

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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USNRC

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD '01 FEB -2 P 4 :59

In the Matter of:)	Docket No. 72-22-ISFSI	OFFICE OF SECRETARY RULEMAKINGS AND ADJUDICATIONS STAFF
PRIVATE FUEL STORAGE, LLC	)	ASLBP No. 97-732-02-ISFSI	
(Independent Spent Fuel)		
Storage Installation)	)	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 L¹ in its entirety. Contention L generally asserts "[t]he Applicant has not demonstrated the suitability of the proposed ISFSI site

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).

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 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

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.

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”).

attempts, one⁴ filed after PFS's exemption request, and the other⁵ 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, 2000⁷ 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 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

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").

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

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

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

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 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.”

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 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. *Sæ* 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. *Sæ* 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. *Sæ 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,

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.

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 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 eminently qualified to testify as an

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 and

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 I 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, Mississippi, 80 F.3d 1074, 1078 (5th Cir. 1996).

Furthermore, PFS inappropriately tries to claim the expertise of State's witness, Dr.

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

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. *Sæ 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 34-36¹⁵; 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 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

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.

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 resistance 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 led 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. *Sæ 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.

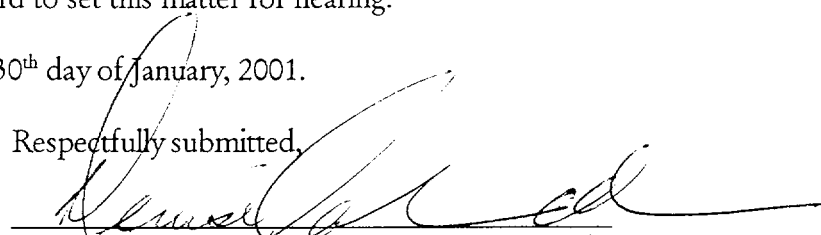
CONCLUSION

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

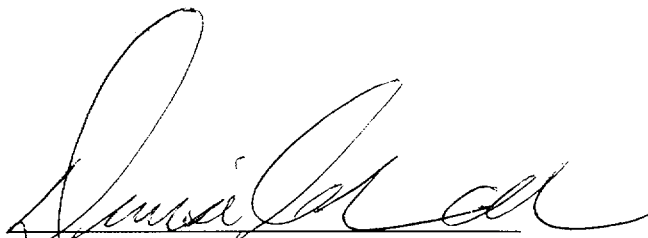
John Paul Kennedy, Sr., Esq.
1385 Yale Avenue
Salt Lake City, Utah 84105
E-Mail: john@kennedys.org

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

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

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:

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

)
) Docket No. 72-22-ISFSI

)
) 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.

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

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

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

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

¶ 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 soil layering in the upper 35 feet it would have been more 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. *Sæ* 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. *Sæ* 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 & Ostadan Tr. 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. Sæ 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. Sæ 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. Sæ 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. Sæ 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:

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

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Docket No. 72-22-ISFSI

ASLBP No. 97-732-02-ISFSI

January 30, 2001

DECLARATION OF DR. M. LEE ALLISON

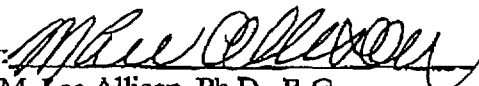
I, Dr. M Lee Allison, hereby declare under penalty of perjury and pursuant to 28 U.S.C. § 1746, that:

1. I am currently the State Geologist for the State of Kansas and held that same position for the State of Utah from 1989 to 1999. I have over twenty-five years experience in geological policy management, scientific research with emphasis on structural geology and geophysics, geological exploration, and consulting. My experience includes work with state, local, and federal agencies, university research organizations, major petroleum companies, and an aerospace research laboratory.
2. I hold a PhD., in Geology from the University of Massachusetts, and MS, Geology from San Diego State University and a BA, Geology (geophysics option) from the University of California, Riverside. My experience in interpretation of seismic reflection data was gained during my employment as a Exploration Geologist for the oil industry and during by employment as a senior geologist at the University of Utah Research Institute.
3. I have published numerous publications. A copy of my curriculum vitae is attached hereto which describes in greater detail my qualifications, training and publications.
4. I was designated as one of the State's testifying expert for this proceeding on June 28, 1999. I have reviewed the applicable sections of the Applicant's SAR, 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 by counsel for Private Fuel Storage ("PFS") on October 25 and 26, 2000. I was present at the State's deposition of PFS's geotechnical witnesses, John Clark and Marc Sterling on October 24 and 25, 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 as they relate to Basis 1. I provide this declaration in support of the State of Utah's Response the PFS's Motion for Summary Disposition, Basis 1. The following statements in this declaration are based on my experience, training, and best professional judgment.
7. It is my opinion that PFS has not used an integrated approach to evaluate both the vibratory ground motion and surface fault displacement. For example, 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 sequence.
8. PFS's approach has not been comprehensive. PFS considers only the structural grain of the valley that runs northwest. But PFS has ignored the east-west Pass Canyon and the topographic embayment at the east-west trending Rydatch Pass, which are anomalies to the assertions that the northwest structural grain of the valley is the only aspect of the structural geology that needs to be investigated.
9. Another failure in its "integrated" approach, is that Geomatrix collected no seismic tie line(s) 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 and 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 and projected locations of the East or West faults and other unnamed faults.

Executed this 30th day of January 2001.

By: 
M. Lee Allison, Ph.D., R.G.

M. LEE ALLISON
Kansas Geological Survey
1930 Constant Ave.
Lawrence, Kansas 66047
785-864-3965, fax 785-864-5317
lallison@kgs.ukans.edu

EDUCATION

Ph.D., Geology, University of Massachusetts, Amherst, Massachusetts, 1986
M.S., Geology, San Diego State University, San Diego, California, 1974
B.A., Geology (geophysics option), University of California, Riverside, California, 1970

SUMMARY OF EXPERIENCE

Over twenty-five years experience in geological policy management, scientific research with emphasis on structural geology and geophysics, geological exploration, and consulting. Experience includes work with state, local, and federal agencies, university research organizations, major petroleum companies, and a national research laboratory. Professional skills include management of an organization with a budget of over \$8 million, establishment and direction of a non-profit research organization, use of integrated geological and geophysical research methods, geological mapping and use of satellite imagery. Provided leadership to numerous advisory boards, councils and professional organizations on earthquake, geophysical, and oil and gas research. Author of technical and non-technical papers on geology, drilling, energy and mineral resources, and active fault zones. Frequent lecturer to symposia, workshops, council meetings, petroleum companies, and state and federally sponsored organizations.

PROFESSIONAL EXPERIENCE

UNIVERSITY OF KANSAS, Kansas Geological Survey, Lawrence, Kansas 1999-present
State Geologist and Director

Direct one of the largest state geological surveys in the nation, with up to 160 employees and an annual budget of over \$8 million. Provide oversight to the Energy Research Center and the Data Access and Support Center.

STATE OF UTAH, Department of Natural Resources, Salt Lake City, Utah 1989-1999
State Geologist and Director, Utah Geological Survey

Direct the activities of one of seven divisions in the Department having a staff of 75 and an annual budget of over \$5 million. Created the Geologic Extension Service and the Environmental Sciences Program. Oversaw a seven-fold increase in publication sales. Expanded UGS oil and gas program and initiated petroleum industry cooperatives. Started Strong Motion Instrumentation Program for earthquake recording.

WESTERN EARTH SCIENCE TECHNOLOGIES, INC. (WEST), Salt Lake City, Utah 1988-1994
President

Directed non-profit consortium of 12 universities in six Rocky Mountain states engaged in oil and gas research. Created organizational structure as part of working committee and elected as first president. Contributed to establishment of scientific program for WEST. Based at Univ. of Wyo., Laramie.

UNIVERSITY OF UTAH RESEARCH INSTITUTE, Center for Dipmeter Research, 1988-1989
Salt Lake City, Utah
Manager

EX 26

Founded and directed the Center to perform multiple research projects for government and industry in subsurface borehole geophysics. Personally responsible for all technical and financial development. Secured major funding from Gas Research Institute and industry.

UNIVERSITY OF UTAH RESEARCH INSTITUTE, Salt Lake City, Utah

1987-1989

Senior Geologist

Established an oil and gas research program at UURI. Developed assessment programs for Utah oil and gas fields and evaluation of Uinta Basin resources.

Supervised \$7 million deep geothermal drilling operation while on Ascension Island in the south Atlantic. Monitored technical, administrative, and financial activities on a daily basis. Ran earthquake seismic network and carried out paleomagnetic field studies.

Supervised a multinational team of 50 personnel to demobilize and transport 1200 tons of drilling equipment from Ascension Island to the U.S. Coordinated activities among British island government, U.S. Air Force, and government and UURI contractors.

STANDARD OIL PRODUCTION COMPANY (SOHIO, BP), Dallas and Houston, Texas

1984-1987

Exploration Geologist

Used integrated geological and geophysical methods to generate prospects in Oklahoma, Arkansas, Texas, Nevada, and Wyoming. Responsible for new exploration models in Wind River Basin, and Basin and Range province. Division consultant on dipmeter interpretation and remote sensing. Initiated exploration data exchange program between Kennecott and Sohio. Developed detailed structural analyses of Ouachita-Marathon uplifts.

CONSULTING GEOLOGIST

1981-1983

Wellsite supervision and log analysis, San Joaquin Valley and Los Angeles Basin, California, under contract to industry. Trained company geologists in wellsite procedures and techniques.

