 ft/sec was measured. Ostadan Dec. ¶ 11. PFS has done neither. Failure to perform these re-evaluations makes the surface design basis ground motion uncertain and the correct seismic loadings imparted to the shallow soil profile

~~and the foundations undefined.~~

~~The State's seismologist, Dr. Arabasz, agrees that the point at which the developed ground motion should be introduced in the soil profile at the PFS site is an engineering decision and he has deferred the issue to Dr. Ostadan. Arabasz Dec. ¶ 8. Furthermore, the result of PFS's failure to evaluate the conflicting shear wave velocity data has other implications (e.g., on all calculations that use the design basis ground motion as an input, such as the soil and foundation stability analyses), which are discussed in Section V below.~~

The Youngs Declaration ¶ 8, Exhibit C to PFS's Motion, states "PFS ... will be revising its design basis ground motion based on new shear and pressure wave velocity profiles and dynamic soil properties being developed for the site." *See also* PFS Motion at n. 3. Moreover, it is apparent from the Youngs Declaration that PFS is still collecting site data (*i.e.* acquisition of some additional downhole velocity data). Youngs Dec. ¶ 9.

Dr. Youngs describes various steps, (a) - (e) involved in developing site specific design basis ground motions. The third step, Step (c), is the characterization of the strong ground shaking that potential future earthquakes may produce. Id. ¶ 9. Dr. Youngs advises that PFS's revised design basis ground motion not only directly affects Step (c), but it also requires changes to Step (d) (computation of 2,000 year return period ground motion) and Step (e) (adjustment of ground motion for near-fault

effects), but he implies that Basis 2 and Basis 3 are unaffected by these significant changes. Id.

~~The State disputes Dr. Youngs's assertion that the revised design basis ground motion will not affect Basis 2 or Basis 3. It is obvious Step (c), the development of the design basis ground motion, relates directly to Basis 2. By looking at the recitation of proposed future changes that PFS will need to make to its SAR (e.g., seismic wave propagation, soil profiles for use in soil-structure interaction, storage pad analysis, seismic loads, etc.), is it equally as obvious that the future changes will directly affect Basis 3 too. *See* Parkyn's Dec. 22, 2000 letter, Exhibit 9, *see also* Bartlett Dec. ¶ 17.~~

~~PFS's collection of new data and apparent substantive re-evaluation of its geophysical characterization of the ISFSI site by themselves, raises significant doubt that the parties should be required to proceed further and, at this time, the Board should deny PFS's Motion for Summary Disposition for Basis 2 and 3. Morris, 15 NRC at 532 (1982) (if there is any possibility that a litigable issue of fact exists or any doubt as to whether the parties should be permitted or required to proceed further, the motion must be denied). Moreover, PFS's re-evaluation is not merely procedural but affects the safety consideration at the PFS site. *See* Brach's letter, Exhibit 10.~~

V. In Addition to Relying on Non-conservative Assumptions, PFS's Investigation Does Not Satisfy the Concerns Raised by the State in Basis 3.

In order to fully inform the Board regarding Basis 3, a hearing is warranted on the complex technical and safety considerations that relate to PFS's subsurface

investigation, sampling and analysis, and testing for engineering analysis. The technically complex issues raised by the State in Basis 3 are significant especially when considered in the context of the non-conservative assumptions PFS intends to rely upon in its seismic analysis of the site.

A. PFS Has Not Considered Other Factors that Affect the Non-conservative Assumptions PFS Relied upon in Its Seismic Analysis of the Site.

Since its initial application to the NRC, PFS has updated its soil profile. *See e.g.*, Trudeau Dec., Exhibit 2, which describes five soil layers. The CPT and boring data revealed a more complex soil layering system than the first phase of PFS's investigation indicated. Generally, the two uppermost layers are of concern to the State with respect to the sliding and bearing capacity of the soils to resist seismic forces. The uppermost layer, Layer 1, consists of Eolian Silt approximately three feet thick underlain by Layer 2, consisting of approximately seven feet of upper Bonneville, predominantly clays characterized as silty clay/clayey silt. Bartlett & Ostadan Tr. 472.

PFS proposes a bold and untried strategy of a soil-cement mixture in Layer 1 under the storage pad, which PFS asserts will provide an adequate factor of safety against sliding and bearing capacity. SAR (Rev. 9) at 2.6-60. Trudeau & Chang Tr. 152. There are no detailed calculations or field testing to demonstrate that this novel concept will function as PFS's speculates. Trudeau & Chang Tr. at 149-51. The only

discussion of the soil-cement concept is contained in approximately one page of the SAR. SAR, Rev. 9 at 2.6-60. PFS claims that this cursory description is adequate to describe the anticipated properties of the material, and in any event, the State's concerns will be addressed at a future date, when PFS considers design specification. Trudeau Dec. ¶ 30.

~~There is absolutely no objective basis for PFS's claim that the soil-cement will offer the required resistence to seismic loads and perform as an integral soil-cement mat. Bartlett Dec. ¶ 23. PFS has admitted that the soil-cement strategy is still at the conceptual stage. Exhibit 7, Trudeau & Chang Tr at 148, State's Mat. Fact ¶¶ 45, 51. To the extent that PFS is relying on satisfying the State's concerns at some future date, this in and of itself should be a sufficient ground for denying PFS's Motion. *See* Morris, 15 NRC at 532 (1982). Furthermore, there are significant unresolved critical design concerns that PFS has not considered, such as the strength and performance of the soil-cement mat under torsional and bending earthquake forces, the permeability of the soil-cement mix, and shrinkage and cracking of the soil cement as the mix cures, dries and is exposed to long-term, ambient environmental conditions. *See* Trudeau & Chang Tr. 145-52, Bartlett Dec. ¶ 24, Utah Material Facts ¶¶ 47, 51, 57, 73.~~

~~Another bold philosophy at the PFS ISFSI is Holtec's assumption that the casks will slide on the pad in a controlled manner during a large earthquake. There is no other redundancy built into Holtec's expected design. But such a bold assumption has~~

~~no margin for error. Ostadan Dec. ¶ 26. This issue relates to Basis 3 because Holtec's assumptions are relied upon in PFS's analysis of the soils to resist seismic loads. Id.~~

~~In this case, Holtec's assumptions are negated by the potential that cold bonding between the cask and the pad may occur over time. When two large bodies (cask and pad) are in contact, some local deformation and redistribution of stresses may occur at the points of contact which would create a bond, and this would not allow the cask to slide on the pad or move smoothly during an earthquake. Thus, Holtec's assumption that sliding will reduce the seismic forces is incorrect. In this instance, the seismic loads would be greater than assumed and it is questionable whether the soils beneath the pad will have the capacity to sustain that additional load. Ostadan Dec. ¶ 26.~~

B. PFS Has Not Satisfied the Concerns Raised by the State in Basis 3.

There are a number of significant concerns raised by the State in Basis 3 that have not yet been resolved by PFS's investigation and analysis. PFS asserts that many of the State's concerns are not contained within Basis 3. PFS Motion at 10. Obviously PFS wishes that were the case since its investigation is so flawed and is ongoing. But PFS's wishes are not legal arguments; PFS's absurdly narrow reading of Basis 3 should be rejected.

~~The remaining major failings in PFS's subsurface investigations, Basis 3 subpart a, include PFS's failure to conduct deep hole drilling to establish the location of~~

~~bedrock and to measure soil velocity data to that depth. Utah L at 83; Bartlett & Ostadan at 92.~~

Moreover, PFS has not conducted a site specific investigation and laboratory analyses that show that soil conditions are adequate for the proposed foundation loading. Utah L at 85. PFS cannot support its claims that the soils are reasonably uniform in the horizontal direction. PFS Motion at 12. Even within Layer 2 of the new soil layering system, the CPT data suggest significant variation exists in the CPT tip stress measurements from CPT sounding to CPT sounding. The Applicant has made no geostatistical analysis of this variation to determine an adequate horizontal spacing for sampling to acceptably define the variation. Also, the variation in CPT tip stress has not been used to understand the potential variability in engineering properties obtained from the laboratory test program. State's Material Fact ¶ 30; Bartlett & Ostadan Tr. 471 - 506; Bartlett Dec. ¶ 25.

. Also, PFS maintains, without objective evidence, that natural cementation has lead to an apparently high shear strength for the Layer 2 soils. Trudeau & Chang Tr. 75-78. However, PFS has not demonstrated that cementation is substantial and is uniform throughout Layer 2 and can be relied upon to resist seismic forces. PFS's lack of investigation has led to a poor understanding of cementation and its role in affecting the undrained shear strength, particularly at the large strains that will be introduced by the design basis ground motion. Bartlett & Ostadan Tr. 129-130.

Further, PFS has not considered another possible mechanism for the apparently high shear strength values seen in Layer 2. The higher shear strength values may be caused by dessication (drying) of the surficial, clayey soils at the time of sampling and testing. Such soils will manifest a high shear strength; however, upon rewetting, or increase in soil moisture, the shear strength will decrease. PFS has not investigated the effect that potential changes in moisture content have on increasing or decreasing the undrained shear strength. Bartlett Dec. ¶ 19; Bartlett & Ostadan Tr. 129-30. *See also* PFS Motion at 12-14. PFS's analysis of the geochemical effects and the environmental conditions at the site that may affect the moisture content of the soil is rudimentary. Utah L at 84; *see also* Utah Material Facts ¶¶ 40, 49, 61, 68 and 69; Bartlett Dec. ¶ 18.

PFS's sampling and analysis, Basis 3 subpart b, are inadequate to characterize the site or to ascertain the soil conditions to determine the reliability of the foundation system to earthquake loading. PFS Motion at 15-16.

PFS has not performed the required density of spacing as outlined in NRC Regulation Guide 1.132, "Site Investigations for Foundations of Nuclear Power Plants," for the pad emplacement area. Nor has PFS performed continuous sampling for each major structure as recommended by Reg. Guide 1.132 Part C6. Sampling.

PFS has not considered the potential spatial variation of key soil properties (*e.g.*, shear wave velocity, undrained shear strength) in a systematic way in its field investigations and design calculations. Because variation and uncertainty has not been

treated in a consistent and statistical manner, it is not possible to determine the reliability of the soil and foundation systems to earthquake loading. Utah L at 85; Bartlett Dec. ¶¶ 9-10. For example, the foundation stability calculations for the pad emplacement area and Canister Transfer Building have not accounted for the potential variation of shear strength in Layer 2. Bartlett Dec. ¶ 13. Cone penetrometer tip stress values have been taken across the PFS site that suggest spatial variation (both vertical and horizontal); however, no statistical assessment of the impact of this variation has been made on the factor of safety against dynamic sliding and bearing capacity. Moreover, PFS has based the seismic design of the foundation systems for the pad emplacement area on very limited laboratory testing from one borehole. PFS has not demonstrated that this single datum is representative of the foundation soil for the entire pad emplacement area. Utah L at 85 Such extreme under-sampling may be subject to severe bias and could potentially lead to overestimation of the shear strength capacity available to resist earthquake forces. Bartlett Dec. ¶¶ 11-12.

Further, PFS has not adequately characterized the properties of the Bonneville Deposits under levels of strain that are anticipated by the design basis earthquake. Utah L at 87. *See* Utah Material Fact ¶ 17; Bartlett & Ostadan tr. 451-452, 506. PFS has conducted stress-controlled cyclic triaxial tests to measure the collapse potential of the Bonneville sediments under cyclic earthquake loading. SAR at 2.6-100 (Rev. 11). PFS maintains that it has conducted stress controlled triaxial tests to quantify the reduction

in shear stress due to free-field ground motion. PFS Motion at 25-26. However, PFS has not performed strain-controlled, cyclic triaxial testing at large strain to show that the shear modulus and damping values used in development the design basis ground motion are appropriate for lightly to moderately cemented soils. Utah L at 86; Bartlett Dec. ¶ 28.

