

## RELATED CORRESPONDENCE

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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSIONOFFICE OF THE SECRETARY  
RULEMAKINGS AND  
ADJUDICATIONS STAFFBEFORE 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

February 15, 2002

STATE OF UTAH'S OBJECTIONS AND RESPONSE TO  
APPLICANT'S EIGHTH SET OF FORMAL DISCOVERY REQUESTS  
TO INTERVENOR STATE OF UTAH

The State responds to Applicant's February 5, 2002 Eighth Set of Discovery Requests ("Applicant's 8th Set"), which relate exclusively to Contention Utah QQ, a contention that has now been incorporated into unified contention Utah L/QQ.

## GENERAL OBJECTIONS

These objections apply to the State of Utah's responses to all of the Applicant's Eighth Set of Discovery Requests.

1. The State of Utah objects to the Applicant's instructions and definitions on the grounds and to the extent that they request or purport to impose upon the State any obligation to respond in manner or scope beyond the requirements set forth in 10 CFR §§ 2.740, 2.741 and 2.742.

2. The State of Utah objects to Applicant's Request for Production of Documents to the extent that it requests discovery of information or documents protected under the attorney-client privilege, the attorney work-product doctrine and limitations on discovery of trial preparation materials and experts' knowledge or opinions set forth in 10

CFR § 2.740 or other protection provided by law.

**I. GENERAL DISCOVERY RESPONSES**

**A. General Interrogatories**

**GENERAL INTERROGATORY NO. 1.** State the name, business address, and job title of each person who was consulted and/or who supplied information for responding to interrogatories, requests for admissions and requests for the production of documents. Specifically note for which interrogatories, requests for admissions and requests for production each such person was consulted and/or supplied information.

If the information or opinions of anyone who was consulted in connection with your response to an interrogatory or request for admission differs from your written answer to the discovery request, please describe in detail the differing information or opinions, and indicate why such differing information or opinions are not your official position as expressed in your written answer to the request.

**ANSWER TO GENERAL INTERROGATORY NO. 1:** The following persons were consulted and/or supplied information in responding to the discovery requests for Applicant's 8th Set of Discovery. Their Declarations are attached hereto.

**General Discovery Requests**

Denise Chancellor, Esq.  
Assistant Attorney General, Utah Attorney General's Office  
160 East 300 South, 5<sup>th</sup> Floor,  
Salt Lake City, Utah 84114-0873

**Utah Contention QQ (Unified Contention Utah L/QQ)**

**Interrogatories Nos. 1-8, 10, 12, 14-15** (in whole or in part)

Steven F. Bartlett, Ph.D., Assistant Professor, University of Utah,  
Civil Engineering Department, EBRO 113, 160 South Central Campus Drive,  
Salt Lake City, Utah 84112-0110

**Interrogatories Nos. 4-5, 7-14** (in whole or in part)

Farhang Ostadan, Ph.D  
2 Agnes Street, Oakland, California 94618

In response to whether the information or opinions of anyone who was consulted in connection with the State's answer to an interrogatory differs from the State's written answer

to the discovery request, the State is unaware of any such difference among those who may have been consulted. The Applicant's 8th Set contains no requests for admission.

**GENERAL INTERROGATORY NO. 2.** To the extent that the State has not previously produced documents relevant to any Utah admitted contention, including without limitation Unified Consolidated Contentions Utah L and Utah QQ (Geotechnical), as those contentions were submitted to the Board by the parties on January 17, 2002 (hereinafter "Consolidated Utah L/ QQ"), identify all such documents not previously produced. The State may respond to this request by notifying PFS that relevant documents are available for its review and/or copying.

ANSWER TO GENERAL INTERROGATORY NO. 2 To the extent that any documents are relevant to this request, they will be available for review and copying at the Office of the Attorney General.

**GENERAL INTERROGATORY NO. 3.** For each admitted Utah contention, including without limitation Consolidated Utah L/ QQ, give the name, address, profession, employer, area of professional expertise, and educational and scientific experience of each person whom the State expects to call as a witness at the hearing. For purposes of answering this interrogatory, the educational and scientific experience of expected witnesses may be provided by a resume of the person attached to the response.

ANSWER TO GENERAL INTERROGATORY NO. 3: The State has already identified witnesses for Contention Utah L, Parts A and B. See State's Objections and Response to Applicant's Second, Fourth, and Seventh Sets of Discovery dated June 28, 1999, January 31, 2000 and September 28, 2001, respectively. The only newly-named witnesses are Drs. Mohsin R. Khan and James K. Mitchell. The witnesses who will testify within the scope of Utah QQ -- and who are eligible to be deposed during this discovery period - are Drs. Bartlett, Ostadan, Kahn, and Mitchell. The persons the State expects to call as witnesses at the hearing for unified contention Utah L/ QQ and their area of testimony are as follows:

Barry Solomon, Senior Geologist, Utah Geologic Survey  
Area of Testimony: Geologic setting.