JET PROPULSION LABORATORY, CalTech-NASA, Pasadena, California

1980

Scientist II

Computer processing and interpretation of satellite imagery for petroleum exploration techniques. Participated in NASA-industry *Geosat* project.

STANDARD OIL CO. OF CALIFORNIA (CHEVRON), San Francisco, California

1974-1979

Development Geologist and Exploration Geologist

Responsible for development geology of 40 oilfields in southern California. Wellsite geology in Alaska and California on- and offshore, exploration field work in Alaska. Registered lobbyist to City of Los Angeles. Seismic interpretation of southern Alaska. Responsible for mapping major geologic trends for Federal offshore lease sales.

STATE OF CALIFORNIA, Division of Oil and Gas, Inglewood, California

1971

Junior Oil and Gas Engineer

Evaluated compliance with regulations for drilling operations in southern California. Carried out first environmental investigation of an oil field in California under a new law and established criteria for subsequent reviews. Produced geological maps published in "California Oilfields."

PROFESSIONAL ACTIVITIES

- *Learning from the Land*, Science Forum on the Grand Staircase-Escalante National Monument, Cedar City, Utah, Nov. 1-7, 1997; Field Trip Committee Chairman
- American Association of Petroleum Geologists, General Chairman, 1998 Annual Meeting
- Geological Society of America, General Chairman, 1997 Annual Meeting
- Utah Seismic Safety Commission, 1994 -present; Chair, Education and Awareness Committee, 1995-1997
- State Advisory Council on Science and Technology (Utah); Ex-officio, 1993-1999
- North American Commission on Stratigraphic Nomenclature (AASG representative), 1989-1992
- University of Utah Department of Geology and Geophysics Advisory Council, 1990-1996
- Steering Committee, 3rd International Reservoir Characterization Conference, 1991
- Interstate Oil Compact Commission, Enhanced Recovery Committee, 1991
- Utah Advisory Council on Intergovernmental Relations Earthquake Task Force, 1989-90
- Utah Earthquake Advisory Board, 1992-1994; Executive Committee, 1992-1994
- Utah Geographic Information Council, 1990-1995 (Acting Chair)
- Utah State Mapping Advisory Council, 1989-1999; Chair 1989-1996
- Kansas Water Authority (ex-officio), 1999-present
- Tertiary Oil Recovery Project (TORP- University of Kansas), Advisory Board, 1999-present
- University of Kansas Center for Research Inc., Board of Directors, 1999-present
- Kansas GIS Policy Board, 1999-present

OTHER EXPERIENCE

- California Army National Guard, 1970-1976: 185th Armored Division; 80th RAOC; 240th Signal Bn.
- News Director, KUCR-FM, Riverside, California, 1968-69
- Co-founder of Mission Control Computers (computer store), Santa Monica, California, 1977
- Grandeur Peak Neighborhood Association, Salt Lake City, Utah, co-founder and spokesperson, 1993

PROFESSIONAL ASSOCIATIONS

- American Association for the Advancement of Science, 1993-present
- American Association of Petroleum Geologists, 1989-present, (Astrogeology Committee member, 1988-present; General Chairman, 1998 Annual Meeting)
- American Geophysical Union: 1980-present
- Association of American State Geologists: 1989-present, (Energy and Minerals Policy Committee; Geologic Hazards Policy Committee; National Geologic Map Peer Review Panel, 1995-97; USGS Publications Transfer Committee, Co-chair; Ad Hoc Committee on the Future of the USGS, Chair; Secretary, 1999-2000)
- Association for Women Geoscientists: 1990-present
- Geological Society of America: 1974-present (General Chairman, 1997 Annual Meeting; International Survey Program Ad Hoc Committee, Chair)
- Nevada Petroleum Society: 1985-present
- Rocky Mountain Association of Geologists: 1983-1995
- Society of Professional Well Log Analysts: 1989-present
- Utah Geological Association: 1989-present, (Guidebook editor, 1990)
- Wyoming Geological Association: 1983-1995
- Sigma Xi: 1999-present
- Kansas Academy of Sciences: 1999-present
- Kansas Geological Society: 1999-present

POLITICAL CAMPAIGNS

- Energy Advisor, Clifford for Congress, Houston, Texas, May, 1989-March, 1990
- Campaign Manager, Caprio for Congress, San Diego, California, 1974
- Press Secretary, Media Director, and Acting Campaign Manager, Caprio for Congress, San Diego, California, 1972
- City Precinct Chairman, Unruh for Governor, Riverside, California (population 150,000), 1970

CERTIFICATIONS AND RECOGNITION

- California Registered Geologist #3411
- Wyoming Professional Geologist #2974
- California Community College Teaching Credential
- Ambassador Award*, Salt Lake Convention and Visitors Bureau, 1992
- Baylor Brooks Award (Outstanding Alumnus)*, San Diego State University Geology Alumni Assoc., 1998
- Honorary Member, Utah Geological Association, 1999

PROFESSIONAL AND TECHNICAL TRAINING

- 1991 Technical Writing - Shipley & Assoc.
- 1986 Interpreting Old E-logs - Standard Oil
- 1986 Rock Mechanics - Geological Society of America short course
- 1985 Balancing Cross Sections - Geological Society of America short course
- 1979 Structural Geology Seminar - Chevron
- 1978 Stratigraphic Seminar - Chevron
- 1976 Linear Operator (seismic processing) - Chevron
- 1975 Navigation School - Chevron
- 1975 Formation Evaluation - Chevron
- 1975 SCAT (dipmeter interpretation) - Chevron
- 1974 Basic Chevron School (petroleum geophysics)

GRANTS AND CONTRACTS

Principal Investigator, 1994-1999, "Increased Oil Production and Reserves Utilizing Secondary/Tertiary Recovery Techniques on Small Reservoirs in the Paradox Basin, Utah", U.S. Dept. of Energy, \$5,115,003

Principal Investigator, 1993-1998, "Increased Oil Production and Reserves from Improved Completion Techniques in the Bluebell Field, Uinta Basin, Utah", U.S. Dept. of Energy, \$5,676,856

Principal Investigator, 1993-1998, "Geological and Petrophysical Characterization of the Ferron Sandstone for 3-D Simulation of a Fluvial-deltaic Reservoir", U.S. Dept. of Energy, \$1,673,641

Principal Investigator, 1987-1989, "Geology of the Grassy Trail Creek Oil field", Utah Geological & Mineral Survey, \$8,000

Principal Investigator, 1987, "Stratigraphic Heterogeneity from Dipmeter Logs," Gas Research Institute, \$160,000

Principal Investigator, 1999-, Seismic Hazards in Skull Valley, Utah, Affecting Storage of High-level Nuclear Waste," Utah Department of Environmental Quality, cost reimbursable

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Structural Analysis of the Tensleep Fault, Bighorn Basin, Wyoming, Ph.D., 1986, University of Massachusetts, Amherst, 314p., Dr. Donald U. Wise, advisor.

Geophysical Studies Along the Southern Portion of the Elsinore Fault, M.S., 1974, San Diego State University, 229p., Dr. Robert B. McEuen, advisor.

INVITED TALKS:

Cities Service Research, Tulsa, Oklahoma, March 8, 1984: *"Structural Analysis of the Tensleep Fault, Bighorn Basin, Wyoming."*

Conoco Research, Ponca City, Oklahoma, March 22, 1984: *"Structural Analysis of the Tensleep Fault, Bighorn Basin, Wyoming."*

Stephen F. Austin State University, Nacogdoches, Texas, March, 1984: *"Structural Analysis of the Tensleep Fault, Bighorn Basin, Wyoming."*

Sierra Club, Dallas, Texas, Spring 1986: *"Geology of the Moons of Jupiter."*

University of Utah, Dept. of Geology and Geophysics, Salt Lake City, Utah, January 5, 1989: *"Geology of the Moons of Jupiter."*

Utah Geological Association, Salt Lake City, Utah, January 9, 1989: *"Variations of Stress in the Basin and Range."*

Amoco Prod. Research, Tulsa, Oklahoma, March 2, 1989: *"Statistical Curvature Analysis Techniques/Borehole Breakouts."*

Conoco Research, Ponca City, Oklahoma, March 2, 1989: *"Statistical Curvature Analysis Techniques/Borehole Breakouts."*

Phillips Petroleum, Bartlesville, Oklahoma, March 3, 1989: *"Statistical Curvature Analysis Techniques/Borehole Breakouts."*

Bureau of Economic Geology, Austin, Texas, May 22, 1989: *"Variations of Stress in the Basin and Range."*

Shell Research, Houston, Texas, May 24, 1989: *"Statistical Curvature Analysis Techniques/Borehole Breakouts."*

Texaco Research, Houston, Texas, May 25, 1989: *"Statistical Curvature Analysis Techniques/Borehole Breakouts."*

Haliburton Logging Services, Houston, Texas, May 25, 1989: *"Statistical Curvature Analysis Techniques/Borehole Breakouts."*

Arco Research, Plano, Texas, May 26, 1989: *"Statistical Curvature Analysis Techniques/Borehole Breakouts."*

Oryx Energy Co., Plano, Texas, May 30, 1989: *"Statistical Curvature Analysis Techniques/Borehole Breakouts."*

Occidental Petroleum, Tulsa, Oklahoma, May 31, 1989: *"Statistical Curvature Analysis Techniques/Borehole Breakouts."*

Utah State University, Dept. of Geology, Logan, Utah, February, 1990: *"Variations of Stress in the Basin and Range."*

Professional Geologists of Utah, AIPG, Salt Lake City, February 7, 1990: *"Geologic Bills in the 1990 Utah"*

Legislature."