Probably the most glaring shortcoming in PFS's soils investigation and analyses is in the quantification of how the soils and foundation systems will perform under anticipated static and dynamic loading. Utah L at 90 and 92. ~~PFS segmented its geotechnical analysis and design by various disciplines; by doing so, PFS has failed to integrate its various investigations and analyses into a consistent and unified design package. Ostadan Dec. ¶ 8.~~

PFS's analyses are inadequate to accurately model the expected behavior of the foundation soils under dynamic loading. Utah L at 85. ~~PFS, for example, has not adequately or accurately evaluated the effects of cold bonding, fling, or incline waves on the expected behavior of the soils and foundation under dynamic loading. *See e.g.*, Ostadan Dec. ¶¶ 17-27, Bartlett Dec. ¶¶ 20, 22.~~ Further, PFS has not conducted an adequate or complete investigations to determine the properties of the various materials underlying the site. Utah L at 86. PFS has not considered that a significant portion of the undrained shear strength of the Bonneville Sediments is already mobilized by free-field ground motion; hence significantly reducing the amount of

shear strength capacity remaining to resist foundation sliding under dynamic forces. Ostadan Dec. ¶ 28.

~~The scope of PFS's investigation been insufficient with respect to the characterizations of soils at depth and the correlations of the seismic refraction data with the SCPT data. Utah L at 86. *See* Bartlett Dec. ¶¶ 13-17. PFS initially collected seismic refraction data which suggested the shear wave velocities in the uppermost soil profile to be approximately 750 feet per second (ft/sec). Later and more continuous SCPT data show the shear wave velocities to be 540 ft/sec, thus contradicting the seismic refraction data. The SCPT data also demonstrates that the uppermost soil layer is a soft thin layer. PFS used the SCPT data to revise calculation of the soil strain-compatible soil properties for soil-structure interaction but it has failed to use the SCPT to revise development of the design basis ground motion. Ostadan Dec. at ¶¶ 9-12.~~

PFS has insufficient relevant test data to support the selection of design parameters. Utah L at 86. ~~Because the development of the design basis ground motion did not recognize the soft thin upper soil layer, PFS's engineers have inappropriately introduced the design motion at the ground surface instead at a point of below the surface on top of a competent soil layer. Ostadan Dec. at ¶¶ 10-11.~~

PFS has inaccurately or inadequately characterized the basis for the selection of samples or conducted relevant tests to determine the soil's physical characteristics due

to anticipated loading or the duration of loading during a seismic event. Utah L at 87. ~~In particular, Holtec's analysis of the pad-cask system and invalid assumptions that Holtec relied upon create significant unresolved safety concerns. Design and stability of the foundation and the supporting soil system are functions of the dynamic forces that will be imparted to them. Thus, Holtec's analysis is important because Holtec's calculation generates the seismic loads that would be acting on the pad and the soil system. Ostadan Dec. ¶¶ 20-21.~~

~~The Holtec calculation, *Multi Cask Response at the PFS ISFSI from 2000 Year Seismic Event* (Holtec International) (Aug. 20, 1999) creates numerous and significant concerns that affect the entire design package. First, Holtec placed the input motion in the wrong location when it conducted its dynamic analysis of the cask and the pad. Ostadan Dec ¶ 22. Second, Holtec assumed that seismic waves would arrive at the foundation structure vertically and failed to take into account that seismic waves may arrive at an angle which would cause larger rocking and torsional vibration than Holtec assumed. Id. Third, Holtec's nonlinear analysis inappropriately relied on one set of time histories instead of at least three. Id. ¶¶ 16 and 22. Fourth, Holtec failed to account for frequency dependency of soil springs and damping coefficients for the pads. Ostadan Dec ¶ 22. Finally, Holtec used the invalid assumption that the storage pad would act as a rigid mat when, in fact, other PFS calculations show the pad will be flexible. Id. Thus, PFS cannot demonstrated the capability of the soil's physical~~

~~characteristics to withstand anticipated loading or the duration of loading during a seismic event. *See also* Bartlett ¶ 21.~~

PFS has not shown that the static and dynamic engineering properties of the soils were properly determined and that reasonable and conservative values were used in the design. Utah L at 89. ~~*See* Utah Material Fact ¶ 92. Holtec has a bold design that has no redundancy built into it. Holtec assumes that the cask and pad will slide in a controlled manner during a large earthquake and that this will reduce the seismic loads on the pads and soils below. Because there is no redundancy in Holtec's expected design the failure of the casks to slide will impart forces greater than anticipated to the pad, the pad foundation, and the soil system. Holtec for example, has not considered the effects of cold bonding where over time local deformation and redistribution of stresses may occur and create a bond between the cask and the pad and hence transfer larger dynamic forces that was anticipated by PFS in analyzing the dynamic stability of the foundation soils.. Ostadan Dec. ¶ 26.~~

PFS has not explained how the developed data were used in the design analysis, how the test data were enveloped for design, and why the design envelope is conservative. Utah L at 89. ~~PFS used the wrong parameter (*i.e.*, spectral acceleration) in estimating the foundation loading in the stability analysis and this incorrect assumption may require the use of a design spectral acceleration value close to or in excess of 1 g. Ostadan Dec. ¶ 27.~~

The PFS site is one of seismic complexity. ~~PFS has not adequately or accurately assessed potential earthquakes and resulting ground motions, especially with respect to incline waves, variation in phasing of the time histories and "fling." Utah L at 90. PFS incorrectly assumed that propagating waves from an earthquake would arrive vertically but failed to consider that waves would arrive at an angle. Ostadan Dec. ¶ 22. Nor has PFS used a sufficient number of time histories in its nonlinear analysis of the casks on the pad, to take into account the sensitivity of the nonlinear analysis to phasing. Ostadan Dec. ¶ 18. In addition, PFS has ignored the effects of "fling" (*i.e.*, a large pulse of energy delivered in a short burst). Id. ¶ 17. PFS's failure to accurately or adequately assess these effects in its analysis of soils, soil-structure or design basis ground motion has serious safety implications because the magnitude and frequency of those forces may be greater or different than those anticipated by PFS's analysis.~~

~~PFS has inadequately analyzed the overturning of the canister transfer building by ignoring the effect of the rotational mass moment of inertia, by ignoring the effect of coupling between two horizontal directions, and by incorrectly assuming the mass center of the building to be at the center of the mat. Ostadan Dec. ¶ 29. PFS's calculations do not demonstrate why the design envelope is conservative or whether PFS correctly applied the developed data in its design analysis. Ostadan Dec ¶ 29.~~

PFS has made no attempt to compare the site specific data with the published data. For example, PFS has not conducted strain-controlled cyclic triaxial tests to

determine the large strain shear modulus and damping values for the Bonneville Clay. Utah L at 90-91; *see also* Bartlett Dec. ¶ 28.

Finally, the tests conducted to date by PFS do not allow a reviewer to make a reasonable judgment about how the soil will perform under anticipated static and dynamic loading of the short and long term conditions. Utah L at 92. Ostadan Dec.; Bartlett Dec.

CONCLUSION

The subject matters of PFS's motion and this response are extremely complicated and technical; even people in other technically oriented disciplines have a hard time grasping them. This complexity is another reason to deny Applicant's motion; the Board should avail itself of the opportunity to hear testimony from and question experts from both sides before drawing its conclusions.

For the reasons stated above, PFS is not entitled to Summary Disposition and the State requests the Board to set this matter for hearing.

DATED this 30th day of January, 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
Laura Lockhart, Assistant Attorney General
Attorneys for State of Utah
Utah Attorney General's Office
160 East 300 South, 5th Floor, P.O. Box 140873
Salt Lake City, UT 84114-0873
Telephone: (801) 366-0286, Fax: (801) 366-0292

CERTIFICATE OF SERVICE

I hereby certify that a copy of STATE OF UTAH'S RESPONSE TO APPLICANT'S MOTION FOR SUMMARY DISPOSITION OF UTAH CONTENTION L was served on the persons listed below by electronic mail (unless otherwise noted) with conforming copies by United States mail first class, this 39th day of January, 2001:

Rulemaking & Adjudication Staff
Secretary of the Commission
U. S. Nuclear Regulatory Commission
Washington D.C. 20555
E-mail: hearingdocket@nrc.gov
(*original and two copies*)

G. Paul Bollwerk, III, Chairman
Administrative Judge
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission
Washington, DC 20555
E-Mail: gpb@nrc.gov

Dr. Jerry R. Kline
Administrative Judge
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission
Washington, DC 20555
E-Mail: jrk2@nrc.gov
E-Mail: kjerry@erols.com

Dr. Peter S. Lam
Administrative Judge
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission
Washington, DC 20555
E-Mail: psl@nrc.gov

Sherwin E. Turk, Esq.
Catherine L. Marco, Esq.
Office of the General Counsel
Mail Stop - 0-15 B18
U.S. Nuclear Regulatory Commission
Washington, DC 20555
E-Mail: set@nrc.gov
E-Mail: clm@nrc.gov
E-Mail: pfscase@nrc.gov

Jay E. Silberg, Esq.
Ernest L. Blake, Jr., Esq.
Paul A. Gaukler, Esq.
Shaw, Pittman, Potts & Trowbridge
2300 N Street, N. W.
Washington, DC 20037-8007
E-Mail: Jay_Silberg@shawpittman.com
E-Mail: ernest_blake@shawpittman.com
E-Mail: paul_gaukler@shawpittman.com

John Paul Kennedy, Sr., Esq.
1385 Yale Avenue
Salt Lake City, Utah 84105
E-Mail: john@kennedys.org

Joro Walker, Esq.
Land and Water Fund of the Rockies
2056 East 3300 South Street, Suite 1

Salt Lake City, Utah 84109
E-Mail: joro61@inconnect.com

Danny Quintana, Esq.
Danny Quintana & Associates, P.C.
68 South Main Street, Suite 600
Salt Lake City, Utah 84101
E-Mail: quintana@xmission.com

James M. Cutchin
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
E-Mail: jmc3@nrc.gov
(*electronic copy only*)

Office of the Commission Appellate Adjudication
Mail Stop: O14-G-15
U. S. Nuclear Regulatory Commission
Washington, DC 20555

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
	)	January 30, 2001

STATE OF UTAH'S STATEMENT OF DISPUTED AND RELEVANT MATERIAL FACTS

In support of its Response to Applicant's Motion for Summary Disposition of Utah Contention L, the State submits this Statement of Disputed and Relevant Material Facts.

BASIS 1

~~1. The State disputes PFS Material Fact Basis 1 ¶ 5 to the extent that PFS implies that PFS has complied with Reg. Guide 1.165 and Standard Review Plan ("SRP") 2.5.1 (basic geologic and seismic information), SRP 2.5.2 (evaluation of vibratory ground motion), and SRP 2.5.3 (evaluation of surface fault displacement). PFS has not adequately evaluated vibratory ground motion. *See* PFS's letter to the NRC dated December 22, 2000 ("PFS Dec. 22, 2000 letter"), submitted to the Atomic Safety and Licensing Board on December 28, 2000, by PFS's counsel, Jay E. Silberg. Furthermore, the State disputes PFS evaluation of vibratory ground motion and surface fault displacement. *See* Utah Material Facts 2-11.~~

2. The State disputes PFS Material Fact Basis 1 ¶ 12. There is no support that the two trenches referred to in ¶ 6 of the Coppersmith or ¶ 9 of the Clark Declarations are each 250 feet long. *See* Volume 1, Final Report, *Fault Evaluation Study and Seismic Hazard Assessment* prepared by Geomatrix Consultants, Inc. for the Private Fuel Storage Facility, dated February 1999, p. 8 (Exh. 2 to Coppersmith Decl.).

3. The State disputes PFS Material Fact Basis 1 ¶ 4. PFS's has been neither integrative and nor comprehensive. For example, PFS did not use the soil velocity data obtained from seismic cone penetration tests in order to convert the seismic reflection data to show depth of marker beds such as the Promontory soil and key geologic horizons within the Lake Bonneville sequence. Allison Dec. ¶ 7.