Steven F. Bartlett, PhD, Assistant Professor  
University of Utah, Civil Engineering Department  
Area of Testimony: Characterization of subsurface soils; seismic design and foundation stability; adequacy of PFS's design and seismic exemption, in particular DOE Standard 1020.

James K. Mitchell, Sc.D., P.E., Consultant  
Area of Testimony: Soil-cement (cement-treated soil).

Farhang Ostadan, PhD, Consultant  
Area of Testimony: Seismic design and foundation stability; in particular soils, foundations, and soil-structure interaction and cask stability analysis; adequacy of PFS's design and seismic exemption.

Mohsin R. Khan, PhD, Altran  
Area of Testimony: Cask stability analysis and adequacy of PFS's design.

Walter J. Arabasz, PhD, Research Professor of Geology and Geophysics  
University of Utah, Director, University of Utah Seismograph Stations.  
Area of Testimony: Seismic exemption, excluding radiation dose limits and consequences.

Marvin Resnikoff, PhD,  
Senior Associate, Radioactive Waste Management Associates  
Area of Testimony: Seismic exemption, in particular radiation dose limits and consequences.

The State has already provided the Applicant with copies of resumes and declarations of the above-listed witnesses, either directly or as part of filings in this proceeding, including reference to those documents the witnesses have reviewed or relied upon. The State is in the process of determining whether any of those resumes need to be updated and will advise PFS if and when revisions thereto are available.

**GENERAL INTERROGATORY NO. 4.** For each admitted Utah contention, including without limitation Consolidated Utah L/ QQ, identify the qualifications of each expert witness whom the State expects to call at the hearing, including but not limited to a list of all publications authored by the witness within the preceding ten years and a listing of any other cases in which the witness has testified as an expert at a trial, hearing or by deposition within the preceding four years.

ANSWER TO GENERAL INTERROGATORY NO. 4: See Answer to General

Interrogatory No. 3.

**GENERAL INTERROGATORY NO. 5.** For each admitted Utah Contention, including without limitation Consolidated Utah L/ QQ, describe the subject matter on which each of the witnesses is expected to testify at the hearing, describe the facts and opinions to which each witness is expected to testify, including a summary of the grounds for each opinion, and identify the documents (including all pertinent pages or parts thereof), data or other information which each witness has reviewed and considered, or is expected to consider or to rely on for his or her testimony.

ANSWER TO GENERAL INTERROGATORY NO. 5: See Answer to General

Interrogatory No. 3

**B. General Document Requests**

**GENERAL REQUEST NO. 1.** All documents in your possession, custody or control identified, referred to, relied on, or used in any way in (a) responding to the interrogatories and requests for admissions set forth in Applicant's previous sets of Formal Discovery Requests to Intervenor State of Utah, (b) responding to the following interrogatories and requests for admissions in this document, or (c) responding to any subsequent interrogatories and requests for admissions filed with respect to the State's Contentions as admitted by the Board.

ANSWER TO GENERAL REQUEST NO. 1 - UTAH L, PART B: See specific

discovery Answers, below.

II. DISCOVERY RESPONSE - UTAH QQ (now consolidated with unified contention Utah L/ QQ)

A. General Objections to Discovery Relating to Contention Utah QQ

The State objects to the scope of the Applicant's discovery requests to the extent that they are outside the scope of Contention Utah QQ. Contention Utah QQ has been consolidated into Unified Contention Utah L/ QQ. At this time, however, discovery is limited exclusively to the scope of Utah QQ. Discovery on the remainder of the unified contention Utah L/ QQ has closed (*i.e.*, Utah L, Part A and Utah L, Part B). *See* Private Fuel Storage Proceeding General Schedule – As Revised 9/20/01.

The State also objects to the structure and content of the Applicant's discovery requests. In each and every interrogatory (Nos. 1 through 15), the Applicant requests the State to answer a technical issue and as well to "state the consequences on the safety of the PFS facility" relating to that technical issue. In addition to the specific objections below, the State objects to Interrogatories Nos. 1 through 15 on the following grounds. First, Interrogatories Nos. 1 through 15 are compound in that they request an answer to a technical issue and as well an answer as to safety consequences. This is particularly egregious given that the State acceded to the Applicant's request to propound fifteen interrogatories on the State instead of the usual ten interrogatories the Board has set for each contention.

Second, Interrogatories Nos. 1 through 15 are overbroad in that they request the State to "identify and fully describe each respect" in which PFS's consideration or analysis of an issue relating to unified Contention Utah L/ QQ is deficient. To start with, PFS already

knows the State's position on these issues based on the State's previous responses to discovery, witness depositions, and responses to PFS's Motions for Summary Disposition on various portions of what is now Unified Contention Utah L/ QQ. In addition, for some issues, the list of deficiencies, omissions and unconservative assumptions are so great that it is unreasonable and burdensome for the State to recite each and every respect in which PFS has failed to consider or analyze the particular issue. That said, the State will answer Interrogatories Nos. 1 through 15 based on the significant differences that it has with the Applicant.