Brigham Young University, Dept. of Geology, Provo, Utah, February 27, 1990: *"Variations of Stress in the Basin and Range."*

Bountiful Area Chamber of Commerce, April 18, 1990: *"Earthquake Hazards in Utah."*

University of Utah, Dept. of Mining Engineering, Salt Lake City, Utah, May 10, 1990: *"Variations of Stress in the Basin and Range."*

Petroleum Accountants Association, Salt Lake City, 1990: *"Oil and Gas Developments and Potential in Utah."*

Desk and Derrick Club, Salt Lake City, Industry Appreciation Night, November 12, 1990, *"Utah Petroleum Potential - New Horizons of Economic Opportunity."*

Chevron Oil Field Research Center, La Habra, California, November 13, 1990, Tar Sands Symposium, *Tar Sand Developments in Utah"*.

American Society for Photogrammetry and Remote Sensing, Salt Lake City, November 29, 1990: *"The Utah Geographic Information Council."*

Dixie Geological Association, St. George, Utah, Founding meeting, January 30, 1991: *"New Directions in Utah Petroleum,"* keynote address.

Utah Association of Petroleum & Mining Landmen, Salt Lake City, March 7, 1991: *"New Drilling Techniques in Utah."*

Association for Women Geoscientists, Salt Lake City, April 17, 1991, Panel discussion on *"Affirmative Action in State Government."*

Utah Geological Association, Salt Lake City, Utah, April 22, 1991, *"Oil and Igneous Intrusions in Nevada: An Exploration Model for the Great Basin"*.

Association of Desk and Derrick Clubs, Region VII Meeting, Salt Lake City, May 25, 1991, *"Earthquakes and the Industry in Utah"* seminar.

University of Utah Dept. of Geology and Geophysics, Distinguished Lecture Series, October 31, 1991, *"Geology, Politics, and Scams: What's Happening in Utah."*

National Earthquake Prediction Evaluation Council, Alta, Utah, 1991, *"Earthquake Prediction in Utah."*

Utah Bar Association, Energy, Natural Resources and Environmental Law Section, Salt Lake City, January 7, 1992, *"Horizontal Drilling and Applications in Utah,"* Continuing Legal Education short course.

Salt Lake City Rotary Club, January 21, 1992, *"Earthquakes in Utah,"*

Utah Division of Water Rights, Dam Safety Workshop, Salt Lake City, March 19, 1992, *"Geological Failure of Dams Around the World,"*

Uinta Basin Symposium, Vernal, Utah, May 13, 1992, *"Uinta Basin: America's Energy Storehouse,"* keynote address.

Utah Association of Petroleum & Mining Landmen, Salt Lake City, Nov. 5, 1992, *"Horizontal Drilling and Coalbed Methane - New Exploration Targets in Utah."*

Desk & Derrick Club, Salt Lake City, April 12, 1993, *"Earthquakes and oil wells"*.

Southern Utah University, Dept. of Geology, April 20, 1993, *"The St. George earthquake of Sept., 1992"*.

Snow College, Dept. of Physical Sciences, April 21, 1993, *"The St. George earthquake of Sept., 1992"*.

AIME, Soda Springs, Idaho, April 22, 1993, *"The St. George earthquake of Sept., 1992"*.

Holladay Rotary Club, Salt Lake City, February 16, 1994, *"Implications of the Northridge Earthquake for Utah."*

Salt Lake City Rotary Club, April 5, 1994, *"Implications of the Los Angeles and Draney Peak Earthquakes for Utah,"*

Utah Association of Petroleum and Mining Landmen, Salt Lake City, March 4, 1995, *"Oil and Gas Developments in Utah."*

31st Annual Engineering Geology & Geotechnical Engineering Conference, Logan, Utah, March 30, 1995, *"Geologic Hazards: How Much Risk is Acceptable?"*, keynote address.

Assoc. of Engineering Geologists, Utah Section, Salt Lake City, August 16, 1995, *"Geologic Hazards: How Much Risk is Acceptable?"*

University of Utah Law School, Salt Lake City, October 9, 1995, *"Energy and mineral resources in Utah."*

Central U.S. Earthquake Consortium, Annual Meeting, St. Louis, MO, November 14, 1995, Panel discussion *"Role of Seismic Safety Commissions in Risk Reduction Efforts."*

Utah Association of Petroleum and Mining Landmen, Salt Lake City, January 4, 1996, *"Geology and gas potential of Utah's Ferron Sandstone."*

League of Women Voters, Bountiful, Utah, February 6, 1996, *"Utah Earthquakes."*

Chamber of Commerce, Bountiful, Utah, May 15, 1996, *"Utah Earthquakes."*

Utah Geological Association, Salt Lake City, February 10, 1997, *"Energy and Mineral Resources of the Grand Staircase-Escalante National Monument - the Politics of Geology."*

Kiwanis Club, Salt Lake City, March 20, 1997, *"Geo-politics of the Grand Staircase-Escalante National Monument."*

Wallace Stegner Center for Land, Resources and the Environment, University of Utah, Salt Lake City, May 15, 1997, *"Geography, geology, and mineral resources of the Grand Staircase-Escalante National Monument", Visions of the Grand Staircase-Escalante: Exploring the Future of Utah's Newest National Monument.*

Utah Mining Association Annual Convention, Park City, Utah, September 18, 1997, *"Mining on Mars"*.

University of Nebraska, Lincoln, Nebraska, Stout Lecture Series, September 19, 1997, *"Geology and resources of the Grand Staircase-Escalante National Monument - the Politics of Geology."*

Brigham Young University, Provo, Utah, Dept. Of Geology, October 9, 1997, *"Geology and resources of the Grand Staircase-Escalante National Monument - the Politics of Geology."*

Geological Society of America, Annual Meeting, Salt Lake City, Utah, October 23, 1997, Panelist, Hot Topics

Debate, "*The New Grand Staircase-Escalante National Monument: Environmental Preservation vs. Resource Exploitation vs. Tourism.*"

Colorado Plateau Field Institute, Utah Valley State College, Orem, Utah, November 12, 1997, "*Geology and resources of the Grand Staircase-Escalante National Monument.*"

Mining and Metallurgical Society of America, Salt Lake City, Utah, January 6, 1998, "*Implications of the Global Warming Treaty for Utah Coal.*"

San Diego State University Geology Alumni Association Annual Meeting, Banquet speaker, San Diego, CA, April 7, 1998, "*Energy and Mineral Resources of the Grand Staircase-Escalante National Monument, Utah: A Study in the Politics of Geology.*"

Assoc. Of Engineering Geologists, Utah Chapter, Salt Lake City, May 6, 1998, "*Geologic Hazards Issues Affecting Storage of Spent Nuclear Fuel in Skull Valley, Utah*" (with Barry Solomon)

Fractured Reservoirs Conference, Petroleum Technology Transfer Council, Salt Lake City, October 23, 1998, "*Predictions of subsurface fracture orientations using borehole breakouts: examples from the western U.S.*"

Utah Assoc. Of Professional Landmen & Society of Petroleum Engineers (Utah Chapter) joint meeting, Salt Lake City, January 14, 1999, "*The Digital Geologic Resources Atlas of Utah,*" (with Douglas A. Sprinkel).

Utah Geological Association, Salt Lake City, July 12, 1999, "*Utah Geological Survey and Utah: The next 50 years.*"

Kansas Geological Society, Wichita, September 23, 1999, "*Energy and Mineral Resources of the Grand Staircase-Escalante National Monument: the Politics of Geology.*"

Dept. of Geology, University of Kansas, October 7, 1999, Colloquium "*Energy and Mineral Resources of the Grand Staircase-Escalante National Monument, Utah: the Politics of Geology.*"

Geological Society of America Annual Meeting, Denver, Colorado, October 27, 1999, Panelist, IEE - Geology and Public Policy Forum, "*Creationism vs. Evolution in the Classroom: Should Geoscientists Make a Stand?*"

Geological Society of America Annual Meeting, Denver, Colorado, October 28, 1999, Hot Topics panelist, "*Evolution and Creationism: the Situation in Kansas.*"

Dept. of Geology, Kansas State University, November 4, 1999, Colloquium "*Energy and Mineral Resources of the Grand Staircase Escalante National Monument, Utah: the Politics of Geology.*"

National Science Foundation, Arlington, VA, March 15, 2000, "*Stealth Creationism: the Assault on Evolution in Kansas.*"

Kansas Independent Oil and Gas Association (KIOGA) Annual Meeting, Wichita, Kansas, August 28, 2000, keynote address, "*Helping Producers Make Kansas Richer.*"

Leadership Kansas, Hays, Kansas, September 15, 2000, "*Geology of Water, Oil, and Gas in Kansas.*"

Geology Club, San Jose State University, Calif., October 9, 2000, "*Assault on Science: The Evolution Battle in Kansas.*"

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- Chidsey, T.C., M.L. Allison, and J.G. Palacas, 1990, *Potential for Precambrian Source Rock in Utah (abs)*, AAPG Bull., v74, p1319.
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- Allison, M. Lee, and Susan J. Lutz, 1991, *Faulted Shoreline and Tidal Deposits of the Moenkopi Fm., Grassy Trail Creek Field, Utah (abs)*, AAPG Bull., v75, p1122.
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- Allison, M. Lee, 1998, *Geography and Geology of the Grand Staircase-Escalante National Monument*, in Walker, J and S. George, (editors), Visions of the Grand Staircase-Escalante: Exploring the Future of Utah's Newest National Monument, Wallace Stegner Center for Land, Resources, and the Environment, University of Utah, p3-12.
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- Allison, M. Lee 1999, *The Utah Geological Survey and Utah: the Next 50 Years (abs)*, Utah Geological Association Newsletter, v31, #7, p1-3.
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BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

January 30, 2001

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.