4. The State disputes PFS Material Fact Basis 1 ¶¶ 8, 11, 50 and 54. The east-west Pass Canyon is an anomaly to the structural grain of the valley runs northwest. Another anomaly to the northwest structural grain is the topographic embayment at the east-west trending Rydalch Pass. PFS has not shot enough seismic lines to analyze the anomalies to its claim that the only structural features of the valley run northwest. Allison Dec. ¶ 8

5. The State disputes PFS Material Fact Basis 1 ¶ 14. PFS has not shot an perpendicular line in a north-south direct to correlate its interpretation of the east-west seismic lines. Moreover there are an insufficient number of east-west seismic lines to determine the length of the East Fault or the West Fault or intervening faults. Allison Dec. ¶ 9.

6. The State disputes PFS Material Fact Basis 1 ¶ 18. PFS has not analyzed that the East and West Faults may be listric and could cause the secondary faults found at the site to flatten out and create surface rupture. Allison Dec. ¶ 9.

7. The State disputes PFS Material Fact Basis 1 ¶ 31 to the extent that PFS claims that the faults are laterally discontinuous. No data has been collected or presented to locate the ends of the faults. Allison Dec. ¶ 9.

8. The State disputes PFS Material Fact Basis 1 ¶ 41. The Wasatch fault, for example, demonstrates that a new faulting may occur on an unidentified strand of an existing fault. *See* Black, B.D., Lund, W.R., Schwartz, D.P., Gill, H.E., May, B.H., 1996, "Paleoseismic Investigations on the Salt Lake City Segment of the Wasatch Fault Zone at South Fork, Dry Creek and Dry Gulch Sites, Salt Lake County, Utah," Utah Geological Survey Special Studies 92, 22 p.

9. The State disputes PFS Material Fact Basis 1 ¶ 51. PFS has not shot any perpendicular tie lines to correlate the data it obtained from the east-west seismic lines. Allison Dec. ¶ 9.

10. The State disputes PFS Material Fact Basis 1 ¶ 52. The placement and

number of seismic lines is inadequate. Allison Dec. ¶ 9.

11. The State disputes PFS Material Fact Basis 1 ¶ 54. See Material Facts above. Allison Dec. ¶ 7-9.

BASIS 2

12. The State disputes PFS Material Fact Basis 2 ¶ 1.[1] PFS has not quoted basis 2 in its entirety. Basis 2, as admitted, states:

> **2. Ground motion.** The site may also be subject to ground motions greater than those anticipated by the Applicant due to spatial variations in ground motion amplitude and duration because of near surface traces of potentially capable faults (the Stansbury and Cedar Mountain faults). Sommerville, P.G., Smith, N.F., Graves, R.W., and Abrahamson, N.A., Modification of empirical strong ground motion attenuation relations to include the amplitude and duration effects of rupture directivity, *in* 68 Seismological Research Letters (No. 1) 199 (1997). 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).

State's Contentions on the Construction and Operating License Application by Private Fuel Storage, LLC for an Independent Spent Fuel Storage Facility (November 23, 1997) at 74.

13. The State disputes PFS Material Fact Basis 2 ¶ 3. While the Applicant may have "appropriately" implemented the methodology of Somerville et al., ~~the Applicant has not adequately assessed the design basis ground motions in terms of achieving adequate conservatism in its analysis. Arabasz Tr. at 57-58, 63-64. Arabasz Dec. ¶ 7.~~

~~14. PFS has not conducted a fully deterministic seismic hazard analysis as required by 10 CFR § 72.102(f)(1) and, by reference, 10 CFR 100 Appendix A. Instead, PFS has submitted two seismic analyses identified as "deterministic" but which used a hybrid methodology that incorporated probabilistic elements and accompanying uncertainties in the treatment of the seismic sources and other inputs to the analyses. Arabasz Tr. at 46-47, 58; Arabasz Dec ¶ 7.~~

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[1] PFS has not sequentially numbered its material facts; at this point PFS starts re-numbering its material facts.

~~15. The Staff admitted that the Deterministic Seismic Hazard Analysis performed by Geomatrix Consultants, Inc., as reported in Appendix 2 of the PFS 1997 Safety Evaluation Report and as updated by Geomatrix in Updated of Deterministic Ground Motion Assessment (April 1999) "did not meet the deterministic requirements in 10 C.F.R. Part 100 Appendix A." Staff's Objections and Responses to the "State of Utah's Sixth Set of Discovery Requests Directed to the NRC Staff (Utah Contention L)" (February 14, 2000), Response to Requests for Admissions 1 and 2 at 7-8.~~

~~16. In developing its design basis ground motions for the probabilistic seismic hazard analysis, PFS did not account for seismic cone penetration test ("SCPT") data obtained in 1999 which show that the average shear-wave velocity in the uppermost 10 feet of the soil profile underlying the PFS site is about 540 feet per second. Instead, PFS used lower resolution data obtained earlier from seismic refraction surveys to assign an average shear-wave velocity of 750 feet per second to the uppermost 45 feet. Whether PFS is required to perform a deterministic or probabilistic seismic hazard analysis, failure to account for the SCPT data could result in incorrectly characterizing earthquake ground motions at the ground surface for the purposes of engineering design and dynamic analysis. Arabasz Dec ¶ 8; Bartlett & OstadanTr. at 316-320 and 335-36.~~

BASIS 3:

Part a: Subsurface investigations

17. The State disputes PFS Material Fact Basis 3 ¶ 4. *See* Utah Material Facts ¶¶ 18-22.

18. The Applicant has not performed the density of boring as outlined by U.S. NRC Regulatory Guide 1.132, Appendix C, "Site Investigations for Foundations of Nuclear Power Plants". Bartlett & OstadanTr. at 95-96.

19. The Applicant has not considered shear strength anisotropy in the design of the foundation system. BartlettTr. at 300-308.

~~20. Discrepancies in seismic cone penetration test ("SCPT") shear wave velocity data and seismic refraction data have not been resolved in the determination of the design basis ground motion. Bartlett & OstadanTr. at 316-322, 466; *see also* PFS's Dec. 22, 2000 letter to revise design basis ground motion.~~

21. The Applicant has not performed strain-controlled, cyclic triaxial testing of the Bonneville Deposits to determine the behavior of these soils under earthquake

loading at the level of strain anticipated by the Design Basis Earthquake. Bartlett & OstadanTr. at 451-452, 506.

22. The Applicant has not adequately quantified potential variation in the undrained shear strength across the PFS site from the laboratory test program. Bartlett & OstadanTr. at 471-476, 504-506, 512, 550-551. *See also* Bartlett Dec. ¶ 16.

23. The State disputes PFS Material Fact Basis 3 ¶ 5. The information gathered by PFS as to the site's subsurface conditions is inadequate to support the design of the facility. Exhibit 9; Bartlett Dec ¶¶ 9,10.

~~24. Uncertainty remains regarding shear wave velocity data and their application to design. Bartlett & OstadanTr. at 300-02; Bartlett Dec. ¶ 17.~~

25. Uncertainty remains regarding the stress-strain behavior of the Bonneville Deposits at large strain. Bartlett & OstadanTr. at 300-01.

26. Uncertainty remains in the potential variation of the undrained shear strength for the Bonneville Deposits across the PFS site. Bartlett & OstadanTr. at 303-04; Bartlett Dec. ¶ 15

27. Potential shear strength anisotropy in the Bonneville deposits has not been considered in the design of the foundation system. Bartlett & OstadanTr. at 300-01.

28. The State disputes that PFS's geologic characterization of the site is "unambiguous." *See* PFS Material Fact, Basis 3 ¶ 9. *See* Utah Material Facts ¶¶ 14-17; *see also* Utah Material Facts ¶¶ 2-11.

29. The State disputes PFS Material Fact Basis 3 ¶ 12. A grid pattern for placing borings may be reasonable and may be a common approach for the first phase of investigations but the State disputes that such a grid pattern implies any adequacy in the density of sampling. The State disputes the adequacy of spacing borings at 600 feet apart. Bartlett & OstadanTr. at 91-94, 538; Bartlett Dec. ¶ 9.

30. The State disputes PFS Material Fact Basis 3 ¶ 13 that the soil properties at the PFS facility site are reasonably uniform in the horizontal direction. Even within

layer 2 of the new soil layering system,[2] the CPT data suggest significant variation exists in the CPT tip stress measurements. In addition, the Applicant has made no geostatistical analysis of this variation to determine an adequate spacing for sampling. Also, the variation in CPT tip stress has not been used to define potential variability in the undrained shear strength determined from the laboratory test program.. Bartlett & OstadanTr. at 471 - 506; Bartlett ¶¶ 10, 11.

31. The State also disputes that PFS did not need to establish a denser set of borings in the pad emplacement area than the one initially provided. PFS Material Fact Basis 3 ¶ 13. *See* Utah Material Fact ¶ 30; Bartlett & OstadanTr. at 91-94; Bartlett DEc. ¶ 12.

32. The State agrees that PFS has conducted sampling and testing additional to that initially conducted but the State disputes that such sampling and testing is considerable. PFS Material Fact, Basis 3 ¶ 14. *See e.g.*, Bartlett & OstadanTr. at 91-94.

33. The State disputes that PFS Material Fact Basis 3 ¶ 17 supports PFS's soils investigation of the pad emplacement and canister transfer building ("CTB"). Material Fact ¶ 17 asserts that PFS may conduct some borings in 2001, at an unknown depth and at unknown spacing in a generalized but non-specific location relating to non-safety related structures. Data from the proposed future borings, if any, in the vicinity of non-safety related structures has no relevance to the resolution of existing issues in the pad emplacement and CTB areas. Bartlett Dec. ¶ 26.

34. The State disputes PFS Material Fact Basis 3 ¶ 19. A depth of thirty feet may be adequate for shallow foundation over small areas but investigation to a depth of thirty feet is not adequate for determining the soil properties required for strong ground motion modeling of the soil column. Bartlett & OstadanTr. at 92, 127-28.

35. The State disputes PFS Material Fact Basis 3 ¶ 20 to the extent that PFS relies on published data to incorporate uncertainties into the development of design parameters used in PFS's analyses of soil-structure interaction. ~~Moreover, PFS is in the midst of revising calculations relating to the design parameters in PFS's analyses of soil-structure interaction due to discovered discrepancies in the shear wave velocity data. *See* Exhibit 9; Bartlett Dec. ¶ 17.~~

36. While the cone penetrometer testing ("CPT") is useful for determining

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[2] *See e.g.*, Bartlett & OstadanTr. at 29, 30; Utah L tr. Exh. 53 (SAR, Rev. 8, Fig. 2.6-5).

soil layering in the upper 35 feet it would have been more a useful if the CPT soundings were conducted before the borehole drilling, and the laboratory sampling program were planned after an initial evaluation of the CPT data.. Bartlett & OstadanTr. at 90-92. The State therefore disputes PFS Material Fact Basis 3 ¶ 21 to the extent that the sequencing of PFS's CPT after the borehole drilling and laboratory sampling program do not allow for investigation of other soil parameters at the site. Id.

37. The State disputes PFS Material Fact Basis 3 ¶ 22. The CPT data has more use than solely being "confirmatory." It gives information regarding the variability of key engineering properties in the horizontal and vertical direction. PFS has not quantified the CPT sounding variability, nor has PFS incorporated the potential variation suggested by the CPT data in determining engineering properties for use in foundation stability analyses. Bartlett & OstadanTr. at 471-506.

38. While PFS may have accurately characterized the thickness and extent for the upper 35 feet of soil profile, the composition of the upper 35 feet has not been fully characterized because CPT data does not directly measure the soil composition; it is inferred from the data. The State disputes PFS Material Fact Basis 3, ¶ 23 in that soil composition has not been resolved regarding the degree and nature of the cementation that PFS says exists in the Bonneville deposits. Bartlett & OstadanTr. at 129-30.

39. While there may not be uncertainty regarding the thickness or extent of various materials in the upper 35 feet, uncertainty still remains regarding the composition and engineering properties of these materials. PFS Material Facts Basis 3, ¶ 24. Bartlett & OstadanTr. at 227.