Third, the safety consequences and whether or not PFS's design is conservative is within the scope of Utah L, Part B - now Section E, Unified Contention Utah L/ QQ. By answering Interrogatories Nos. 1 through 15 - to the extent that any of the safety consequences or unconservatism in PFS's design are included within the scope of Utah QQ - the State does not (nor does it intend to) limit its right to offer testimony within the scope of Utah L, Part B (*i.e.*, Section E, Unified Contention Utah L/ QQ).

#### **B. Interrogatories - Utah QQ**

General Objections to Discovery Relating to Contention Utah QQ, Section A above, are incorporated into each and every answer to Interrogatories Nos. 1 through 15.

**INTERROGATORY NO. 1:** With respect to paragraph C.3.c of Consolidated Utah L/ QQ, identify and fully describe each respect in which the State contends that PFS has failed to consider or analyze the impact on the properties of the native soil caused by the construction and placement of cement-treated soil, state the consequences on the safety of the PFS facility of each such failure, and explain the bases therefor.

**ANSWER TO INTERROGATORY NO. 1:** The Applicant has failed to address potential moisture content changes, disturbance, and remolding of the native clay underlying

the soil-cement<sup>1</sup> (cement-treated soil) and the impact that these will have on the properties of the native clay. Placing the soil-cement under the storage pads will lead to an increase in the water content of the partly saturated silty clay, clayey silt soils beneath them. These changes will affect the settlement, strength, and adhesion between the soil and the soil-cement. Also, the Applicant proposes to place the cement-treated soil directly upon an overconsolidated silty clay, clayey silt subbase. If care is not taken during construction, the use of heavy placement equipment could cause significant remolding of the subbase soils, and such remolding could markedly affect the shear strength of the subbase at the interface with the cement-treated soil. Changes in the properties of the native clay can affect the static settlement and dynamic stability of the storage pads and Canister Transfer Building ("CTB") foundations.

**INTERROGATORY NO. 2:** With respect to paragraph C.3.d of Consolidated Utah L/QQ, identify and fully describe each respect in which the State contends that PFS has failed to show that its proposal to use cement-treated soil will perform as intended and has failed to adequately address possible mechanisms that may crack or degrade the function of cement-treated soil over the life of the facility, state the consequences on the safety of the PFS facility of each such mechanism, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 2: The Applicant claims that the soil-cement treatment will act as an engineered foundation to maintain the dynamic stability to the pads and CTB mat foundation, but has delayed the submission of requisite soil-cement testing and analyses until the construction phase. This is not acceptable because the Applicant must demonstrate that the soil-cement strategy will perform its intended function

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<sup>1</sup> The use of the term "soil-cement" in these discovery responses does not imply that the State accepts that PFS will, in fact, use soil-cement. See State of Utah's Request for Admission of Late-Filed Contention Utah QQ (Seismic Stability) at n. 2.



during earthquake loading. The Applicant has not presented sufficient information, analyses and testing to allow for independent review and verification of the soil-cement design. Thus, the Applicant's claim of sufficient factors of safety for dynamic stability of the foundation systems has not been demonstrated.

Regarding earthquake loading, the Applicant's calculations assume that the pad and mat foundations and the soil-cement will behave as rigid bodies and that the soil-cement will only be placed in compression by compressional forces that are in-phase with the pad and mat foundations; the calculations ignore the oscillatory nature of seismic loading. In addition, the rigid body behavior of the foundations with strictly in-phase translational motion is not realistic for the PFS site. A relatively thin (approximate 3 to 4-foot thick) veneer of soil-cement having extremely large areal dimensions (*i.e.*, significantly exceeding the footprint dimensions of the CTB and the dimensions of the pad emplacement area) will have to resist a variety of earthquake wave forms, with varying angles of inclination, wavelengths and phasing. The dynamic stresses resulting from these earthquake waves will be controlled by out-of-phase motion of the foundations and the soil-cement and will place the soil-cement in tension, which may simply crack the soil-cement and render it ineffective in performing its intended function.

In addition, the Applicant has not addressed the potential for pad-to-pad interaction and the resulting effects on the soil-cement due to out-of-phase motion of individual pads.

Furthermore, the concrete pad and mat foundations, soil-cement, and native soil have markedly different stiffnesses and masses associated with them. The Applicant has not addressed the kinematic and inertial interaction of the soil-cement with the foundation

systems. Because the Applicant has not evaluated the nature and magnitude of the stresses caused by these interactions, the dynamic stability of the foundation systems has not been demonstrated.

Regarding the soil-cement's ability to resist such interaction, the Applicant has not addressed bending, torsional and uplift stresses that will develop in the soil-cement resulting from interaction with the foundations and the earthquake waves. The tensile strength of cement-treated soil is typically only about a fifth to a third of the unconfined compressive strength; so even rather low tensile stresses can cause cracking. Because the Applicant has not calculated the magnitude of these stresses and the ability of the soil-cement to resist these stresses, the Applicant has not demonstrated the seismic performance and structural adequacy of the proposed cement treatment.