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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.


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NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

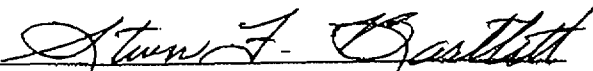
- Bending and tensional stresses introduced in the soil cement mat during the earthquake by horizontally propagating and inclined waves
 - Stress concentrations at the pad and soil-cement mat interface due to non-uniform thickness and large differences in stiffness between the concrete pad and the soil-cement 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 it 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.

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 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 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.

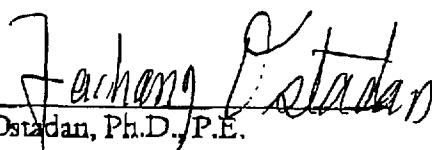
PFS estimated seismic load by multiplying mass times acceleration but this ignores the coupling from the two horizontal directions. Seismic loads from the dynamic analysis of the building including the coupling from the two horizontal directions should be used in the stability analysis. PFS has ignored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

0599601 PD #5 PRI.20
PO #9 PRI.2C

100 Pine Street, 10th Floor
San Francisco, CA 94111
(415) 434-9400 • FAX (415) 434-1365



February 20, 1997
Project 3801

VS-184

NOTED S.M. MACIE MAR 5 1997

Mr. John Donnell
Stone & Webster Engineering Corporation
7677 E. Berry Avenue
Engelwood, CO 80111-2137

Subject: Review of Draft Report "Seismic Survey of the Private Fuel Storage Facility,
Skull Valley, Utah" by Geosphere Midwest, SWEC J.O. No. 05996.01

Dear John:

As per your request, we have reviewed the subject geophysical report and our review of that report is attached.. Our particular focus in this review was the degree to which the report provides information of importance to our deterministic ground motions assessment. This information includes the depth to bedrock and the shear-wave velocity profile beneath the site. We are particularly concerned with the resolution of the seismic survey in this respect and the associated uncertainties. In addition, we have reviewed the structural interpretations made of the seismic reflection profile.

The review was conducted by John Lutinger of Geomatrix and Bill Honjas of William Lettis and Associates. These individuals have considerable experience in conducting and interpreting seismic surveys.

If you have any questions concerning this review, please feel free to give me a call.

Sincerely,

Kevin J. Coppersmith
Project Manager

PFS-01035

Geomatrix Consultants, Inc.
Engineers, Geologists, and Environmental Scientists

00048

CONDENSED TRANSCRIPT

UNITED STATES OF AMERICA NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

Thursday, November 16, 2000 - 10:11 a.m.

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

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



CitiCourt
THE REPORTING GROUP

50 South Main, Suite 920
Salt Lake City, Utah 84144

801.532.3441

TOLL FREE 877.532.3441

FAX 801.532.3414

Deposition of: Dr. Steven F. Bartlett & Dr. Farhang Ostadan
Taken: November 16, 2000

SHEET 1 PAGE 1

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

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A P P E A R A N C E S

For the Intervenor: Denise Chancellor, Esq.
ASSISTANT ATTORNEY GENERAL
Office of the Attorney General
160 East 300 South, 5th Floor
Salt Lake City, UT 84114-0873

For the Applicant: Mattias F. Travieso-Diaz, Esq.
SHAW PITTMAN
2300 N. Street, NW
Washington, D.C. 20037-1128

Also Present: Barry J. Solomon, Thomas Y. Chang,
Paul Trudeau

I N D E X

WITNESSES	PAGE
DR. STEVEN F. BARTLETT	
DR. FARHANG OSTADAN	

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P R O C E E D I N G S

DR. STEVEN F. BARTLETT

and

DR. FARHANG OSTADAN,

having been first duly sworn to tell the truth,
were examined and testified as follows:

E X A M I N A T I O N

BY MR. TRAVIESO-DIAZ:

Q. Good morning, gentlemen. Mr. Bartlett, will you state your full name for the record, please?

A. (Dr. Bartlett) Steven, with a V, Floyd Bartlett.

Q. And you, Mr. Ostadan?

A. (Dr. Ostadan) Farhang Ostadan.

Q. My name is Matias Travieso-Diaz. I'm an attorney representing PSFS in this proceeding. I'll be asking questions today with respect to what has been identified in this matter as Contention L.

Before we start, let me make sure that if you don't understand a question that I ask, please ask me to rephrase it, restate it or have it read back, whatever. And make sure that you don't answer a question unless you understand it fully.

Today you are testifying as a panel, and I will probably be directing questions to one of you.

Deposition of: Dr. Steven F. Bartlett & Dr. Farhang Ostadan
Taken: November 16, 2000

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1 That doesn't take away from the other the opportunity to
2 add if you have something to add. Nevertheless, the
3 only thing that I ask is that you don't confer before
4 providing the answers. And I also ask that only one of
5 you speak at a time so the record doesn't get confused.
6 Is that understood?

7 A. (Dr. Bartlett) Yes.

8 Q. Since you are going to be testifying as a
9 panel, could I ask as a preliminary question, what
10 portions of what has been identified as Contention L do
11 you regard yourself as being expert on so that we can
12 define in advance your areas of expertise? You,
13 Mr. Bartlett?

14 A. (Dr. Bartlett) Bases 2, 3, and 4.

15 Q. 2, 3, and 4. How about you, Mr. Ostadan?

16 (Dr. Ostadan) I can't cite the number on
17 the basis I don't recall. But all those calculations
18 and design parameters relating to loading of the
19 foundation and ground motion, seismicity.

20 Q. Let me start asking questions of you,
21 Mr. Bartlett. What is your current position and
22 employer?

23 A. (Dr. Bartlett) I'm employed by the
24 University of Utah. I'm an assistant professor in the
25 Civil and Environmental Engineering Department.

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1 Q. Do you have any other jobs aside from your
2 position with the university?

3 A. (Dr. Bartlett) No.

4 Q. And your work in connection with what is
5 known as Contention L, is that part of your university
6 assignment?

7 A. (Dr. Bartlett) No, it actually began when I
8 was working for the Utah Department of Transportation.

9 Q. Is this a separate employment for you?

10 A. (Dr. Bartlett) Yes. I changed employments
11 in August.

12 Q. But you retain your responsibility for this
13 work?

14 A. (Dr. Bartlett) Yes.

15 Q. So technically, right now you're working
16 both for the university and as a separate matter in
17 connection with this work?

18 A. (Dr. Bartlett) Yes, in contract with the
19 state Attorney General's office.

20 Q. Any other thing like that that you're doing?

21 A. (Dr. Bartlett) No.

22 Q. Okay. Now, are you -- I take it you're
23 familiar with the PFS project?

24 A. (Dr. Bartlett) Yes.

25 Q. When did you become involved with the PFS

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1 project?

2 A. (Dr. Bartlett) My best recollection, the
3 first team meeting we had as a panel with the state
4 experts was sometime in spring of '99.

5 Q. When you say met the experts as a panel, who
6 were the experts that met?

7 A. (Dr. Bartlett) The other experts that were
8 part of Contention L.

9 Q. And those were?

10 A. (Dr. Bartlett) Let's see. At that time
11 Dr. Lee Allison, geological survey; Barry Solomon, state
12 geological survey. Denise Chancellor was there, Connie
13 Nakahara, Dr. Walter Arabasz. And I believe
14 Dr. Peschmann, but I'm not sure, from the University of
15 Utah. That's the best of my recollection.

16 Q. And when you were retained to work on this
17 matter, what were you asked to do?

18 A. (Dr. Bartlett) I was asked to review the
19 geotechnical portions of Contention L.

20 Q. Who retained you?

21 A. (Dr. Bartlett) Initially on not our panel
22 but I think another panel, the Department of
23 Transportation was involved. I believe the name is Dave
24 Miles. And through my immediate supervisor, Dave Miles
25 found out that I had expertise in these areas and was

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1 requested by UDOT management to join the panel.

2 Q. What have you done in connection with what's
3 known as Contention L since the time you were retained?
4 Just generally.

5 A. (Dr. Bartlett) What have I done?

6 Q. Yes. What activities have you carried out?

7 A. (Dr. Bartlett) Review of the SAR, review of
8 the supporting calculations.

9 Q. Let me show you something that is already on
10 the record, so I'm not going to introduce it as a new
11 exhibit. But let me give you a copy. This is Exhibit
12 3.

13 For the record, Exhibit 3 is a State of
14 Utah's Contentions on the Construction and Operating
15 Licence Application by Private Fuel Storage, LLC for an
16 Independent Spent Fuel Storage Facility. It is dated
17 23rd of November, 1997, and the exhibit actually only
18 contains the portion of the document that deals with
19 what's known as issue L, geotechnical.