40. The State disputes PFS Material Facts Basis 3, ¶ 25 in that PFS claims that "the top 30 feet or so of the profile are the only ones of interest from a geotechnical standpoint...." Use of the term geotechnical is too broad in this statement. Deeper sediments (*i.e.*, below 30 feet) are of "geotechnical" interest because their nature affects the ground response modeling, which is a "geotechnical" issue. The State disputes that PFS can restrict the geotechnical investigations to only the upper 30 feet. Bartlett & OstadanTr. at 92, 107, 127-28, 560.

41. The State disputes PFS Material Fact Basis 3 ¶ 26. *See* Utah Material Fact ¶¶ 39, 40.

42. The State disputes PFS Material Fact Basis 3 ¶ 28. First, the statement is not a material fact; it is a legal conclusion. Second, the Applicant has not followed

Reg. Guide 1.132 "Site Investigations for Foundations of Nuclear Power Plants" regarding borehole spacing. Bartlett & OstadanTr. at 126-127; Bartlett Dec. ¶ 9. Also, PFS has not performed continuous sampling for each major structure as recommended by Reg. Guide 1.132 Part C6. Sampling. Id. Third, the State disputes that the characterization has resolved the following key issues regarding: ~~shear wave velocity~~, shear strength variability, cementation, anisotropy, and degradation of shear strength due to earthquake cycling. *See* Utah Material Facts 18-22. Bartlett & OstadanTr. at 126-28; Bartlett Dec. ¶ 15.

43. The State disputes PFS Material Fact Basis 3 ¶ 29. The SAR does not discuss the effect of seasonal changes in moisture content of the soils and how changes in moisture content may affect the undrained shear strength of the soil. Bartlett & OstadanTr. at 130; Bartlett Dec ¶ 18.

44. The State disputes PFS Material Fact Basis 3 ¶ 31 that there is no potential for groundwater leaching at the PFS site. For example, some "geochemical" leaching of calcium carbonate may occur due to rainwater even though the amount of leaching may not be significant. Bartlett & OstadanTr. at 206

45. The State disputes PFS Material Fact Basis 3 ¶ 32 that potential weather-related geochemical effects will be eliminated by the use of soil cement under the pads and the installation of a surface rainfall collection system. The statement is pure conjecture and is not supported by any fact or objective evidence. The PFS soil-cement mat is still in the conceptual stage and there have been no tests or calculations relating to this concept. Bartlett & OstadanTr. at 216-17.

46. The capping of a soil layer does not preclude changes in moisture content because of capillary action and unsaturated flow of water through a fine-grained soil. Bartlett & OstadanTr. at 216-218; Bartlett Decl. ¶ 19.

47. The soil-cement may also develop shrinkage cracks and other types of stress related cracks. Bartlett & OstadanTr. at 216-223; Bartlett Dec. ¶ 22. Furthermore, the undrained shear strength of unsaturated, fine-grained soils is affected by changes in the moisture content. Thus, variations in moisture content can change the undrained shear strength, which is a key design parameter for the PFS foundations. Id.

48. The State disputes PFS Material Fact Basis 3 ¶ 33 and Trudeau Dec. ¶ 30 as unsupported by any objective fact or analysis. Bartlett & OstadanTr. at 220-27.

49. The State disputes PFS Material Fact Basis 3 ¶ 34. Neither the actual nor "anticipated" properties of the soil cement mat have been adequately described. The SAR gives typical unconfined compressive strengths for soils treated with cement. PFS has admitted that it has not considered bending and tensional stresses that will develop in the soil-cement mat. TrudeauTr. at 147-152. No design values or test program has been implemented to explore these failure mechanisms and present strength properties germane to these modes of failure. Bartlett & OstadanTr. at 216-17.

50. The State disputes the relevance to PFS's Motion for Summary Disposition PFS's assertion that it may test soil cement and develop design specifications at some future unspecified date. *See* PFS Material Fact Basis 3 ¶ 35. The State disputes that this assertion offers any support to PFS's subsurface soils investigation. Bartlett Dec. ¶ 26.

51. The State disputes PFS Material Fact Basis 3 ¶ 35. While PFS may prepare design specification for the construction and testing of the soil-cement at the construction phase of the project, the State disputes that PFS has demonstrated that the soil-cement strategy will be sufficient to resist seismic loading. PFS has admitted that the design is still conceptual. TrudeauTr. at 148. There are design issues that PFS has not considered, such as the permeability of the soil cement mix, the behavior of the soil cement on seismic loading and shrinkage and cracking of the soil cement. Bartlett & OstadanTr. at 216-17; Bartlett Dec. ¶ 22.

52. The State disputes PFS Material Fact Basis 3 ¶ 36 because it contradicts the statements made by PFS in Basis 3 ¶¶ 31 and 32. In paragraphs 31 and 32 PFS precludes changes due to geochemical effects but in paragraph 36 PFS introduces the idea that some geochemical effects will occur, albeit slowly.

53. The State also disputes ¶ 36 in that the statement that the geochemical effects will develop so slowly that they will not impact the facility during its lifetime implies that one has some measure or knowledge of the rate of change occurring due to geochemical processes. None of these data has been presented by the Applicant.

54. The State disputes PFS Material Fact Basis 3 ¶ 37. While collapse of the partially cemented soil due to static loading may not be a major issue, the State disputes that the Applicant has demonstrated that these soils will not undergo a significant degradation of shear strength during earthquake loading. Bartlett & OstadanTr. at 185-86, 505-506; Bartlett Dec. ¶¶ 12, 20, 22.

Part b: Sampling and analysis

55. PFS's initial sampling and analysis program was woefully deficient. Bartlett Dec. ¶ 12; Bartlett & OstadanTr. at 235-39. A significant expansion of a woefully deficient laboratory test program does not imply that the current program is sufficient. *See also* PFS Material Fact Basis 3 ¶ 38.

56. The State disputes PFS Material Fact Basis 3 ¶ 43. The depth of bedrock is important for ground response modeling. Ground response modeling and its output is required to determine the seismic forces imparted to the foundations; hence the depth to bedrock is germane for geotechnical design. *See* Utah Material Fact ¶ 49.

57. The State disputes PFS Material Fact Basis 3 ¶ 44; Layer 1, in which PFS will place its soil-cement mix is also a concern. The soil cement stabilization proposed by PFS has not resolved all issues related to Layer 1. *See* Utah Material Facts ¶¶ 49-51; Bartlett Dec. ¶¶ 22, 23.

58. The State disputes PFS Material Fact Basis 3 ¶ 45. The characterization and stabilization of layer 1 is also important for the structural design of the facility. *See* Utah Material Facts ¶ 49-51; Bartlett Dec. ¶¶ 22, 23.

59. The State disputes PFS Material Fact Basis 3 ¶ 46. The adequacy of the number of samples is not supported by any geostatistical analysis. Bartlett & OstadanTr. at 237-240. The determination of adequacy of sampling has been made in an subjective manner. Id.; Bartlett Dec ¶ ¶ 9, 10.

60. The State disputes PFS Material Fact Basis 3 ¶ 47. While Layer 2 has a "monotonous" CPT tip resistance trace when compared with the other layers in the shallow profile, the State disputes that layer 2 is uniform. Significant variation does appear, even in this layer. *See* Utah Material Facts ¶¶ 30, 31; Bartlett Dec. ¶ 11.

61. The State disputes PFS Material Fact Basis 3 ¶ 48. It is sometimes appropriate to use the "least favorable measured property" for design in conducting an engineering analyses, but the State disputes that the value selected by PFS actually represents the lowest value for Layer 2. Layer 2 is the critical layer for sliding failure. There is no evidence whether the design values that PFS used were upper-bound, mean, or lower bound values because no formal assessment of variability has been done by PFS. Bartlett & Ostadan Tr. at 473. Moreover, when PFS's witness Paul Trudeau eventually admitted what the design values used for Layer 2 represented, he characterized them as "mean values." TrudeauTr. at 97-98. Thus, PFS did not use "the least favorable measured properties" for the key layer because PFS only used "mean values." Bartlett Dec. ¶ 13.

~~62. The State disputes PFS Material Fact Basis 3 ¶ 49. The State disputes that the foundation stresses of the cask storage pads will be distributed over a "large soil volume." PFS's statement in ¶ 49 assumes that the cask storage pads and soil-cement mat will behave as an integral unit during earthquake motion. This has not been demonstrated by PFS and integral behavior (no cracking) may not be true. PFS has not considered the impacts of vertically propagating waves and the bending and torsional stress induced by such waves in the soil-cement mat. TrudeauTr. at 147. These bending and torsional stresses may be large enough to crack and fracture a non-reinforced soil-cement mat and the mat will not behave as an integral unit. Bartlett & OstadanTr. at 217, 222; Bartlett Dec. ¶ 22.~~

~~63. PFS has not considered the possibility of tension cracking forming in the soil-cement mat due to drying and other environmental factors (e.g., freeze-thaw). Bartlett & OstadanTr. at 210, 222; Bartlett Dec. ¶ 23.~~

~~64. If the soil-cement mat cracks prior to the seismic event or fractures occur during earthquake motion, then the shear stress mobilized in the foundation will not be over a "large area," but may be restricted to a more localized area, that is, approximately the size of one storage pad. Bartlett Dec. ¶ 22.~~

65. The State disputes PFS Material Fact Basis 3 ¶ Basis 3 Par. 50. *See* Utah Material Facts ¶¶ 28-34. *See also* Bartlett & OstadanTr. at 179-80.

66. The State disputes PFS Material Fact Basis 3 ¶ 51. PFS's statement it is "conservatively using Layer 2 parameters to represent those for the entire top 30 feet of the profile" is unsupported because PFS must specify the parameter before the degree of conservatism or unconservatism can be determined.

67. The State disputes PFS Material Fact Basis 3 ¶ 54. The State disputes that PFS has resolved accounting for the anticipated loading and duration of loading. Moreover, PFS has not conducted strain-controlled cyclic triaxial testing to explore the possibility of shear strength degradation. Bartlett & Ostadan Tr. at 537.

68. The State disputes PFS Material Fact Basis 3 ¶ 59 in that, of the listed items in ¶ 59, only grain-size, water content, and Atterberg limits are parameters or properties; the remainder of the listed items are soil tests, and are not parameters.

69. The State disputes PFS Material Fact Basis 3 ¶ 60 to the extent that PFS asserts that resonant column tests are a form of strain-controlled cyclic triaxial tests.

The two test apparatuses can be significantly different. Bartlett & OstadanTr. at 302; Bartlett Dec. ¶ 27.

70. The State disputes PFS Material Fact Basis 3 ¶ 61, which is a conclusory statement that no "tests were needed beyond those carried out by PFS." For example, PFS needs to conduct strain-controlled cyclic triaxial testing, as well as triaxial extension tests, which PFS has not performed. Bartlett & OstadanTr. at 100-101, 105, 451-452, 506.

71. The State disputes PFS Material Fact Basis 3 ¶ Basis 3 Par. 62. PFS has not established the large-strain behavior of the Bonneville Clay. One such test to establish such behavior is strain-controlled cyclic triaxial testing, which PFS has not performed. *See* Utah Material Facts ¶ 70.

72. The State disputes PFS Material Fact Basis 3 ¶ 63. A percentage of the design value of the undrained shear strength will be mobilized by the free-field ground motion. Bartlett & OstadanTr. at 15-86. The degree of mobilization has not been estimated by PFS, nor has been accounted for in the seismic design of the foundation. TrudeauTr. at 135-136. ~~Further, the design basis free-field ground motion is being revised by PFS (Exhibit 9); thus, PFS's statement is inconclusive and cannot be resolved until revised calculations supporting the new design basis free-field ground motion are presented. Bartlett Dec. ¶ 17.~~

73. The State disputes PFS Material Fact Basis 3 ¶ 69. Notwithstanding that PFS intends to use soil cement and install some type of surface water runoff collection system, and the facility may be located in semi-arid environment, over time changes in water content of the partially saturated, fine-grained foundation soils are still possible Bartlett & OstadanTr. at 206-07; *see also* Utah Material Facts ¶ 45-47. PFS has not analyzed the effects of changes in the moisture content caused by capillary action, unsaturated flow, or the permeability or potential for cracking of the soil-cement mix. Bartlett & OstadanTr. at 206-07, 216-17. The moisture content of the foundation soils, especially Layer 2, is critical because if the moisture content increases , the clays in Layer 2 may be susceptible to decrease in shear strength. Bartlett & OstadanTr. at 227; Bartlett ¶ 19.