In addition, soil-cement has a cement content that is sufficient to attain minimum durability standards as measured by American Society for Testing and Materials (ASTM) wet-dry and freeze-thaw tests. More cement is needed as the fines content in the soil to be treated increases. The strength of soil-cement generally decreases as soil plasticity increases. The amounts of cement that are proposed to be added by the Applicant (between approximately 1 to 8.5 percent) may not be sufficient to produce a true soil-cement. If it is not a true soil-cement, then the durability of the cement-treated soil may be an issue, because the wet-dry, freeze-thaw exposure may be significant for this site.

From a strength and durability standpoint, the Applicant has not presented evaluations regarding potential cracking or deterioration of the soil-cement resulting from drying, curing, shrinkage, traffic loadings, settlement of adjacent foundations, and sulfide,

salt or other chemical attack.

**INTERROGATORY NO. 3:** With respect to paragraph C.3.e of Consolidated Utah L/QQ, identify and fully describe each respect in which the State contends that PFS has underestimated the dynamic Young's modulus of the cement-treated soil when subjected to impact during a cask drop or tipover accident scenario, state the consequences on the safety of the PFS facility of such an underestimation, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 3: In the drop/tipover analysis of the casks (*PFSF Site-Specific HI-STORM Drop/Tipover Analyses*, Rev. 0 and Rev. 1, Holtec Report No. HI-2012653, April 3, 2001 and May 7, 2001 respectively), Holtec assumed a lower stiffness of the cement-treated soil under the pad to meet the drop/tipover condition. In doing so, it has failed to recognize the difference between the static and dynamic impact modulus of the cement-treated soil and the effect of significant temporal and spatial change in bearing pressure acting on the cement-treated soil. The expected large difference between the static and dynamic impact modulus and lack of any test data on soil-cement by the Applicant invalidates the assumption in the drop/tipover analysis and will lead to an underestimation of the impact forces resulting from the drop/tipover scenario.

**INTERROGATORY NO. 4:** With respect to paragraphs D.1.a and D.2.d of Consolidated Utah L/QQ, identify and fully describe each respect in which the State contends that it is unconservative for PFS to assume that only vertically propagating in-phase waves will strike the Canister Transfer Building ("CTB"), the storage pads, casks and foundations and to account for horizontal variation of ground motion, state the consequences on the safety of the PFS facility of each such failure or lack of conservatism, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 4 Because the PFS site is located close to a set of major faults dipping under the site (*see Development of Design Basis Ground Motions for the Private Fuel Storage Facility*, Rev. 1, March 2001, Geomatrix), seismic waves arriving at foundation structures will not be in the form of vertically propagating waves as was assumed

by Holtec. The inclined waves tend to cause larger rocking and torsional vibration above and beyond what is analyzed by the assumption that the waves will be only vertically propagating. This arrival of inclined waves and surface waves is contrary to the assumptions in HI-2012640 for the storage pad and Calculation No. 05996.02-SC-5, Rev. 2, *Seismic Analysis of Canister Transfer Building* (SWEC April 4, 2001). Waves striking at angles will cause additional rocking and torsional motions of the foundations and casks above and beyond the motion caused by vertically propagating waves. If sufficiently large, these motions can lead to instability of the casks and the foundation.

**INTERROGATORY NO. 5:** With respect to paragraphs D.1.b and D.2.a of Consolidated Utah L/ QQ, identify and fully describe each respect in which the State contends that it is incorrect for PFS to assume that the CTB mat foundation and storage pads will behave rigidly during a design basis earthquake and that such an assumption of rigidity results in significant underestimation of the dynamic loading and overestimation of foundation damping, state the consequences on the safety of the PFS facility, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 5 PFS has incorrectly used the assumption of rigidity in the calculation of the dynamic forces acting upon the CTB mat (see Calculation Nos. 05996.02-SC-5, 05996.02-SC-7) and storage pad foundations (see HI-2012640). Based on the results reported in *Storage Pad Analysis and Design*, Calc. No. 0599602-G(PO17)-2, Rev. 3, 4/5/01 (ICEC), the assumption of rigidity is not valid and results in erroneous calculation of the foundation damping and also violates the assumption that a uniform coefficient of sliding friction exists between the bottom of the casks and the top of the pad. The sliding resistance of the casks atop the pads will not be constant due to local deformations of the surface of the pads resulting from inertial loadings imposed by the casks.

Analyses performed by the State of Utah (Analytical Study of HI-STORM 100 Cask

System Under High Seismic Condition, Technical Report No. 01141-TR-000, Revision 0)<sup>2</sup> show that the HI-STORM 100 cask dynamic analysis is highly sensitive to the local pad stiffness values used as input in the mathematical model. Thus, the estimates of potential sliding and rocking displacements are dependent upon the local stiffness values used. Holtec used an initial high local contact vertical stiffness of  $454 \times 10^6$  lbs/in. (see HI-971631, Appendix C). Although high contact stiffness values are generally used in mathematical simulations, the high stiffness values artificially treat the solution as linear without amplification in the upward direction which gives non-unique or invalid results. The State maintains that a contact stiffness of  $454 \times 10^6$  lbs/inch is too high for an unanchored cask because the contact stiffness makes the vertical frequency of the cask too rigid, thus artificially reducing the vertical displacement. High contact stiffness values also absorb significant amounts of energy before sliding actually occurs. Holtec's use of an initial high local contact vertical stiffness significantly minimizes vertical excitation. In addition, the high values of vertical stiffness used by Holtec also artificially and significantly reduce the estimated horizontal sliding displacements.