20 Q. (By Mr. Travieso-Diaz) Do you have that
21 document in front of you?

22 A. (Dr. Bartlett) I do.

23 Q. Have you seen this document before?

24 A. (Dr. Bartlett) Yes, I have.

25 Q. Are you familiar with it?

1 A. (Dr. Bartlett) Yes.
2 Q. What is the source of your familiarity?
3 A. (Dr. Bartlett) I've read through it and
4 used it somewhat as the basis of my review. As a
5 structure, I guess.
6 Q. When did you see this document most
7 recently?
8 A. (Dr. Bartlett) Parts of it yesterday.
9 Q. Okay. So it's fresh in your mind?
10 A. (Dr. Bartlett) Reasonably.
11 Q. Now, let me ask you to take a look at page
12 83 of Exhibit 3. And near the top of the page there is
13 a paragraph that starts with -- it's in bold characters
14 and starts with a sentence that reads, "Characterization
15 of subsurface soils." Do you see that?
16 A. (Dr. Bartlett) Yes.
17 Q. And there's a text that starts there, page
18 83, and if I'm not mistaken, runs all the way through
19 page 92.
20 A. (Dr. Bartlett) Then I see on 92, 4,
21 stability and foundation loading, yes.
22 Q. Is it your understanding that the text
23 between pages 83 and page 92 is what's known within
24 Contention L as Basis 3?
25 A. (Dr. Bartlett) Correct.

1 Q. And now, Section 3 has in turn three
2 subsections: subsection A, entitled "Subsurface
3 investigations." It starts on page 83 and runs through
4 top of page 85 that has a new subsection, B, called
5 "Sampling and analysis." Is that correct?
6 A. (Dr. Bartlett) Correct.
7 Q. And then there is a -- subsection B runs
8 through page 89, and there is a subsection C entitled
9 "Physical property testing for engineering analysis."
10 Is that correct?
11 A. (Dr. Bartlett) The page was 89?
12 Q. Yes.
13 A. (Dr. Bartlett) Yes, I see that.
14 Q. All right. And your understanding is that
15 these are the three subsections, if you will, of Section
16 3 --
17 A. (Dr. Bartlett) Yes.
18 Q. -- or Basis 3?
19 A. (Dr. Bartlett) Yes.
20 Q. Were you the author of any part of Section 3
21 of this document?
22 A. (Dr. Bartlett) No.
23 Q. There is a person by the name of Lawrence
24 White that is mentioned on the first page, I think, of
25 Exhibit 3. I believe it's the first page.

1 A. (Dr. Bartlett) Yeah, I see his name.
2 Q. Do you see his name?
3 A. (Dr. Bartlett) Yeah.
4 Q. Is Lawrence White the author of any part of
5 the text of subsection 3 of Exhibit -- of Contention L?
6 A. (Dr. Bartlett) That I'm not sure. I've
7 been told that this has been written by a combination of
8 Lawrence White and Barry Solomon, so I'm not sure. But
9 it's probably reasonable to assume that he wrote most of
10 that, being a geotechnical.
11 Q. Do you know Mr. White?
12 A. (Dr. Bartlett) I've never met him.
13 Q. So I take it that you didn't have any
14 communications with him with respect to this contention?
15 A. (Dr. Bartlett) None.
16 Q. All right. Are you aware that you have been
17 designated by the State of Utah as an expert witness in
18 this proceeding?
19 A. (Dr. Bartlett) I am.
20 Q. And on what aspects of the licensing of this
21 facility are you expected to testify?
22 A. (Dr. Bartlett) The subsurface
23 investigations, the laboratory sampling, the
24 geotechnical and foundation analysis.
25 Q. Now, you said a moment ago that your

1 understanding is that the text of what's known as
2 subsection or Basis 3 of Contention L was originated
3 from Mr. White -- or Dr. White and Mr. Solomon?
4 A. (Dr. Bartlett) Yes.
5 Q. Do you -- and I take it Mr. White is no
6 longer -- Dr. White is no longer among the experts in
7 the group that you work with?
8 A. (Dr. Bartlett) That's correct.
9 Q. Do you have any knowledge of the
10 circumstances that led to your replacing Mr. White?
11 A. (Dr. Bartlett) I had just been told the
12 state no longer decided to retain him as a consultant.
13 Other than that, I don't know.
14 Q. All right. Now, in getting prepared or in
15 discharging your functions that you described a moment
16 ago with respect to Contention L, what documents have
17 you reviewed of those prepared by the applicant in
18 connection with the issues that are part of
19 Contention L?
20 A. (Dr. Bartlett) The Safety Analysis Report
21 has been the basis of my review, the supporting
22 calculations that are in the SAR that's a part, mainly
23 2.6. I don't believe I've gone beyond the SAR in
24 supporting calculations, and attachments and appendices.
25 Q. From time to time we might refer to a

Deposition of: Dr. Steven F. Bartlett & Dr. Farhang Ostadan
Taken: November 16, 2000

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1 document, so maybe you have reviewed them and you'll be
2 able to update that list. And I take it that you not
3 only reviewed the SAR but you reviewed the periodical
4 dates to it as to where it filed?

5 A. (Dr. Bartlett) Yes, I did. As they came to
6 us, I was reviewing the updates to the SAR.

7 Q. Now, when you say that you reviewed the SAR
8 and the calculations, do you mean also to include among
9 those documents the reports or the documents that
10 reflect SAR's investigations or laboratory tests?

11 A. (Dr. Bartlett) I'm not sure what those
12 other documents you're referring to are.

13 Q. For example, do you review boring records?

14 A. (Dr. Bartlett) I looked at the published
15 boring logs, yes.

16 Q. Do you look at lab test reports?

17 A. (Dr. Bartlett) Yes.

18 Q. Do you look at any such documents as lab
19 reports of boring records that were not part of the SAR?

20 A. (Dr. Bartlett) Some were provided to me I
21 think in discovery, but at the time I don't recall going
22 through them very extensively. I think I've focused my
23 reading of the SAR in supporting calculations and the
24 appendices that included the laboratory testing.

25 Q. So if there were materials that were

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1 internal documents to the state have you reviewed?

2 A. (Dr. Bartlett) Just drafts of discovery.
3 And then anytime the SAR was updated as we were
4 preparing, we would do our own review of the SAR and we
5 would pass our SAR comments, if you will, amongst each
6 other.

7 Q. There has been testimony by other witnesses,
8 both for the state and the applicant, to the effect that
9 applicant has performed significant additional work in
10 matters relating to Contention L since this Exhibit 3
11 was filed in November '97. Is it your understanding
12 that that has also been the case with respect to what's
13 called Basis 3 or issue 3?

14 A. (Dr. Bartlett) There's been other work
15 performed at the site.

16 Q. And have you undertaken to review that
17 additional work done by applicant since 1997 to
18 determine whether the issues raised in November of '97
19 as part of Basis 3 have been addressed, resolved or
20 modified?

21 A. (Dr. Bartlett) I have reviewed the
22 subsequent work. I've seen primarily in this case
23 additional cone penetrometer testing, dilatometer
24 testing, and subsequent laboratory testing as provided
25 usually in the request for additional information.

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1 provided in discovery that may have provided additional
2 information, you have not seen them?

3 A. (Dr. Bartlett) I've seen things that were
4 provided in discovery. And the extent of my review may
5 depend on how germane, what was provided, what I felt
6 were key issues, and whether they shed any light into
7 them or not. A project like this generates quite a bit
8 of paperwork and memorandums and correspondence, and I
9 have read some of them, yes. But in detail, no.

10 Q. I'm sorry. If you see me cutting you off,
11 cut me off, please.

12 A. (Dr. Bartlett) Fair enough.

13 Q. I asked you a moment ago, are documents
14 prepared by applicant. Now, have you reviewed documents
15 prepared by other parties? For example, have you
16 reviewed documents prepared by the NRC?

17 A. (Dr. Bartlett) I have looked at the NRC's
18 Safety Evaluation Report briefly. I have also looked at
19 the request for additional information.

20 Q. Have you looked at any documents prepared by
21 the state or any other party?

22 A. (Dr. Bartlett) Yes, that's true. Our
23 internal documents, yes, that we've prepared.

24 Q. And I don't mean to ask you about, of
25 course, communications with counsel, but what sort of

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1 Did I answer all of your question?

2 Q. Yes. But now my question is, did you seek
3 to -- in light of this new information that you have
4 looked at, have you sought to review the text of Issue 3
5 as appears in Exhibit 3? And you can please do this
6 with me now, to figure out if there is any portion of
7 what is described between pages 83 and 92 of Exhibit 3
8 that is no longer applicable because it has been
9 resolved or taken care of by subsequent reviews.

10 A. (Dr. Bartlett) It may be difficult for me
11 to find exactly the pieces that have been resolved, but
12 I can tell you at least in generalities what I think has
13 changed since the initial submission of Contention L to
14 where we stand at this particular point in time.

15 Q. Will you please do that?

16 A. (Dr. Bartlett) Sure. I do not believe
17 there are any issues of liquefaction at this site.
18 Dynamic settlement does not appear to be a major issue
19 at this site. The calculations supporting consolidation
20 settlement and secondary consolidation settlement.