74. The State disputes PFS Material Fact Basis 3 ¶ 71. A carefully designed laboratory testing program should also anticipate potential changes in "field conditions" with time. The moisture content of the foundation soils can change with time, even with a soil-cement mat placed over the pad emplacement area. *See* Bartlett & OstadanTr. at 129-130, 213-223; Bartlett ¶ 19. Changes in water content will occur

with time, which in turn may affect the undrained shear strength of the clayey soils. Thus, the State disputes that it is sufficient for PFS to determine only the undrained shear strength for the foundation soils at the time of drilling; PFS must also anticipate potential changes in the moisture content and verify that changes in the moisture content do not significantly affect the undrained shear strength. PFS has not performed a laboratory test program that defines the correlation between undrained shear strength and moisture content. Bartlett ¶ 18.

75. The State disputes PFS Material Fact Basis 3 ¶ 76. Utah Material Fact ¶¶ 18-27.

76. The State disputes PFS Material Fact Basis 3 ¶ 86. ~~PFS has not conservatively interpreted the shear wave velocity data. *See* Utah Material Fact ¶ 78.~~ In addition, PFS has not considered the potential variability in the undrained shear strength in the design of the facility. Utah Material Fact ¶ 37.. Furthermore, PFS has not adequately defined the role of cementation in affecting the undrained shear strength of the soil. Utah Material Fact ¶ 38; Bartlett & OstadanTr. at 128-130. Moreover, PFS has not considered soil anisotropy. Bartlett & OstadanTr. at 300-302; Bartlett Dec. ¶ 15. Nor has PFS demonstrated that degradation of shear strength will not occur at the strain levels anticipated for the design basis ground motion. Utah Material Fact ¶ 54.

77. The State disputes PFS Material Fact Basis 3 ¶ 86. ~~In the latest revision of the SAR, PFS included a shear key one-foot deep around the Canister Building to improve the shear resistance against sliding. In PFS's revised calculation, it is shown that the factor of safety is as low as 1.1. Calculation No. 05996-02-G(B)-13 *Stability Analyses of the Canister Transfer Building Supported on a Mat Foundation*, Rev. 3, Stone & Webster (6/19/00) at 13. This inadequate calculation relies on the passive resistance behind the one-foot shear key to develop the resisting forces against sliding. The State disputes that the passive soil and its reaction under the mat have been considered in the stability analysis of the building and design of the mat. Ostadan Dec. ¶ 28. *See also* Bartlett ¶ 17.~~

~~78. Other information contain in the SAR and supporting documents have not been conservatively interpreted to determine the design parameters. For example, the Applicant considered an average velocity of 750 ft/sec for the Holocene formation in order to develop the 2000-year motion. The Applicant's recent subsurface investigation using seismic cone penetration test ("SCPT") has shown a low velocity profile in the upper 10 ft as having a velocity of approximately 540 ft/sec (SAR Figure 2.6-28). In light of the new and refined SCPT data for the shallow soil layers, the State~~

~~disputes that PFS may use the design motion at the top of the layer with a velocity of 540 ft/sec (i.e., at the surface of the ground) (Calculation No. 05996.02-G(P018)-2, *Soil and foundation parameters for dynamic soil structure interaction analyses, for 2000 yr return period design ground motions*, Geomatrix Consultants (Aug. 10, 1999)). See PFS Material Facts ¶¶ 86, 95-96. The State also disputes that PFS has specified the design motion at the top of the 750-ft/sec layer in the dynamic analysis of the foundations consistent with the assumption used in the development of the design motion. Bartlett & OstadanTr. at 316-20; Ostadan Dec. ¶ 9.~~

79. The State disputes PFS Material Facts Basis 3 ¶ 88 and Trudeau Dec. ¶ 63. The Applicant has not complied with NUREG-0800, SRP § 3.7.1, *Seismic Design Parameters*. In accordance with the SRP the variation in dynamic properties must be recognized in the design. To capture the variation and scattering of the data, the Applicant may change the soil shear modulus by a factor of two. In this case the Applicant has varied the sheer modulus by a factor of one and a half. Bartlett & OstadanTr. at 128-29; Ostadan Dec. ¶ 14.

80. The State disputes PFS Material Facts Basis 3 ¶¶ 94 and 95 to the extent that the mere performance of additional tests suggests that the number of tests are sufficient, or that PFS's test data are accurate or adequate or have been accurately applied. Bartlett Dec. ¶¶ 9,10.

81. The State disputes PFS Material Facts Basis 3 ¶ 96. Exhibit 9. See Utah Material Facts above. The statements is ¶ 96 are mere conclusions.

Contention Utah L

82. The State disputes that PFS has satisfied the concerns raised by the State in Basis 3 of Contention Utah L. *See* Utah Material Facts ¶¶ 83-98.

83. The State disputes that the Applicant has conducted site specific investigation and laboratory analyses that show that soil conditions are adequate for the proposed foundation loading. Utah L at 85.

~~84. PFS segmented its geotechnical analysis and design by various disciplines; by doing so, PFS has failed to integrate its various investigations and analyses into a consistent and unified design package. Ostadan Dec. ¶ 8.~~

85. The States disputes that PFS's analyses are adequate to accurately model the expected behavior of the soil foundation under static and dynamic loading. Utah L

at 85. ~~PFS, for example, has not adequately or accurately evaluated the effects of cold bonding, fling, or incline waves on the expected behavior of the soil foundation under static and dynamic loading. *See e.g.*, Ostadan Dec. ¶¶ 17, 19, 22; Bartlett ¶¶~~

86. ~~The States disputes that PFS has conducted adequate or complete investigations to determine the properties of the various materials underlying the site, especially with respect to the seismic response of the structures important to safety. Utah L at 86. *See e.g.*, Bartlett ¶¶ 20, 22.~~ Nor has the scope of PFS's investigation been sufficient with respect to the degradation of soil strength, the characterizations of soils at depth, or the correlations of the seismic refraction data with the SCPT data. Utah L at 86. *See e.g.*, Bartlett ¶ 17.

~~87. PFS initially collected seismic refraction data which suggested the shear wave velocities in the uppermost soil profile to be approximately 750 feet per second (ft/sec). Later and more reliable SCPT data show the shear wave velocities to be 540 ft/sec, thus contradicting the seismic refraction data. The SCPT data demonstrates that the uppermost soil layer is a soft thin layer. PFS used the SCPT data to revise calculation of the soil strain-compatible soil properties but it has failed to use the SCPT to revise development of the design basis ground motion. Ostadan Dec. at ¶¶ 9-12.~~

~~88. The State disputes that PFS has sufficient relevant test data to support the selection of design parameters. Utah L at 86. Because the development of the design basis ground motion did not recognize the soft thin upper soil layer, PFS's engineers have inappropriately introduced the design motion at the surface instead of below the surface on top of a competent soil layer. Ostadan Dec. at ¶¶ 10-11.~~

89. The State disputes that PFS has obtained representative undisturbed samples of each of the site soils to determine the soils dynamic properties, especially with respect to soil degradation curves. Utah L at 87. Bartlett & Ostadan Tr. at 99-101.

90. The State disputes that PFS has accurately or adequately characterized the basis for the selection of samples or conducted relevant tests to determine the soil's physical characteristics due to anticipated loading or the duration of loading during a seismic event. Utah L at 87. ~~In particular, Holtec's analysis of the pad-cask system and invalid assumptions that Holtec relied upon create significant unresolved safety concerns. Design and stability of the foundation and the supporting soil system are functions of the dynamic forces that will be imparted to them. Thus, Holtec's analysis is important because Holtec's calculation generates the seismic loads that would be acting on the pad and the soil system. Ostadan Dec. ¶¶ 20-21. *See also* Bartlett ¶ 18.~~

91. The Holtec calculation, *Multi Cask Response at the PFS ISFSI from 2000 Year Seismic Event* (Holtec International) (Aug. 20, 1999) creates numerous and significant concerns that affect the entire design package. First, Holtec placed the input motion in the wrong location when it conducted its dynamic analysis of the cask and the pad. Ostadan Dec ¶ 22. Second, Holtec assumed that seismic waves would arrive at the foundation structure vertically and failed to take into account that seismic waves may arrive at an angle which would cause larger rocking and torsional vibration than Holtec assumed. Id. Third, Holtec's nonlinear analysis inappropriately relied on one set of time histories instead of at least three. Id. ¶¶ 16 and 22. Fourth, Holtec failed to account for frequency dependency of soil springs and damping coefficients for the pads. Ostadan Dec ¶ 22. Finally, Holtec used the invalid assumption that the storage pad would act as a rigid mat when, in fact, other PFS calculations show the pad will be flexible. Id. Thus, the State disputes that PFS has demonstrated the capability of the soil's physical characteristics to withstand anticipated loading or the duration of loading during a seismic event. Bartlett ¶ 21.

92. The State disputes that PFS has shown that the static and dynamic engineering properties of the soils were properly determined and that reasonable and conservative values were used in the design. Utah L at 89. *See* Utah Material Fact ¶ 91. Holtec has a bold design that has no redundancy built into it. Holtec assumes that the cask and pad will slide in a controlled manner during a large earthquake and that this will reduce the seismic loads on the pads and soils below. Because there is no redundancy in Holtec's expected design the failure of the casks to slide will impart forces greater than anticipated to the pad, the soil-structure and the soil system. Holtec for example, has not considered the effects of cold bonding where over time local deformation and redistribution of stresses may occur and create a bond between the cask and the pad. Ostadan Dec. ¶ 26. *See also* Bartlett ¶ 21.

93. The State disputes that PFS has explained how the developed data were used in the design analysis, how the test data were enveloped for design, and why the design envelope is conservative. Utah L at 89. PFS used the wrong parameters in estimating the foundation loading stability analysis and these incorrect assumptions may require the use of a design value close to or in excess of 1 g. Ostadan Dec. ¶ 27. *See also* Bartlett ¶¶ 20, 25.

94. The PFS site is one of seismic complexity. The State disputes that PFS has adequately or accurately assessed potential earthquakes and resulting ground motions, especially with respect to incline waves, variation in phasing of the time histories and "fling." Utah L at 90. PFS incorrectly assumed that propagating waves

~~from an earthquake would arrive vertically but failed to consider that waves would arrive at an angle. Ostadan Dec. ¶ 22. Nor has PFS used a sufficient number of time histories in its nonlinear analysis of the casks on the pad, to take into account the sensitivity of the nonlinear analysis to phasing. Ostadan Dec. ¶ 18. In addition, PFS has ignored the effects of "fling" (*i.e.*, a large pulse of energy delivered in a short burst). Id. ¶ 17. PFS's failure to accurately or adequately assess these effects in its analysis of soils, soil-structure or design basis has serious safety implications because the forces and the frequency of those forces may be greater or different than those anticipated by PFS's analysis.~~

~~95. PFS has inadequately analyzed the overturning of the canister transfer building by ignoring the effect of the rotational mass moment of inertia, by ignoring the effect of coupling between two horizontal directions, and by incorrectly assuming the mass center of the building to be at the center of the mat. Ostadan Dec. ¶ 29. These omissions and inadequacies in the canister transfer building Calculation No. 05996-02-G(B)-13 (*Stability Analyses of the Canister Transfer Building Supported on a Mat Foundation*, Rev. 3, Stone & Webster (June 19, 2000) do not support PFS's claims in the SAR that Calculation No. G(B)-13 determined the CTB to be stable with respect to overturning due to static and dynamic load conditions. SAR at 4.7-8e (Rev. 17). Nor does Calculation No. G(B)-13 demonstrate why the design envelope is conservative or whether PFS correctly applied the developed data in its design analysis. Ostadan Dec ¶ 29.~~

96. The State disputes that PFS has made an attempt to compare the site specific data with the published data. For example, PFS has not conducted strain controlled cyclic triaxial tests to determine the large strain shear modulus and damping values for the Bonneville Clay. Bartlett Dec. ¶ 28. Utah L at 90-91

97. The State disputes that PFS has made an attempt to compare the site specific data with the published data. For example, PFS has not conducted cyclic strain-controlled triaxial tests to determine the large strain shear modulus and damping values for the Bonneville Clay. Utah L at 90-91 Bartlett Dec. ¶ 14.