In the stability analysis of the pads, the calculation *Stability Analysis of Storage Pads*, Calculation No. 05996.02, G(B)-04, Revs. 7 and 8 (SWEC), PFS has assumed a rigid pad foundation and has failed to consider the natural frequency of vibration of the soil-pad system. The assumption of pad rigidity leads to a significant underestimation of the inertial

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<sup>2</sup> See Attachment F to the Joint Declaration of Drs. Steven Bartlett, Mohsin Khan, and Farhang Ostadan, State's Response to the Applicant's Motion for Summary Disposition of Part B, Utah Contention L (December 7, 2001).

force of the pads, especially in the vertical direction. Also, Holtec's analysis for seismic stability of the casks (Holtec Report No. HI-2012640 titled *Multi Cask Response at PFS ISFSI from 2000-Yr Seismic Event*) does not account for amplification due to pad-to-pad interaction effects and frequency dependency of soil spring and damping in the soil-structure interaction analysis. Therefore, the motions of the pads are expected to be higher than those assumed by Holtec. As a result, the computed cask reactions during the cask uplift and drop and subsequent impact due to foundation motion amplifications would be much higher than those used in PFS's pad design.

In addition, Holtec has assumed BETA damping coefficients corresponding to 5% structural damping. Singh/Soler Tr. at 100. This is a high damping value. In reality, the structural damping would be small or insignificant for a rigid cask, and only friction should be the primary energy dissipation mechanism. Holtec's use of high BETA damping coefficients also underestimates potential sliding and rocking displacements that may lead to cask collision or tipover during a seismic event.

In the calculation of the seismic stability of the Canister Transfer Building (Calculation No. 05996.02-SC-5, Rev. 2, *Seismic Analysis of Canister Transfer Building*, SWEC), and the supporting calculation (Calculation No. 05996.02-SC-4, Rev. 2, *Development of Soil Impedance Functions for Canister Transfer Building*, SWEC), Stone & Webster has erroneously assumed that the large mat of the CTB is rigid. This assumption leads to overestimation of foundation damping and underestimation of seismic loads for design of the building.

**INTERROGATORY NO. 6:** With respect to paragraph D.1.c(i) of Consolidated

Utah L/ QQ, identify and fully describe each respect in which the State contends that PFS has failed to properly consider the effects of soil cement around the pads and the unsymmetrical loading that the soil cement would impart on the pads once the pads undergo sliding, state the claimed effect of each such failure on the motion of the casks sliding on the pads and the consequences on the safety of the PFS facility, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 6: PFS submitted further calculations by Holtec in response to NRC's concern that the storage pads can slide on the soil by about six inches. PFS Commitment Resolution Letter # 37, dated August 7, 2001. The new Holtec calculation is over-simplified and incorrect. The calculation incorporates nonlinear soil springs under the storage pad to allow sliding of the pad and it attempts to show that the casks are still stable even though the pad can slide by as much as six inches. In this calculation, Holtec assumed an idealized and favorable condition to model the sliding of the pad over the soil. It has simply ignored the effect of soil-cement around the pad and the unsymmetric loading that the soil-cement will impart on the pad once the pad undergoes sliding movement. The cement-treated soil will create an active and a passive side. The cracking and potential crushing of the soil-cement on the passive side and separation of the soil-cement on the active side due to lack of tensile capacity of soil-cement will impart unbalanced forces on the pad and severely impact the stability of the casks on the pads.

One of the errors made by the Applicant in its Newmark sliding block analysis presented in Calc. 05996.02-G(B)-04, Revision 9, is the assumption of symmetrical pad sliding. The Applicant did not consider the potential for unsymmetrical sliding, as described above. The potential for unsymmetrical sliding will produce larger displacements than those calculated in Cal. G(B)-04, Revision 9.

**INTERROGATORY NO. 7:** With respect to paragraph D.1.c(ii) of Consolidated Utah L/QQ, identify and fully describe each respect in which the State contends that PFS's claimed failure to consider the flexibility of the pad under DBE loading fails to provide a realistic evaluation of the foundation pad motion with cement treated soil under and around the pads in relation to the motion of the casks sliding on the pads, state the consequences on the safety of the PFS facility, and explain the bases therefor

ANSWER TO INTERROGATORY NO. 7: See Answers to Interrogatories Nos. 2

and 4 through 15.