21 Q. Anything else?

22 A. (Dr. Bartlett) Not that jumps out at me at
23 the moment.

24 Q. Rather than forcing you to rely on your
25 memory, could I ask you to take a minute to review,

1 actually go over and these ten pages. We may take a
2 couple minutes break for to you do that, so if anything
3 else comes to mind that you believe has been resolved,
4 you can tell us.
5 A. (Dr. Bartlett) Sure.
6 (Recess from 10:30 to 10:36 a.m.)
7 Q. (By Mr. Travieso-Diaz) Do you need the
8 question read back to you?
9 A. (Dr. Bartlett) Yes, please.
10 (The record was read: "A. It may be difficult for
11 me to find exactly the pieces that have been resolved,
12 but I can tell you at least in generalities what I think
13 has changed since the initial submission of Contention L
14 to where we stand at this particular point in time.
15 Q. Will you please do that?
16 A. (Dr. Bartlett) Sure. I do not believe
17 there are any issues of liquefaction at this site.
18 Dynamic settlement does not appear to be a major issue
19 at this site. The calculations supporting consolidation
20 settlement and secondary consolidation settlement.
21 Q. Anything else?
22 A. (Dr. Bartlett) Not that jumps out at me at
23 the moment."
24 Q. And then I asked, will you review the text
25 of Basis 3 of Contention L that goes from page 83 to 92

1 of Exhibit 3 and tell me if any of the matters raised on
2 those pages has been resolved, to your understanding.
3 A. (Dr. Bartlett) I want to refer to page 84.
4 I do not wish to make a lot of comments on the geology
5 and structural geology and engineering geology of this
6 site because it's not my area of expertise, but there
7 has been further work done in that, and so I'll defer
8 you maybe to other experts about those particulars that
9 are mentioned there -- structural geology, geological
10 history, and engineering geology.
11 One thing on page 84, the estimation of
12 thicknesses of the layers, and that I think has been
13 resolved from an engineering standpoint by the cone
14 penetrometer.
15 Q. Can you tell us where on page 84 you're
16 referring to?
17 A. (Dr. Bartlett) Oh, it's the second line.
18 It talks about uncertainties in estimation of the
19 thicknesses of various materials.
20 Q. That's the second line from the top of the
21 page; is that correct?
22 A. (Dr. Bartlett) Yes. I think the cone
23 penetrometer gives us reasonable estimates of
24 thicknesses and, from an engineering standpoint, the
25 stratigraphy of the site.

1 Q. Sorry. So I understand your last comment:
2 do you believe that from the engineering standpoint the
3 stratigraphy of the site has been also defined?
4 A. (Dr. Bartlett) In the upper 30 to 35 feet
5 where the cone penetrometer's been pushed, the
6 stratigraphy and thicknesses of those units.
7 Q. Sorry. Are you finished with the answer?
8 A. (Dr. Bartlett) Are reasonably described as
9 far as thickness.
10 The rest of 84 still talks more about
11 geology, geochemical analyses. I will defer on speaking
12 on those. So that would finish that page.
13 Under "sampling and analysis" on page 86,
14 there's some discussions about not taking particular
15 soil samples in -- I'm reading in the middle of the page
16 where it starts "for example."
17 Q. The second sentence in the second paragraph
18 of the page?
19 A. (Dr. Bartlett) The second sentence, yes.
20 Q. All right.
21 A. (Dr. Bartlett) Well, it's actually the
22 third where it starts, "For example, the soil test
23 data" --
24 Q. Okay.
25 A. (Dr. Bartlett) -- "did not include samples

1 taken from each of the soil strata, did not include each
2 foundation of buildings or structures, and did not
3 include the PMF diversion dike foundation, and did not
4 evaluate compacted soils." There's been additional
5 borings done that cover some of those areas.
6 Q. So do you consider that the concern
7 expressed in that sentence is not applicable?
8 A. (Dr. Bartlett) Pertaining to not placing
9 borings under certain areas, yes, or in certain areas.
10 On to page 87. Second sentence beginning
11 with "The Applicant must obtain representative
12 undisturbed samples of each of the site soils and
13 determine their dynamic properties." We have seen
14 additional testing done to determine the dynamic
15 properties of certain soil layers. We're still not sure
16 whether all layers have been sampled and tested. But
17 there has been additional testing to determine dynamic
18 properties.
19 Q. So the statement made in that sentence, "The
20 Applicant must obtain representative undisturbed samples
21 of each of the site soils and determine their dynamic
22 properties," is that statement still applicable or not
23 applicable?
24 A. (Dr. Bartlett) It's applicable to the
25 extent that they have determined additional dynamic

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21

1 properties. Whether they have sampled all undisturbed
2 samples from all layers, we would not agree with.
3 Definition of layering may differ between your layering
4 system and our layering system.

5 Q. All right, please go.

6 A. (Dr. Bartlett) Okay. On page 88 it's
7 talking about, in the first full sentence on that page,
8 "For example, throughout calculation number 04-3, the
9 criteria for assignment of unit weight," and then it
10 has, "typically used in all soil analysis (strength,
11 consolidation, and dynamic response) are assumed."
12 There's been enough characterization to define the unit
13 weights, I think, of this profile.

14 Q. So again, is it your understanding that this
15 sentence is no longer --

16 A. (Dr. Bartlett) Only dealing with unit
17 weights.

18 Q. Only to the extent of units weights?

19 A. (Dr. Bartlett) Yeah, this is referring
20 to -- just one moment. Let me read it. This is only
21 referring to unit weight. Yes, the unit weights are
22 needed for other analyses, but relating to unit weight,
23 we think that has been resolved.

24 Q. And as you understand the sentence, it does
25 refer to unit weights; is that correct?

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23

1 between calculations, and I don't believe those would be
2 major issues anymore.

3 Q. So would you say, then, the rest of this
4 paragraph starting with calculation 04-3 is also
5 resolved?

6 A. (Dr. Bartlett) Regarding unit weights, yes.

7 Q. Do you think it refers to anything else?
8 I'm just trying to understand what --

9 A. (Dr. Bartlett) I don't believe so.

10 Q. Okay. All right, please go on.

11 A. (Dr. Bartlett) On the second -- the first
12 full sentence on page 89 beginning with "For strengths
13 conducted in the laboratory, full details must be given;
14 for example, how saturation of the sample was determined
15 and maintained during testing and how the pore pressures
16 changed," that does not appear to be applicable, at
17 least regarding the pore pressure changes, because we're
18 dealing with unsaturated sediments.

19 Q. So I take it that your understanding is that
20 this particular concern is no longer applicable because
21 we don't have the type of soils to which it would apply?

22 A. (Dr. Bartlett) The saturation of the
23 samples and measuring of pore pressures does not appear
24 to be applicable in most instances for these soils.

25 The next sentence beginning, "For sites that

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1 A. (Dr. Bartlett) Yes. It's talking about the
2 criteria for assessment of unit weights, then it says
3 typically used for soil analysis -- or all soil
4 analysis, and those would be strength, consolidation,
5 and dynamic response, are assumed. And I believe the
6 current calculations are not using assumed values.

7 Q. Okay.

8 A. (Dr. Bartlett) And any other discussion in
9 this paragraph about unit weights. I don't believe unit
10 weights are a significant issue.

11 Q. So for example, the next sentence in that
12 page that starts -- well, the next -- the sentence after
13 next on that page that starts with "The justification of
14 the values should be provided," is it your
15 understanding that that refers to unit weights?

16 A. (Dr. Bartlett) Correct.

17 Q. And to that extent, that sentence has also
18 been resolved?

19 A. (Dr. Bartlett) Pertaining to unit weights.

20 Q. Now, the next sentence, does it also pertain
21 to unit weights, or is it a different thought? The one
22 that starts with "calculation number 04-3."

23 A. (Dr. Bartlett) Yes, I see it. Just a
24 moment. I think the remainder of this paragraph is
25 trying to point out some discrepancies in unit weights

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1 are underlaid by cohesionless soils and sensitive clays
2 that are or may become saturated, particularly at depths
3 greater than 30 feet, the Applicant should show that all
4 zones that could become unstable because of liquefaction
5 or strain-softening phenomena have been sampled and
6 tested to evaluate their ground-failure potential." As
7 I said before in my general statement, I do not believe
8 liquefaction is an issue. The strain-softening
9 phenomena may still be an issue.

10 Q. So is it your testimony that this sentence
11 is inapplicable to the extent that it refers to
12 liquefaction?

13 A. (Dr. Bartlett) To liquefaction.

14 Q. But it may be applicable to the --

15 A. (Dr. Bartlett) Still strain-softening
16 phenomena, yes. Applicable still to strain-softening
17 phenomena.

18 Q. Okay.

19 A. (Dr. Bartlett) On page 90 beginning with
20 the sentence about two thirds of the way down, "For
21 example, the dynamic analyses presented instead use
22 published information from 1970 which is extrapolated to
23 the site without any basis for such extrapolation. The
24 variation of shear modulus determined for testing cited
25 in this reference is based upon a very small strain

1 derived from laboratory compacted loose to medium dense
2 sand materials." I am going to defer that section maybe
3 to Dr. Ostadan. That's the area of his expertise.

4 Q. May I ask you to stop for a second? Turn
5 the exhibit over to Dr. Ostadan. Maybe this is a chance
6 for him to help us out here.

7 Could you review, Dr. Ostadan, the sentence
8 from page 90 that starts with "For example."

9 And Mr. Bartlett, how far do you believe
10 that he should be reviewing? The sentence goes
11 through --

12 A. (Dr. Bartlett) I think he should probably
13 finish that and through the end of the paragraph.

14 Q. Which ends on the middle of page 91?

15 A. (Dr. Bartlett) Correct.

16 Q. So Dr. Ostadan, you are asked to review the
17 sentence that starts with "For example, the dynamic
18 analysis" on page 90, going through to the end of the
19 paragraph on page 91. And tell us based on your
20 understanding of what has been done whether the concerns
21 raised in those sentences are still applicable.

22 MS. CHANCELLOR: He may need some time to
23 review.

24 MR. TRAVIESO-DIAZ: Absolutely.

25 A. (Dr. Ostadan) Okay. Starting from the

1 determine the void ratios at this site. The cause for
2 the high void ratios still may be discussed. But there
3 are cases that -- well, the request for additional
4 information has addressed some of these high void
5 ratios.

6 Q. Would you help me understand what your
7 assessment of the status of this particular issue is?
8 Will you explain to me whether you feel that the causes
9 of the void ratios have been addressed, or what do you
10 think has been resolved?