98. The tests conducted to date by PFS do not allow a reviewer to make a reasonable judgment about how the soil will perform under anticipated static and dynamic loading of the short and long term conditions. Utah L at 92. Ostadan Dec.; Bartlett Dec.

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
	)	January 30, 2001

DECLARATION OF DR. WALTER J. ARABASZ

I, Dr. Walter J. Arabasz, declare under penalty of perjury and pursuant to 28 U.S.C. § 1746, that:

1. I am Research Professor of Geology and Geophysics and Director, University of Utah Seismograph Stations, University of Utah, Salt Lake City, Utah. I have 30 years professional experience in scientific research, occasional teaching, consulting, and publishing articles in observational seismology, seismotectonics, and earthquake hazard analysis with a primary focus on Utah and the Intermountain West. Since 1977 I have routinely provided professional consulting services on earthquake hazard evaluations for dams, nuclear facilities, and other critical structures. During the past decade I have had major involvement in assessing vibratory and fault-displacement hazards for the high-level nuclear waste repository at Yucca Mountain, including peer review, review of technical reports, and serving on expert teams for seismic source characterization for probabilistic hazard analyses. My service on numerous national and state advisory boards and panels has included — relevant to this filing — serving on the National Research Council's Panel on Seismic Hazard Evaluation (1992-96), the Utah Seismic Safety Commission (currently as chair) since 1994, and numerous panels and work groups under the National Earthquake Hazards Reduction Program since the early 1980s. My curriculum vitae, was submitted as Exhibit A to my January 26, 2000 Declaration and gives greater detail about my professional qualifications, experience and publications.

2. I was designated one of the State's testifying expert with respect to Contention L, Basis 2, on June 28, 1999. I have reviewed the Applicant's SAR sections, and

updates thereof, relating to its earthquake hazards investigation of the proposed site, and relevant calculations, reports, and other documents prepared by the Applicant or its contractors and submitted to the NRC or produced to the State in discovery. I have participated in answering the Applicant's discovery to the State as well as assisted in the preparation of discovery for the State directed to the Applicant. I am also familiar with NRC regulations, Rulemaking Plan to amend Part 72, guidance documents, the methodologies for earthquake hazard evaluation and new developments pertaining to the latter.

3. I have reviewed the NRC Staff's preliminary and final Safety Evaluation Report ("SER") for the PFS facility, dated December 15, 1999 and September 29, 2000 respectively, as well as the Staff's Position on Utah L (April 28, 2000).

4. I assisted in the preparation of the State of Utah's Request for Admission of Late-Filed Modification to Basis 2 of Utah Contention L, filed on January 26, 2000 and the State's November 9, 2000 Request for Admission of Late-filed Modification to Basis 2 of Utah Contention L.

5. I was deposed by Private Fuel Storage ("PFS") on October 18, 2000. I was present at the State's deposition of PFS's seismic hazards witnesses, Drs. Kevin J. Coppersmith and Robert R. Youngs, held on October 19, 2000.

6. I have reviewed portions of PFS's Motion for Summary Disposition for Utah Contention L (December 30, 2000), its Statement of Material Facts on Which No Genuine Dispute Exist, and attachments that are relevant to Contention L, Basis 2, as well as the State's response thereto. I provide this declaration in support of the State Response to PFS's Motion with respect to Contention L, Basis 2.

7. In previous submissions to the NRC, I have stated that PFS has not conducted a fully deterministic seismic hazard analysis ("DSHA") as required by 10 CFR § 72.102(f)(1) and, by reference, 10 CFR 100 Appendix A. *See e.g.*, State of Utah's Objections and Response to Applicant's Second Set of Discovery Requests With Respect to Groups II and III Contentions at 33-38 (June 28, 1999); *see also* Exhibit 11, Arabasz Tr. at 46-49. ~~The NRC Staff has acknowledged that the DSHA performed by Geomatrix Consultants, Inc. and reported in the 1997 SAR and their updated DSHA reported in April 1999 "did not meet the deterministic requirements in 10 CFR 100 Appendix A." NRC Staff's Objections and Responses to the "State of Utah's Sixth Set of Discovery Requests Directed to the NRC Staff (Utah Contention L)" (February 14, 2000),~~

~~Response to Requests for Admissions 1 and 2 at 7-8. The importance of a valid DSHA, other than being required by current NRC regulations, is that it establishes a benchmark to which results of any probabilistic seismic hazard analysis ("PSHA") can correctly be compared. If the DSHA results reported by PFS did not meet NRC requirements, then they cannot validly be compared to PFS's PSHA results, such as done for the NRC Staff by Stamatakos et al., to evaluate the conservatism of the PSHA results.~~

~~8. In developing site ground motion adjustment factors for the design basis ground motion, Geomatrix did not account for seismic cone penetration test ("SCPT") data obtained in 1999 which show that the average shear-wave velocity in the uppermost 10 feet of the soil profile underlying the PFS site is about 540 feet per second. SAR (Rev. 9) at 2.6-30 and Figure 2.6-28. It was only after my deposition that these data were brought to my attention. The soil profile used instead by Geomatrix is one in which the average shear-wave velocity of the topmost layer (45 feet thick) is 750 feet per second, with a range from about 700 to 790 feet per second. Geomatrix Report (February 1999) at F-8 and Figure F-4. The latter soil profile was based on lower resolution shear-wave velocity information from seismic refraction surveys reported by Geosphere Midwest in 1997. Failure to correctly account for the material properties of the uppermost soil layer would affect the outcome of the ground motion analysis, regardless of whether the analysis is deterministic or probabilistic. PFS may be re-analyzing this issue but to date they have not done so. *See* PFS's letter to the NRC dated December 22, 2000 ("PFS Dec. 22, 2000 letter"), submitted to the Atomic Safety and Licensing Board on December 28, 2000, by PFS's counsel, Jay E. Silberg. Because earthquake ground motion must be expressed in a way that can be applied to engineering analyses, the seismic input or control motion may have to be specified at an appropriate point in the soil profile beneath the site rather than at the ground surface. NUREG-0800 § 3.7.1(I)(1). I defer to the State's expert Dr. Ostadan for a more complete discussion of the implications of this issue. *See* Ostadan Dec.~~

Dr. Walter J. Arabasz

January 30, 2001

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
	)	January 30, 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 profession engineer in the State of Utah.

2. Prior to this University of Utah faculty position, I worked for the Utah Department of Transportation ("UDOT") as a research project manager and have held a number of other positions with UDOT and other employers where I have applied my expertise in geotechnical engineering, earthquake engineering, geoenvironmental engineering, applied statistics, and project management. My curriculum vitae was submitted in this proceeding with the State's Objections and Response to Applicant's Second Set of Discovery Requests with respect to Groups II and III Contentions (June 28, 1999). My updated curriculum vitae is attached hereto.

3. I have also worked as a consulting engineer for 1996-1996 for Woodward-Clyde Consultants in Salt Lake City, mainly as a geotechnical designer for the I-15 Reconstruction Project.

4. Prior to my position at Woodward-Clyde Consultants, I worked from 1991-1995 for Department of Energy's ("DOE") contractor, Westinghouse, at the DOE Savannah River Site ("SRS"), near Aiken, South Carolina. I was Westinghouse's

principal geotechnical investigator on a multi-disciplinary team overseeing the seismic qualification of the ITP/H-Area high-level radioactive waste storage tank farm for the SRS; the principal geotechnical investigator reviewing the Safety Analysis Report ("SAR") for the seismic qualification of Defense Waste Processing Facility ("DWPF"), which is a high-level radioactive waste vitrification and storage facility at the SRS, and the project manager for the design of a hazardous waste landfill closure at the SRS. I used NRC regulatory guidance documents for my review of these projects.

5. I was designated as one of the State's testifying expert for this proceeding on June 28, 1999. I have reviewed the Applicant's SAR sections, and updates thereof, relating to its geotechnical investigation of the proposed site, and relevant calculations, reports, and other documents prepared by the Applicant or its contractors and submitted to the NRC or produced to the State in discovery. I have participated in answering the Applicant's discovery to the State as well as assisted in the preparation of discovery for the State directed to the Applicant. I am familiar with and have applied NRC regulations and guidance documents as they relate to geotechnical review.

6. I was deposed individually and as a panel member with Dr. Farhang Ostadan by Private Fuel Storage ("PFS") on November 16 and 17, 2000. I was present at the State's deposition of PFS's geotechnical witnesses, Drs. Paul J. Trudeau and Thomas Y. Chang, held on November 14, 2000.

7. I have reviewed PFS's Motion for Summary Disposition for Utah Contention L (December 30, 2000), its Statement of Material Facts on Which No Genuine Dispute Exist, and all attachments thereto. I provide this declaration in support of the State of Utah's Response the PFS's Motion for Summary Disposition. The following statements in this declaration are based on my experience, training, and best professional judgment.

8. I have reviewed the State's Statement of Disputed and Relevant Material Facts (January 30, 2001), which includes citations to my deposition testimony. The opinions expressed in my deposition remain the same, ~~and indeed, have been reinforced due to PFS's decision that it must perform additional geotechnical characterization which PFS states results from the need to include data it had previously failed to incorporate. *See* PFS's letter to the NRC dated December 22, 2000, submitted to the Atomic Safety and Licensing Board on December 28, 2000, by PFS's counsel, Jay E. Silberg.~~ In addition to this declaration, the transcript of my deposition describes the concerns I still have with PFS's soils and

subsurface investigation.

9. PFS has not performed the density of spacing as outlined in NRC Regulation Guide 1.132, "Site Investigations for Foundations of Nuclear Power Plants," for the pad emplacement area. Nor has PFS performed continuous sampling for each major structure as recommended by Reg. Guide 1.132 Part C6. Sampling. *See* Bartlett & Ostadan Tr. at 92, 107, 127-28, 560.

10. PFS has not considered the potential spatial variation of soil properties (*e.g.*, shear wave velocity, undrained shear strength) in a systematic way in its field investigations and design calculations. Because uncertainty has not been treated in a statistical manner, it is not possible to determine the reliability of the foundation system to earthquake loading. *See* Bartlett & Ostadan Tr. at 237-39.

11. The foundation stability calculations have not accounted for the potential variation of shear strength properties across the pad emplacement area. Cone penetrometer tip stress values have been taken across the PFS site that suggest spatial variation (both vertical and horizontal); however, no statistical assessment of the impact of this variation has been made on the factor of safety. *See* Bartlett & Ostadan Tr. at 240-52.

12. PFS has based the seismic design of the foundation systems for the pad emplacement area on very limited laboratory testing from one borehole. The applicant has not demonstrated that this single datum is representative of the foundation soil for the entire pad emplacement area. Such extreme under-sampling may be subject to bias and could potentially lead to overestimation of shear strength capacity available to resist earthquake forces. *See* Bartlett & Ostadan Tr. at 235-39.

13. The calculation for seismic sliding of the pads, Stability Analyses of Storage Pads, Cal No G(B)04 (Rev 6), Stone & Webster, uses an direct shear undrained shear strength value of 2.1 ksf obtained from borehole C-2. This undrained shear strength is described as a "lower bound estimate"of the undrained shear strength due to seismic loading. However, direct shear test results for this same layer underneath the Canister Transfer Building show an undrained shear strength of 1.75 ksf at a normal stress of 2.0 ksf. (2.0 ksf is the approximate vertical stress at the base of the cask storage pads.). Thus, 2.1 ksf does not represent a "lower bound estimate" of undrained shear strength for this critical layer and a potentially unconservative shear strength has been used in the design of the pads.