**INTERROGATORY NO. 8:** With respect to paragraphs D.1.c(iii) of Consolidated Utah L/QQ, identify and fully describe the variation of the coefficient of sliding friction that the State claims will exist between the bottom of the casks and the top of the pads due to local deformation of the pad at the contact points with the cask fully identifying the deformation that the State claims will exist at the contact points, the claimed effects of such deformation on the coefficient of friction, and the relationship, if any, to the cement treated soil under and around the pads, state the consequences on the safety of the PFS facility of each such claimed effect, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 8: See Answer to Interrogatory No. 5.

**INTERROGATORY NO. 9:** With respect to paragraph D.1.d of Consolidated Utah L/QQ, identify and fully describe each respect in which the State contends that PFS has failed to consider lateral variations in the phase of ground motions and their effects on the stability of the pads and casks, state the consequences on the safety of the PFS facility of each such failure, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 9: Because the PFS site is located close to a set of major faults dipping under the site (*see Development of Design Basis Ground Motions for the Private Fuel Storage Facility*, Rev. 1, March 2001, Geomatrix), seismic waves arriving at foundation structures will not be in the form of vertically propagating waves as was assumed by Holtec. The inclined waves tend to cause larger rocking and torsional vibration above and beyond what is analyzed by the assumption that the waves will only be vertically propagating. This arrival of inclined waves and surface waves is contrary to assumptions in HI-2012640 for the storage pad. See also Answer to Interrogatory No. 4.



**INTERROGATORY NO. 10:** With respect to paragraph D.1.e of Consolidated Utah L/ QQ, identify and fully describe each respect in which the State contends that the PFS calculations for cask sliding do not address the frequency dependency of the springs and damping values used to model the foundation soils, state the consequences on the safety of the PFS facility of such failure, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 10: Because the analysis of the cask-pad-soil-cement is a nonlinear analysis, it is very important to consider all potential variation in the motion of the pad and the casks. If the pads and the casks move out-of-phase, significant instability conditions may arise. The soil spring and damping used in the Holtec analysis do not properly consider the frequency dependency of these parameters. Holtec has provided no check to compare the parameters used by other available rigorous solutions to ensure the foundation parameters are reasonably accurate. In the calculation of soil spring and damping for the Canister Transfer Building (Calc. No. 05996.02-SC-4, Rev. 2, *Development of Soil Impedance Functions for Canister Transfer Building*, 3/21/01, SWEC) it has been shown that the soil spring and damping are highly dependent on the frequency due to soil layering at the site. The contrast in the dynamic properties of the underlying stratum has significantly increased by inclusion of soil-cement in the foundation design, thus increasing the concern regarding frequency dependency of soil spring and damping.

**INTERROGATORY NO. 11:** With respect to paragraph D.1.f of Consolidated Utah L/ QQ, identify and fully describe each respect in which the State contends that the PFS has failed to consider the potential for cold bonding between the casks and the pads, state the consequences on the safety of the PFS facility of such failure, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 11: Holtec's design of the casks assumes that the casks will slide on the pad in a controlled in-phase manner during a large earthquake without excessive sliding, pounding or tipping. There is no engineered mechanism (e.g.,

anchorage) or other redundancy built into Holtec's proposed design to ensure limited or controlled sliding. However, such a bold design concept could be negated by the potential for cold bonding between the casks and the pad that may develop over time. When two bodies (cask and pad) with such a large load (the cask) 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 and thus negate the design concept.

**INTERROGATORY NO. 12:** With respect to paragraph D.1.g of Consolidated Utah L/ QQ, identify and fully describe each respect in which the State contends that the PFS has failed to analyze for the potential of pad-to-pad interaction in its sliding analyses for pads spaced approximately five feet apart in the longitudinal direction, state the consequences on the safety of the PFS facility of such failure, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 12: The actual load path under seismic loading has not been considered. The effect of pad-to-pad interaction only five feet apart in the longitudinal direction has been ignored. In the dynamic stability analyses for the pads, the passive resistance for one pad will act as a pushing force on the next pad. This interaction has been totally ignored in the evaluation, thus seriously invalidating the conclusion of the stability of the pads. In the continuation of the stability analysis, a row of ten pads has been considered. PFS ignored the fact that cement-treated soil has limited capacity under tensile and bending stresses and cannot behave as a reinforced concrete mat. The cracking caused by out-of-phase motion of the pads and the cement-treated soil, and the other impacts of striking seismic waves prevent the cement-treated soil pad for ten rows of the pads to act as an integrated unit. Furthermore, in the SAR the estimated static settlement for the pads is shown to be 1.7 inches. SAR Rev. 22 at 2.6-50. The differential

settlement between the pad and the surrounding cement-treated soil causes bending and cracking of the cement-treated soil propagating away from the pad. This condition invalidates the assumption of an integrated foundation for ten rows of pads and also negates the validity of the passive pressure used in the stability analysis of the individual pads.