11 A. (Dr. Bartlett) I think this is pointing out
12 that from the consolidation testing and other testing
13 for void ratio that there are apparently some high void
14 ratios for these soils, and additional void ratio
15 measurements have been made. I'm not sure the applicant
16 has completely described the reasons for these high void
17 ratios, or at least to our satisfaction.

18 Q. So would it be fair to characterize --

19 A. (Dr. Bartlett) The additional void ratio
20 testing has been done and characterization has been
21 done, but the cause of the high void ratios still may be
22 uncertain.

23 Q. Thank you. You answered the question before
24 I asked.

25 A. (Dr. Bartlett) You're welcome.

1 sentence "for example," use of generic soil curves in
2 the dynamic analysis.

3 Q. Could you for the record identify where
4 you're reading from?

5 A. (Dr. Ostadan) I'm reading on page 90, the
6 second -- the sentence that starts with "For example."

7 Q. Okay.

8 A. (Dr. Ostadan) Middle of the page. Analysis
9 is still based on published information for soil curves.
10 No, I do not think any of the points made until the
11 middle of the page 91 is part of the analysis.

12 Q. Dr. Ostadan, I didn't have the opportunity
13 to ask you this before. Is this opinion that you have
14 expressed based on your review not only of the original
15 SAR submitted by applicant but all of the dates and
16 information?

17 A. (Dr. Ostadan) Yes, it is.

18 Q. So it is based on your understanding of the
19 current state of the investigations and analysis
20 performed by applicant?

21 A. (Dr. Ostadan) Yes, it is.

22 Q. Thank you. Dr. Bartlett, will you continue?

23 A. (Dr. Bartlett) Sure. Leading to the
24 next -- well, the second paragraph on page 91 discussing
25 void ratios. There have been additional work to

1 Q. Could you please go on?

2 A. (Dr. Bartlett) I think that's -- let's see.
3 Got one more paragraph, don't I?

4 The last paragraph talks about some standard
5 types of engineering properties tests, and it cites, for
6 example, "unit weights, porosity, compaction, etc.,
7 which should be performed for layer 1 and 2 soils."

8 As I've stated earlier, I do not believe
9 unit weights are a significant issue here. Porosity is
10 a function of void ratio, so we're really again talking
11 about void ratio when we say porosity. We just
12 discussed that matter. And compaction, though I don't
13 recall seeing standard compaction curves for this site,
14 I would assume those would be done when one would begin
15 to develop a design. I do not believe those type of
16 compaction issues are a problem.

17 Q. Sorry, I didn't hear you.

18 A. (Dr. Bartlett) That any issues relating to
19 compaction or standard compaction curves will really be
20 an issue here.

21 Q. Before I ask you my next question, so the
22 record is clear: when you said the last paragraph, you
23 meant the last paragraph of subsection 3 --

24 A. (Dr. Bartlett) In that subsection, correct.

25 Q. -- which is on top of page 92?

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1 A. (Dr. Bartlett) Yes, beginning with
2 "Further, the Applicant performed only limited."
3 Q. Could you clarify for me what is meant in
4 that paragraph that you just read by layer 1 and layer 2
5 soils?
6 A. (Dr. Bartlett) That I am not sure of.
7 Q. But you said earlier that you were not too
8 sure of whether your definition of layers was the same
9 as applicant's.
10 A. (Dr. Bartlett) That's correct.
11 Q. Could you elaborate on that?
12 A. (Dr. Bartlett) Our information and
13 understanding of the layering of the system has changed
14 since this document was published, and admittedly so.
15 And as I recall in the earlier versions of the SAR we
16 were talking about soils in the upper 30 to 35 feet and
17 then a deeper, denser layer. And I'm assuming these
18 mean for those -- that system. But now it seems we have
19 progressed to the state where we've been talking about
20 the upper layer and as many as possibly five subunits.
21 So when it refers to layer 1 and, 2, I assume it's
22 talking about the original layering as discussed in the
23 SAR.
24 Q. But for purposes of the rest of our
25 discussion today, when we speak of layers, do you mean

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1 this proceeding?
2 A. (Dr. Bartlett) Of legal counsel?
3 Q. Apart from legal counsel.
4 A. (Dr. Bartlett) Oh, apart from legal
5 counsel.
6 Q. Please.
7 A. (Dr. Bartlett) Could you restate the
8 question?
9 Q. Okay. With what parties, other than the
10 lawyers, have you discussed the subject of Contention L?
11 A. (Dr. Bartlett) My immediate supervisors for
12 the Utah Department of Transportation. I've had -- I
13 guess my supervisors now at the University of Utah have
14 asked me questions about my involvement in Contention L.
15 I've just told them what I'm doing, just more as in
16 passing so they know where I'm at and what I'm about.
17 When you mean "besides," do you want also me
18 to include those that are also state expert witnesses?
19 Q. Yes.
20 A. (Dr. Bartlett) Okay. That would also
21 include, then, Dr. Lee Allison, Walter Arabasz, Jim
22 Peschmann, Dr. Ostadan, Barry Solomon. I believe that's
23 all.
24 Q. Now, what is your understanding of the
25 respective roles of the experts that you mentioned in

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1 the layers that were discussed in -- strike that
2 question. Start a new question. Were you here
3 yesterday when Mr. Trudeau and Dr. Chang gave their
4 testimony deposition?
5 A. (Dr. Bartlett) Correct.
6 Q. Do you recall there being a discussion in
7 their deposition of several layers that were identified
8 against particular figures of the SAR?
9 A. (Dr. Bartlett) Correct.
10 Q. Now, for purposes of our discussion today,
11 when we refer to layers, are you speaking for those
12 layers that are now currently depicted in the SAR for
13 the top 30 feet?
14 A. (Dr. Bartlett) Correct. In fact, we could
15 bring the SAR out and identify them if you'd like.
16 Q. We'll do that very soon, but I just wanted
17 to make sure we're speaking of the same --
18 A. (Dr. Bartlett) Since this document is
19 historical, I think it's talking about an older layering
20 system. The layering system has evolved.
21 Q. Thank you. I would ask you to keep this
22 Exhibit 3 handy, since we'll be probably talking about
23 it a lot more.
24 With whom, other than your legal counsel,
25 have you discussed issues relating to Contention L in

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1 this proceeding?
2 A. (Dr. Bartlett) We've broken it up into
3 different disciplines and expertise for our review. And
4 Dr. Arabasz and Dr. Peschmann have taken the lead in the
5 Basis 1, though we have had some comments and input into
6 Basis 1 also. When I mean "we," myself and also
7 Dr. Ostadan.
8 For the geology and geotechnical issues
9 would be Barry Solomon, Lee Allison, myself,
10 Dr. Ostadan.
11 Within that trichotomy, I guess, if you
12 will, Barry would be reviewing the geology; I would be
13 reviewing the geotechnical engineering related to the
14 site characterization, the foundations; Dr. Ostadan
15 would deal with issues of dynamic loadings and dynamic
16 analysis and response. Finished.
17 Q. I didn't want to cut you off. You testified
18 earlier that you did not consult with Dr. White.
19 A. (Dr. Bartlett) No, I did not.
20 Q. To the extent that Dr. White was the person
21 who wrote this Exhibit 3, do you believe it would be
22 useful for you to find out what he meant, for example,
23 here in discussion of layer 1, layer 2?
24 A. (Dr. Bartlett) Yes, that would have been
25 useful.

1 Q. And can I ask you why you didn't speak with
2 him?

3 A. (Dr. Bartlett) I was never given the
4 opportunity as part of the team in the project.

5 Q. Did you seek to contact Dr. White?

6 A. (Dr. Bartlett) No, I did not. He was no
7 longer retained by the state.

8 Q. Explain to me what you mean by you were
9 never given the opportunity.

10 A. (Dr. Bartlett) Well, normally when I would
11 consult on something of this issue in these matters, I
12 would consult with those that would be part of the
13 project team. He was no longer part of the team. I
14 didn't feel it would be appropriate to seek him out once
15 he had been removed from the team.

16 Q. I see. You mentioned a little while ago
17 that your first involvement, or earlier in your
18 involvement with this project that there was a team
19 meeting that you attended.

20 A. (Dr. Bartlett) That's my first recollection
21 of, yes, getting together with the group.

22 Q. What happened at that meeting?

23 A. (Dr. Bartlett) Well, as usual, there were
24 some introductions. There was a fair amount of
25 discussion about the seismic refraction, reflection

1 data. I remember Dr. Allison was there and discussed
2 that to some extent. Myself being new to the team, I
3 didn't take a large part in that, of the conversations
4 during the meeting. Dr. Arabasz was there. I'm sure
5 there was some discussion of the design basis ground
6 motions, how they were being developed, derived. Denise
7 and Connie were there. That's my recollection. It was
8 a year and a half ago, two years ago.

9 Q. Have there been subsequent meetings of that
10 time among the state experts that are working on this
11 Contention L?

12 A. (Dr. Bartlett) From time to time, but
13 usually not quite that extent. That was the first
14 really full panel meeting that I recall.

15 I do recall at that time I think someone
16 else had made the recommendations that we may consider
17 bringing in an expert in soil dynamics at that meeting.

18 Q. I'm getting ahead of the story. I want to
19 pursue that Dr. Ostadan was not part of the team then.

20 A. (Dr. Bartlett) You'll get him later. Fair
21 enough. This was before Dr. Ostadan was part of the
22 team.

23 Q. All right. And you said you have had
24 less --

25 A. (Dr. Bartlett) Yes, not -- not I think the

1 full team. It was different disciplines or expertise.
2 Some of them were face-to-face meetings. Since some of
3 us live in different areas, a lot of them were just
4 phone conferences and calls.