14. PFS has not compared the reasonableness of the undrained shear strength values obtained from the laboratory test program with correlations that are common in the geotechnical literature and commonly used in engineering practice.

15. PFS has not considered shear strength anistropy, which is common in these sediments, in determining foundation stability. *See* Bartlett & Ostadan Tr. at 186.

16. Properties of critical foundation layers should not be averaged with properties from other dissimilar layers. For example, Calculation 05996.02, G(B) No. 5-2, Rev. 2, Tables 2 and 3 average the soil properties for in the upper 30 feet of the profile. These averages are misleading because they include materials of dissimilar types.

~~17. The development of the design basis ground motion did not consider the shear wave velocity data obtained from the seismic cone penetrometer. Because these data have not been used, it is not possible to determine if the correct earthquake loading has been properly determined for the foundation soils. *See* Bartlett & Ostadan Tr. at 127. PFS has decided to re-evaluate its design basis ground motion. *See* Exhibit 9. All calculations that use the design basis ground motion as an input to the dynamic loading analyses will be affected by the revision and will need to be re-analyzed. For example, the change in design basis ground motion will affect the following calculations that I reviewed as part of my evaluation of PFS's soils investigation and analysis: Stability Analyses of Storage Pads, Calculation No G(B)04 and Stability Analyses of the Canister Transfer Building Supported on a Mat Foundation, Calculation No G(B)13.~~

18. PFS has not considered potential moisture content changes in the foundation soils with time and how these changes may affect the undrained shear strength used in design of the foundation systems. Unsaturated, fine-grained soils can derive a significant portion of their cohesion (*i.e.*, undrained shear strength) from matrix suction (*i.e.*, negative pore pressure) that forms in the soil due to partial saturation. Thus, the undrained shear strength of an unsaturated, fine-grained soil can be sensitive to changes in moisture content. PFS has not assessed how potential moisture content changes and the subsequent shear strength changes may impact the seismic design of the foundations. *See* Bartlett & Ostadan Tr. at 216-18.

19. The soil-cement strategy will not preclude changes in moisture content with time in the untreated native soils immediately below the pad foundations. The geotechnical literature discusses cases of change in moisture content in a foundation soil, even after it has been capped by a relatively impermeable barrier.

For example, Holtz and Kovacs (1981) discuss this effect:

A common occurrence is that a pavement or building is constructed when the top soil layer is relatively dry. The structure covering the soil prevents further evaporation from occurring and the soils increase in water content due to capillarity; then the soil may swell.

An Introduction to Geotechnical Engineer, p. 186, Robert D. Holtz, and William D. Kovacs, Prentice Hall, Englewood Cliffs, New Jersey, 1981.

It is not my opinion that the soils at the PFS site are susceptible to swell. However, the important point from this statement is the capping of a soil layer does not preclude changes in moisture content because of capillary action and unsaturated flow of water through a fine-grained soil. Bartlett & Ostadan Tr. at 216-218.

~~20. Foundation stability calculations, Calculation No G(B)04, assume that the maximum inertial force transmitted to the foundation system and soils cannot exceed the friction force between the bottom of the cask and the top of the concrete pad. Based on an assumed upper limit of the coefficient of sliding friction of 0.8, the maximum inertial force transmitted to the foundation system has been limited in the design of the foundation to 0.8 times the combination of the static and dynamic normal forces. This assumption may not represent the upper bound for dynamic loading and inertial forces may larger than those used by PFS.~~

~~21. In the sliding analyses for the pad foundations, PFS has not considered the following items which could lead to higher dynamic loadings to the foundation soils than was used in the calculations: (a) the potential for cold bonding between the casks and the concrete pad; (b) the flexibility of the concrete pad during earthquake motion; (c) the affect that rocking has on concentrating the stress and potentially prohibiting sliding; (d) rocking coming from non-vertically propagating surface waves; (e) and other environmental changes that might change the assumed upper limit of the coefficient of sliding. *See* Ostadan Dec. ¶¶ 16, 22; Bartlett & Ostadan Tr. at 370, 374.~~

~~22. PFS states that the factor of safety against sliding of the pad foundation with in the soil-cement treated soil is above 1.1 when the unconfined compressive strength of the soil-cement is above 125 psi. However, PFS's proposed design assumes that the soil-cement mat is placed in compression only in the horizontal~~

~~direction and that the soil-cement mat will behave as an integral mat during the earthquake and transfer seismic-induced shear stresses over a large area. PFS has not demonstrated the reasonableness of these assumptions. Further, PFS has not considered the following stresses and how they may impact the seismic behavior of the soil-cement mat. Bartlett & Ostadan Tr. at 210, 217, 222.~~

- ~~Bending and tensional stresses introduced in the soil cement mat during the earthquake by horizontally propagating and inclined waves~~

- ~~Stress concentrations at the pad and soil-cement mat interface due to non-uniform thickness and large differences in stiffness between the concrete pad and the soil-cement mat~~

- ~~Shrinkage cracks that will develop in the soil-cement mat due to drying and other environmental conditions.~~

~~23. PFS's proposed soil-cement strategy to improve the dynamic sliding and bearing capacity of layer 1 for the pad emplacement area is still in its conceptual stage. In my opinion, PFS has not demonstrated that the soil-cement strategy will be sufficient to resist seismic loading. There are unresolved design concerns that PFS has not considered, such as the stresses and cracking addressed above. *See* Bartlett & Ostadan Tr. at 216-17. These issues cannot be resolved until PFS completes the design and demonstrates its adequacy with appropriate testing and calculations.~~

24. While PFS may prepare design specification for the construction and testing of the soil-cement at the construction phase of the project, the State disputes that PFS has demonstrated that the soil-cement strategy will be sufficient to resist seismic loading. PFS has admitted that the design is still conceptual. Trudeau tr. 148. There are design issues that PFS has not considered, such as the permeability of the soil cement mix, the behavior of the soil cement on seismic loading and shrinkage and cracking of the soil cement due to environmental factors. Bartlett & Ostadan tr. at 216-17. These issues cannot be resolved until PFS completes the design and demonstrates its adequacy with appropriate testing and calculations.

25. PFS has potentially used non-conservative estimates of the undrained shear strength in the dynamic bearing capacity calculations for the canister transfer building and has used data that is not located near this building.

- A weighted average for the undrained shear strength of 3.18 ksf was used for the upper 28 feet of the profile based on a unconsolidated undrained ("UU") test of 2.2 ksf from borings #4 and C-2 and adjusting this value by 1.64 for the deeper soils from 12 to 28 feet. However, borings #4 and C-2 are not within the footprint of the Canister Transfer Bldg. Both are located more than 1000 feet away from the building.

- The CPT (CPT 37) used to adjust for the unconsolidated-undrained ("UU") shear strength for the deeper layer (is located within the footprint of the Canister Transfer Bldg., more than a 1000 feet from the location of the borehole for the UU testing. This distance is too far and makes the adjustment factor of 1.64 applied to the UU data meaningless.

See "Document Bases for Geotechnical Parameter provided in Geotechnical Design Criteria," Cal No. G(B)05, Rev 2, Stone & Webster; and Calculation No G~~(B)13.~~

26. PFS asserts that it may conduct some future borings in 2001 in a generalized but non-specific location relating to non-safety related structures. PFS Material Fact Basis 3 ¶ 17. Moreover in appears that PFS intends to acquire additional downhole velocity data. *See* Declaration of Robert Y. Youngs at 4, Exhibit D to PFS's Motion. This suggests that PFS has either not collected enough data to support its subsurface investigation or PFS's is improperly implying that such future data should be evaluated in this proceeding.

27. The resonant column tests performed by PFS are not a form of strain-controlled cyclic triaxial tests. The two test apparatuses can be significantly different. Bartlett & Ostadan tr. 302.

28. PFS has not adequately determined large strain modulus and damping values for dynamic analyses using representative sampling and testing for the upper 30 feet of the soil profile.

Executed this 30th day of January 2001.

By: _____
Steven F. Bartlett, Ph.D., P.E.

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
	)	January 30, 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. I was designated one of the State's testifying expert for this proceeding on January 31, 2000. I have reviewed the Applicant's SAR sections, and updates thereof, relating to its geotechnical investigation of the proposed site, and relevant calculations, reports, and other documents prepared by the Applicant or its contractors and submitted to the NRC or produced to the State in discovery. I have participated in answering the Applicant's discovery to the State as well as assisted in the preparation of discovery for the State directed to the Applicant. I am familiar with and have applied NRC regulations and guidance documents as they relate to geotechnical review.

5. I was deposed on a panel with Dr. Steven F. Bartlett by Private Fuel Storage ("PFS") on November 16 and 17, 2000. I was present at the State's deposition of PFS's geotechnical witnesses, Drs. Paul J. Trudeau and Thomas Y. Chang, held on November 14, 2000.

6. I have reviewed PFS's Motion for Summary Disposition for Utah Contention L (December 30, 2000), its Statement of Material Facts on Which No Genuine Dispute Exist, and all attachments thereto. I provide this declaration in support of the State of Utah's Response to PFS's Motion for Summary Disposition.

7. I have reviewed the State's Statement of Disputed and Relevant Material Facts (January 30, 2001), which includes citations to my deposition testimony. The opinions expressed in my deposition remain the same, ~~and indeed, have been reinforced due to PFS's decision that it must perform additional geotechnical and foundation evaluations which PFS states results from the need to include data it had previously failed to incorporate. *See* PFS's letter to the NRC dated December 22, 2000 ("PFS Dec. 22, 2000 letter"), submitted to the Atomic Safety and Licensing Board on December 28, 2000, by PFS's counsel, Jay E. Silberg.~~

~~8. The major concern I have with PFS's geotechnical analysis of the site is that PFS has segmented the investigations and analyses by various disciplines and PFS has failed to integrate those various investigations and analyses into a complete and unified design package. While it is important to evaluate the individual components of PFS's investigations and analyses, it is critical to look at those issues as a whole. In using the soil properties for design, for example, PFS's engineers and seismologists used different variability factors for the same data. This disparate treatment of the data has caused inconsistent and inadequate~~

consideration of the effect of soil variability for design.

9. PFS initially obtained seismic refraction data which suggested the shear wave velocities in the top 10-30 feet of the soil profile to be approximately 750 feet per second (ft/sec.). The later seismic cone penetration test ("SCPT") data shows that the mean value of shear wave velocities in the shallow layer is approximately 540 ft/sec. The SCPT data demonstrates that the uppermost layer at the PFS site is a soft thin layer. Bartlett & Ostadan Tr. 316-320.

10. Basis 2 of Contention L relates to the development of ground motions. Once a design basis ground motion has been developed, engineers take that motion and apply it in their analysis; the engineer must decide at which point in the soil profile this motion should be introduced (*i.e.* the control point). If the soil profile has a thin soft layer, the design motion should be specified as an outcrop at the top of the competent material. NUREG-0800, Standard Review Plan ("SRP") § 3.7.1, *Seismic Design Parameters*; Bartlett & Ostadan Tr. 335.

11. In my opinion there are two correct ways that PFS could apply its ground motions. First, the seismologists from Geomatrix who developed the design basis motion could recognize the soil profile, including the slower velocity layer from the SCPT data, in their calculations. PFS, however, failed to account for the SCPT data in developing ground motions. Alternatively, PFS could recognize that the ground motions were developed for a soil profile that has a velocity of 750 feet per second in the upper layers. Then PFS could use the ground motion that Geomatrix developed by putting it in the soil column where the shear wave velocity of 750 ft/sec has been established. Bartlett & Ostadan Tr. 339.