**INTERROGATORY NO. 13:** With respect to paragraph D.1.h of Consolidated Utah L/ QQ, identify and fully describe each reason why the State contends that PFS's use of only one set of time histories in its non-linear analyses inadequately accounts for phasing of the input ground motion and fault fling, state the consequences on the safety of the PFS facility associated with each such reason, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 13: It is common in the industry that for any nonlinear analysis a minimum of three sets of time histories are used to capture the variation of the response to the phasing of the input motion. This is in recognition of the fact that nonlinear analyses are quite sensitive to input parameters and may amount to significant changes in the response once the input time history is changed. Independent analysis of the casks on the pad by Altran (see footnote 2) has clearly demonstrated the sensitivity of the results to the parameters used for the boundary condition. The same sensitivity is likely to exist with respect to the variation of input motion.

**INTERROGATORY NO. 14:** With respect to paragraph D.2.b of Consolidated Utah L/ QQ, identify and fully describe each respect in which the State contends that PFS improperly ignores in its calculations the presence of a cement-treated soil cap around the CTB and the related impacts on soil impedance parameters and kinematic motion of the CTB foundation, state the consequences on the safety of the PFS facility of this deficiency in the calculations, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 14: The soil-cement and the concrete mat foundation will have significantly different stiffnesses and such contrasts in stiffness (or impedance parameters) will cause kinematic interaction between the soil-cement and the

CTB mat foundation. This interaction may lead to overstressing and cracking of the soil-cement placed immediately adjacent to the CTB and renders it ineffective in performing its intended function and invalidates the impedance function used for CTB analysis. *See also* Answer to Interrogatory No. 2.

**INTERROGATORY NO. 15:** With respect to paragraph D.2.c of Consolidated Utah L/QQ, identify and fully describe each respect in which the State contends that PFS improperly ignores in its calculations the out-of-phase motion of the CTB and the cement-treated soil cap, state the consequences on the safety of the PFS facility of this deficiency in the calculations, and explain the bases therefor.

ANSWER TO INTERROGATORY NO. 15: In the calculation *Stability Analysis of the Canister Transfer Building Supported on a Mat Foundation*, Calculation No. 05996.02-G(B)-13, Revs. 4 and 5 (SWEC), the Applicant relies on passive pressure from soil-cement to resist seismic loads and estimates 0.39 inch moment of the building is acceptable and sufficient to develop the needed passive pressure. This assumption is insufficient and is only valid under ideal conditions. The out-of-phase motion of the building and the soil-cement pad is expected to result in cracking and separation around the foundation. The soil-cement will experience tensile and bending stresses under seismic excitation. Furthermore, the Applicant has estimated a total settlement of about 3 inches for the CTB. SAR Rev. 21 at 2.6-74. The differential settlement between the foundation and the surrounding soil-cement would cause cracking of the soil-cement propagating away from the foundation. The ability of the soil-cement to provide the passive resistance required to maintain stability is of serious concern and does not support the Applicant's conclusion about the stability of the building.

**D. Document Requests - Utah QQ**

**DOCUMENT REQUEST NO. 1:** All documents related to the claims raised by the State in Consolidated Utah L/ QQ.

RESPONSE TO DOCUMENT REQUEST NO. 1: The State objects to this request to the extent that it calls for production of privileged information. Notwithstanding this objection, to the extent that there are any documents responsive to this request they will be available for review at the Office of the Utah Attorney General.

**DOCUMENT REQUEST NO. 2:** All documents, data or other information generated, reviewed, considered or relied upon by any expert or consultant with respect to Consolidated Utah L/ QQ.

RESPONSE TO DOCUMENT REQUEST NO. 2: *See* Response to Document Request No. 1.

**DOCUMENT REQUEST NO. 3:** All documents, data or other information relating to any evaluation performed by any State expert or consultant with respect to the potential use of cement-treated soil at the PFS facility.

RESPONSE TO DOCUMENT REQUEST NO. 3: *See* Response to Document Request No. 1.

**DOCUMENT REQUEST NO. 4:** All documents, data or other information relating to any evaluation performed by any State expert or consultant with respect to the seismic analysis of the storage pads, casks and their foundation soils at the PFS facility.

RESPONSE TO DOCUMENT REQUEST NO. 4: *See* footnote 2.

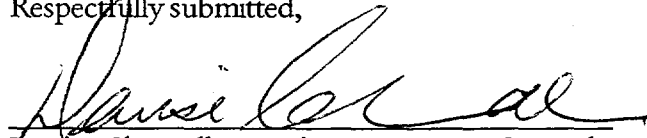
**DOCUMENT REQUEST NO. 5:** All documents, data or other information relating to any evaluation performed by any State expert or consultant with respect to the seismic analysis of the CTB and its foundation.

RESPONSE TO DOCUMENT REQUEST NO. 5: See Response to Document

Request No. 1.

DATED this 15th day of February, 2002.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Denise Chancellor", is written over a horizontal line.