12. The Applicant has not properly developed or employed the shear wave velocity data from the site. In developing the probabilistic ground motions, Geomatrix used shear wave velocities of 750 ft/sec. from the seismic refraction data for the shallow layer and not the mean value shear wave velocity value of approximately 540 ft/sec from the SCPT data. Bartlett & Ostadan Tr. 320. Furthermore, PFS has introduced the control point at the surface, not at the top of the competent layer (*i.e.*, approximately 30 feet below the surface of the site). Bartlett & Ostadan Tr. 335-36.

13. PFS did not re-analyze the seismic refraction data to ascertain whether the shear wave velocity values in the uppermost layer are less than those obtained in the seismic refraction data. Failing to choose the correct properties for the upper

~~layers will impact the layers below and will probably result in greater velocities than those reported by Geomatrix. Bartlett & Ostadan Tr. 319-22. This is important because it may also impact the design motion generated by Geomatrix.~~

14. In the development of soil and foundation parameters, Calculation No. G(P018)-2 *Soil and foundation parameters for dynamic soil-structure interaction analysis, 2000-year return period design ground motions* (Aug. 10, 1999), Geomatrix varied the properties of the upper 30 feet by increasing and reducing the soil shear modulus by a factor of one and a half. Geomatrix conducted no statistical analysis to justify whether this variation is sufficient nor did Geomatrix follow NRC SRP 3.7.1 and vary the shear modulus by a factor of two. On the other hand, Geomatrix chose to change the properties below 30 feet, which Geomatrix considered to be less well known, by a factor or two. Bartlett & Ostadan Tr. 330.

15. In the calculation of the seismic analysis of the Canister Transfer Building (Calculation No. 05996.02-SC-5, *Seismic Analysis of Canister Transfer Building*, Stone & Webster (Aug. 28, 1999)), Stone & Webster chose to vary the shear modulus by a factor of one and a half for all layers, shallow and deep. This is inconsistent with the assumptions made by Geomatrix for deep soil layers and is not sufficient for inclusion of soil variability.

16. Unexplained safety concerns still remain because Geomatrix limited the variability factor of 1.5 to the upper 30 feet but recognized that a larger variability was needed for the deeper layers. This is inconsistent with Stone & Webster's use of a variability factor of 1.5 for all layers. The adequacy of the soil investigation and variability of the soil properties are important design considerations. PFS needs to characterize the data to be able to capture the variance to establish the upper bound, lower bound, and mean of the soil shear modulus. Then a determination can be made whether a limited or larger variation should be considered. Bartlett & Ostadan Tr. 330-33.

~~17. Geomatrix developed time histories in Calculation No. G(PO18)-3 *Development of Time Histories for 2,000-Year Return Period Design Spectra* (August 24, 1999) (Bartlett & Ostadan Tr. Exh. 67), which needed to be compatible with the design response spectrum. PFS's efforts failed in part because PFS did not look at the entire design package, in particular the nonlinear analysis of the casks on the pad (prepared by Holtec) and impacts of pulses caused by "fling." Bartlett & Ostadan Tr. 346-354, 457.~~

18. Geomatrix prepared one set of time histories consisting of three components in Calculation No. G(PO18)-3. Based on my experience, the common industry practice for nonlinear calculations is to use at least three sets of time histories because the nonlinear analysis is sensitive to phasing. In order to cover the variation of the phasing in the design, a minimum of three (or sometimes four) time histories are used. This is an important safety consideration that PFS has failed to address. Bartlett & Ostadan Tr. 345-355.

19. Geomatrix has recognized that "fling" pulses should be included in the time history but PFS has no parametric study in the design package to reveal the impact of the pulses on the design. Such pulses could be symmetric, asymmetric, one-sided or two-sided. Bartlett & Ostadan Tr. 346.

20. PFS could address the effects of fling in two ways. It could go back and look at the dynamic analysis of the casks and the pads and the Canister Transfer Building ("CTB") and show whether those seismic responses are sensitive to pulses or not. PFS has not done so. Alternatively, PFS could have used enough time histories (at least three), with variation in pulses, to ensure the responses are not sensitive to variation of time histories. Bartlett & Ostadan Tr. 350-51. PFS has not done this either. Therefore, PFS's failure to give adequate consideration to the variation in ground motion may have a significant impact on seismic loading of the foundations and the design.

21. I have significant concerns with Holtec's analysis of the pad-cask system and with the invalid assumptions that Holtec relied upon. This is important because stability and design of the soil-foundation system are a function of the dynamic forces that will be considered for design. In order to evaluate the adequacy of the foundation design and the bearing soil, it is critical to understand the nature of the loads and where they are coming from.

22. Holtec calculation, *Multi Cask Response at the PFS ISFSI from 2000 Year Seismic Event* (Holtec International) (Aug. 20, 1999), is an important calculation for the foundation pad design and the soil stability under the pads because it is this calculation that generates the seismic loads that would be acting on the pads. There are a number of concerns with the calculation that affect the entire design package. First, Holtec placed the input motion at the top of the soft soil layer profile when it conducted its dynamic analysis of the cask and the pad. As described in ¶¶ 11 and 12 above, this is inappropriate.

Second, because the PFS site is located close to a number of major active faults (within approximately four to six miles), seismic waves arriving at the foundation structure are not necessarily vertically propagating waves, which Holtec assumed them to be. Based on my experience and the literature, there is a distinct possibility that the waves may come at an angle, and waves at an angle tend to cause larger rocking and torsional vibration above and beyond what is captured by the assumption that the waves will be vertically propagating. Bartlett & Ostadan Tr. 359-60. PFS could correct this oversight by conducting parametric studies to determine the effect of waves arriving at an angle. But PFS has done no such studies.

Third, Holtec's nonlinear analysis may be sensitive to phasing of the input motion and thus multiple time histories should be used. *See* ¶¶ 17-18 above.

The other concerns I have with Holtec's calculations, discussed in greater detail below, are: Holtec's calculation of soil spring and damping; the assumption that the pad will act as a rigid mat; and ignoring the pad to pad interaction and the sliding assumptions Holtec has built into the cask-pad system.

23. Calculations performed for the foundation spring and damping coefficients for the CTB recognize these coefficients are a function of frequencies and show that they are highly frequency dependent. In Holtec's calculations, however, this aspect disappears and frequency dependency has been ignored.

24. Holtec also incorrectly assumed that the pad is rigid. The results generated by Holtec were given to another PFS contractor, International Civil Engineering Consultants ("ICEC") for a subsequent stress analysis of the pads. *See* PFS Calculation No. G(PO17)-2, *Storage Pad Analysis and Design* by International Civil Engineering Consultants (Sept. 23, 1999).

25. When ICEC applied the loading coming from the cask to the pad, they used the computer program, SASSI, which showed that the displacements varied by more than a factor of two and a half from one corner of the pad to the other. Calculation no. G(PO17)-2 at p. 214, table 5.2.5-1 shows that the vertical displacement of the pad varies by a factor larger than 2.5 from one node to the other. This is clearly an indication that the pad is not rigid and that Holtec's assumption is invalid. Thus, the soil spring and damping coefficients generated by Holtec and the assumption made for smooth sliding of the casks on the pad are not correct.

26. Holtec has the very bold philosophy that the cask will side on the pad in a controlled manner during a large earthquake. There is no other redundancy built into Holtec's expected design. But such a bold assumption is negated by the potential that cold bonding between the cask and the pad may occur over time. When two bodies (casks and pad) with each cask having a weight of approximately 350 kips are in contact, some local deformation and redistribution of stresses may occur at the points of contact which would create a bond, and this would not allow the cask to slide on the pad or move smoothly during an earthquake. Thus, Holtec's assumption that sliding will reduce the seismic forces is incorrect. In this instance, the seismic loads would be greater than assumed and it is questionable whether the soils beneath the pad will have the capacity to sustain that additional load. Bartlett & Ostadan Tr. 365-368, 370.

27. The overturning and sliding stability of the pads (SAR at. 2.6-59, Rev. 13 and the supporting calculation) are based on the maximum peak ground acceleration of 0.53g in the vertical direction. PFS has used the wrong parameters in estimating the foundation loading stability analysis. First, the ICEC calculations show that the pad will not behave as a rigid mat. Second, the natural frequency of the foundation in the vertical direction for the lower bound, mean and upper bound soil cases is in the range of approximately 5 to 8 hertz, depending on the soil case. The design response spectrum for those natural frequencies would require the use of a value close to or in excess of 1 g rather than the peak ground acceleration of .53 g used by Stone and Webster in its stability evaluation. Bartlett & Ostadan Tr. 378.

28. In the latest revision of the SAR, PFS included a shear key one-foot deep around the Canister Transfer Building to improve the shear resistance against sliding. In the revised calculation it is shown that the factor of safety is as low as 1.1. Calculation No. 05996-02-G(B)-13 *Stability Analyses of the Canister Transfer Building Supported on a Mat Foundation*, Rev. 3, Stone & Webster (6/19/00) at 13. This calculation relies on the passive resistance behind the one-foot shear key to develop the resisting forces against sliding. The calculation is not adequate for the following reasons:

A shear strength value of 1.8 ksf has been used based on the laboratory test results. This assumption ignores the fact that part of the shear strength has already been mobilized (Calculation No. 05996.02-G(P018)-2, *Soil and foundation parameters for dynamic soil structure interaction analyses, for 2000 yr return period design ground motions*, Geomatrix Consultants (Aug. 10, 1999)) due to the free-field wave propagation, and the full soil shear strength is not

~~available to resist the inertia load of the structure. Bartlett & Ostadan Tr. 185-86.~~

~~While the passive soil pressure is used on one side of the shear key, the static and seismic soil pressures acting on the other side of the mat and the key (6-foot thick) have been ignored.~~

~~Since the soil behind the face of the mat has low overburden pressure, the passive resistance will actually develop behind the key on the inner side of the mat where the overburden of the building confines the soil. The passive resistance under the mat mobilizes the passive zone and develops vertical loads acting locally under the mat. PFS's analysis is faulty because PFS has not considered the passive soil and its reaction under the mat in its stability analysis of the building and design of the mat.~~

~~29. In § 4.7.1.5.3 of the SAR, PFS relies on Calculation No. 05996-02-G(B)-13 for its assertion that it has "evaluated the stability of the Canister Transfer Building and determined it is stable with respect to bearing capacity, overturning, and sliding due to static and dynamic load conditions." SAR at 4.7-8e (Rev. 17). PFS has inadequately analyzed the overturning of the Canister Transfer Building. In Calculation No. 05996-02-G(B)-13 (*Stability Analyses of the Canister Transfer Building Supported on a Mat Foundation*, Rev. 3, Stone & Webster (June 19, 2000)), PFS has calculated a factor of safety of 1.13 for the overturning analysis but this calculation is inadequate for the following reasons:~~

~~For the stability analysis of the Canister Transfer Building (Calculation No. G(B)-13), seismic loads are obtained by multiplying the mass at each elevation by the acceleration response from the dynamic analysis, thus ignoring the effect of the rotational mass moment of inertia. The overturning moment should include the moment caused by the rotational mass moment of inertia at all elevations. PFS failed to consider the effect of rotational mass moment of inertia for the computation of the overturning moment which results in PFS under-estimating the overturning moment.~~

~~PFS estimated seismic load by multiplying mass times acceleration but this ignores the coupling from the two horizontal directions. Seismic loads from the dynamic analysis of the building including the coupling from the two horizontal directions should be used in the stability analysis. PFS has ignored the effect of coupling between horizontal responses in the design and again has~~

~~under-estimated the overturning moment.~~

~~To compute the resisting moment, PFS assumed the mass center of the building to be at the center of the mat and ignored the mass eccentricity at various elevations, which may have overestimated the resisting moment. The actual mass centers at each elevation should be used to compute the moment. PFS has failed to consider the actual mass centers in calculating the resisting moment.~~

~~From the above, I conclude that PFS cannot sustain its statement in the SAR.~~ Further, the use of the developed data in PFS's design analysis does not demonstrate that the design envelope is conservative. *See* Contention Utah L at 89.

Executed this 30th day of January 2001,

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