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 OBJECTIONS AND RESPONSE TO APPLICANT'S EIGHTH SET OF FORMAL DISCOVERY REQUESTS TO INTERVENOR STATE OF UTAH was served on the persons listed below by electronic mail (unless otherwise noted) with conforming copies by United States mail first class, this 15th day of February, 2002:

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

Michael C. Farrar, Chairman  
Administrative Judge  
Atomic Safety and Licensing Board  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555-0001  
E-Mail: [mcf@nrc.gov](mailto:mcf@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](mailto:jrk2@nrc.gov)  
E-Mail: [kjerry@erols.com](mailto: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](mailto: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](mailto:set@nrc.gov)  
E-Mail: [clm@nrc.gov](mailto:clm@nrc.gov)  
E-Mail: [pfscase@nrc.gov](mailto:pfscase@nrc.gov)

Jay E. Silberg, Esq.  
Ernest L. Blake, Jr., Esq.  
Paul A. Gaukler, Esq.  
Shaw Pittman, LLP  
2300 N Street, N. W.  
Washington, DC 20037-8007  
E-Mail: [Jay\\_Silberg@shawpittman.com](mailto:Jay_Silberg@shawpittman.com)  
E-Mail: [ernest\\_blake@shawpittman.com](mailto:ernest_blake@shawpittman.com)  
E-Mail: [paul\\_gaukler@shawpittman.com](mailto:paul_gaukler@shawpittman.com)

John Paul Kennedy, Sr., Esq.  
David W. Tufts  
Durham Jones & Pinegar  
111 East Broadway, Suite 900  
Salt Lake City, Utah 84111  
E-Mail: [dtufts@djplaw.com](mailto:dtufts@djplaw.com)


Joro Walker, Esq.  
Land and Water Fund of the Rockies  
1473 South 1100 East, Suite F  
Salt Lake City, Utah 84105  
E-Mail: [utah@lawfund.org](mailto:utah@lawfund.org)

Larry EchoHawk  
Paul C. EchoHawk  
Mark A. EchoHawk  
EchoHawk Law Offices  
151 North 4<sup>th</sup> Street, Suite A  
P.O. Box 6119  
Pocatello, Idaho 83205-6119  
E-mail: [paul@echohawk.com](mailto:paul@echohawk.com)

Tim Vollmann  
3301-R Coors Road N.W. # 302  
Albuquerque, NM 87120  
E-mail: [tvollmann@hotmail.com](mailto:tvollmann@hotmail.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](mailto: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

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In the Matter of:

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

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)  
)  
)

Docket No. 72-22-ISFSI

ASLBP No. 97-732-02-ISFSI

February 15, 2002

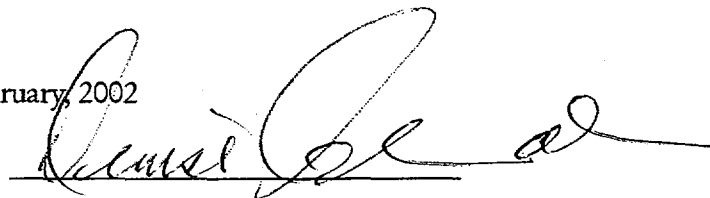
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DECLARATION OF DENISE CHANCELLOR, ESQ.

I, Denise Chancellor, Esq., declare under penalty of perjury and pursuant to 28 U.S.C. § 1746, that the statements contained in State of Utah's February 15, 2002 Objections and Responses to Applicant's Eighth Set of Discovery Requests to Intervenor State of Utah, dated February 5, 2002, are true and correct to the best of my knowledge, information and belief, as they relate to responses to General Discovery.

Executed this 15th day of February, 2002

By:



Denise Chancellor, Esq.  
Assistant Attorney General  
Utah Attorney General's Office

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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In the Matter of:

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

)  
) Docket No. 72-22-ISFSI  
)  
) ASLBP No. 97-732-02-ISFSI  
)  
) February 15, 2002

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**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 the factual statements contained in State of Utah's Objections and Responses to Applicant's Eighth Set of Discovery Requests to Intervenors State of Utah, dated February 5, 2002, are true and correct to the best of my knowledge, information and belief, as they relate to Interrogatories Nos. 1-8, 10, 12, 14-15 (in whole or in part), and document requests relating thereto, for Contention Utah QQ.

Dated this 15<sup>th</sup> day of February, 2002.



By: \_\_\_\_\_

Steven F. Bartlett, Ph.D., P.E.  
Assistant Professor  
Engineering Department  
University of Utah

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:

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

)  
) Docket No. 72-22-ISFSI  
)  
) ASLBP No. 97-732-02-ISFSI  
)  
) February 14, 2002

**DECLARATION OF DR. FARHANG OSTADAN**

I, Dr. Farhang Ostadan, hereby declare under penalty of perjury and pursuant to 28 U.S.C. § 1746, that the factual statements contained in State of Utah's Objections and Responses to Applicant's Eighth Set of Discovery Requests to Intervenor State of Utah, dated February 5, 2002, are true and correct to the best of my knowledge, information and belief, as they relate to Interrogatories Nos. 4-5, and 7-14 (in whole or in part), and document requests relating thereto, for Contention Utah QQ

Dated this 14<sup>th</sup> day of February, 2002.

By:

  
Farhang Ostadan, Ph.D