5 Q. I take it that since Dr. Ostadan was
6 retained to assist in this matter, you have consulted
7 with him?

8 A. (Dr. Bartlett) Yes.

9 Q. Have you consulted with him frequently?

10 A. (Dr. Bartlett) Yes.

11 Q. What did you do to prepare for this
12 deposition we're having today?

13 A. (Dr. Bartlett) For this deposition I
14 focused most of my attention on reviewing the current
15 SAR and its status, reading the revised calculations,
16 looking at the data that are presented in the appendix,
17 appendices of the SAR, reading some of the supporting
18 reports. They're numerous, and I was selective about
19 some of the reports. Reading Contention L, and
20 preparing questions.

21 Q. Did you bring any documents today, to this
22 deposition today?

23 A. (Dr. Bartlett) No, I didn't. Oh. Well,
24 other than I do have some cone penetrometer logs I think
25 that were given to you yesterday.

1 Q. Right. Apart from those cone penetrometer
2 logs which we may talk about later today --

3 A. (Dr. Bartlett) Sure.

4 Q. -- have you prepared or generated any
5 documents in connection with your review of
6 Contention L?

7 A. (Dr. Bartlett) Define a document.

8 Q. Define a document?

9 A. (Dr. Bartlett) Yes.

10 Q. Well, any writing or either by electronic or
11 other means that encompasses or presents your views that
12 results in your analysis.

13 A. (Dr. Bartlett) Sure. Sometimes documents
14 have different meanings. We have had project
15 correspondence, mainly electronic. We have prepared
16 questions and responses for discovery and prepared
17 questions for deposition.

18 Q. Have you conducted any independent
19 calculations or analyses or tests that pertain to the
20 soils at the PFS site or any other issues related to
21 Contention L?

22 A. (Dr. Bartlett) Please repeat the question.

23 MR. TRAVIESO-DIAZ: I don't think I can get
24 it right. Can you read it back?

25 (The record was read: "Q. Have you conducted any

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1 independent calculations or analyses or tests that
2 pertain to the soils at the PFS site or any other issues
3 related to Contention L?"

4 A. (Dr. Bartlett) Not calculations in the
5 engineering sense. I've reviewed calculations, maybe
6 done a few punch of the numbers of my calculator, made a
7 few scribbles in margins and notes, but I have not
8 performed really any substantive calculations.

9 The others were --

10 (The record was read: "Calculations or analyses or
11 tests that pertain to the soils.")

12 A. (Dr. Bartlett) The analyses, no, not in the
13 way I normally use analysis. And the last was --

14 (The record was read: "Or tests.")

15 A. (Dr. Bartlett) No, we've not performed any
16 tests.

17 Q. Perhaps my use of the word "analysis" was
18 ambiguous.

19 A. (Dr. Bartlett) Sure.

20 Q. Let me try to clarify it. By analysis, I
21 mean either what is no more considered by engineers as
22 an analysis of the form, for example, of a calculation,
23 and is reflected in writing that can be preserved and
24 can be reviewed; or a laboratory analysis, if you will,
25 of samples of materials. Either in those two forms of

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1 the word how you perform any analysis.

2 A. (Dr. Bartlett) I did a page or page and a
3 half calculations of undrained shear strengths based on
4 my experience from other projects to see where this
5 particular site would fall within my experience. No
6 laboratory analysis. And again, a few scribbles in
7 margins of things, but they're not really -- just
8 checking numbers and things.

9 Q. Well, that page or page and a half
10 preparation, two questions about it. First question is,
11 did you preserve it?

12 A. (Dr. Bartlett) Yes. It's on my computer.

13 Q. Can we have a copy of that?

14 A. (Dr. Bartlett) Sure.

15 Q. Second question is, well, what were the
16 results of that calculation?

17 A. (Dr. Bartlett) Do you mind if I at least
18 refer to it when I --

19 Q. Absolutely. I mean, if you don't have the
20 answer now, we can --

21 A. (Dr. Bartlett) I have my computer.

22 MS. CHANCELLOR: Can we go off the record
23 for a minute?

24 (Discussion off the record.)

25 (Recess from 11:24 to 11:28 a.m.)

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1 MR. TRAVIESO-DIAZ: So that we describe for
2 the record what transpired when we were on the break,
3 Dr. Bartlett has provided us a diskette containing the
4 text of the calculations of which we referred in the
5 last question and answer. We will be discussing that at
6 a later point.

7 (Exhibit 48 marked.)

8 Q. (By Mr. Travieso-Diaz) Dr. Bartlett, I have
9 introduced as an exhibit Exhibit 48 a document entitled
10 Steven F. Bartlett, Ph.D., P.E., Vita. It consists of
11 five pages and is dated October 2000. Do you have that
12 document in front of you?

13 A. (Dr. Bartlett) I do.

14 Q. Is this an accurate summary of your
15 educational and professional experience?

16 A. (Dr. Bartlett) Yes, through October 2000.

17 Q. Are there any additions or corrections since
18 this document was prepared?

19 A. (Dr. Bartlett) Let me look at the
20 publications, see if I'm writing anything here lately.
21 No, I don't see any.

22 Q. On top of the first page of Exhibit 48 you
23 list a number of areas of emphasis, as you call them.

24 A. (Dr. Bartlett) Uh-huh.

25 Q. Will you review those and tell me which of

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1 them do you believe to be relevant to the matters
2 discussed in Basis or Section 3 of Contention L?

3 A. (Dr. Bartlett) Area of emphasis:
4 geotechnical engineering, earthquake engineering,
5 geoenvironmental engineering, applied statistics, and
6 project management.

7 Q. Sorry; project management?

8 A. (Dr. Bartlett) Project management, yes.

9 Q. Would you explain for the record the
10 distinction that you draw between your expertise in
11 geotechnical engineering and your expertise in
12 earthquake engineering?

13 A. (Dr. Bartlett) Earthquake engineering can
14 be a very broad multidisciplinary area. And here in the
15 area of emphasis of earthquake engineering would be
16 relating to geotechnical earthquake engineering.

17 Q. How would that relate to what we've been
18 talking about as Basis 3 of Contention L?

19 A. (Dr. Bartlett) Many of the issues related
20 to Contention L are geotechnical earthquake engineering
21 issues.

22 Q. I'm sorry. Now I got confused because you
23 said geotechnical earthquake engineering.

24 A. (Dr. Bartlett) Correct. I'm limiting my
25 expertise in earthquake engineering to a specific area

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1 within earthquake engineering, and that would be
2 geotechnical earthquake engineering. I do not want to
3 imply that I have expertise in structural engineering
4 related to earthquakes.

5 Q. Now, how about the distinction you draw, if
6 any, between geotechnical earthquake engineering on the
7 one hand and geotechnical engineering on the other?

8 A. (Dr. Bartlett) Geotechnical earthquake
9 engineering would be a subdiscipline within geotechnical
10 engineering relating to earthquakes and how the soil and
11 other earth or geosystems respond to that.

12 Q. And the broader category of geotechnical
13 engineering, what does that comprise?

14 A. (Dr. Bartlett) Civil engineering.

15 Q. Can you tell me more as to --

16 A. (Dr. Bartlett) Civil engineering?

17 Q. No. Civil engineering, but what portion of
18 civil engineering is what you describe as geotechnical
19 engineering?

20 A. (Dr. Bartlett) It's a subdiscipline of
21 civil engineering.

22 Q. What is included within geotechnical
23 engineering?

24 A. (Dr. Bartlett) Generally relates to issues
25 with soil mechanics, soils and foundation design, though

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1 it has broadened in recent years more into
2 geoenvironmental issues.

3 MR. TRAVIESO-DIAZ: Can I have the answer
4 read back?

5 (The record was read: "A. Generally relates to
6 issues with soil mechanics, soils and foundation design,
7 though it has broadened in recent years more into
8 geoenvironmental issues.")

9 Q. (By Mr. Travieso-Diaz) Will you take a look
10 now at the right-hand side of page 1 of Exhibit 48,
11 which has the general heading of Professional
12 Experience. And here -- you list here on that column
13 that starts on page 1 and I believe goes on to the right
14 side of page 2 and 3 --

15 A. (Dr. Bartlett) Correct. It's a double
16 column format.

17 Q. Exactly. Referring to the right-hand side
18 of the first few pages, could you tell me for which of
19 the projects listed there did your work fall under the
20 category of geotechnical engineering?

21 A. (Dr. Bartlett) I'll just list them by
22 bolded topic there.

23 Q. Okay.

24 A. (Dr. Bartlett) I-15 Design-Build Team.
25 Value Engineering and Design Team, and that was for the

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1 University Parkway Interchange. Private Fuels Storage
2 Facility, Kennecott Utah Copper Tailing Impoundment
3 Modernization Project, Wasatch County Water Efficiency
4 Project, Bear River Pipeline, Cainville,
5 C-a-i-n-v-i-l-l-e, Dam Investigation. DMAD, all
6 capitalized, and Gunnison Bend Dam Investigations.
7 Seismic Retrofit of Salt Lake City Waste Water Treatment
8 Plant. Hurricane Bridge Foundation Investigation.
9 ITP/H-Area Tank Farm Geotechnical Investigation and
10 Seismic Qualification.

11 One more page here. Review Team for the
12 Seismic Design of the Defense Waste Processing Facility.
13 Department of Energy Savannah River Site Hazardous Waste
14 Landfill Closure. RCRA/CERCLA Investigations. UDOT
15 Region 2 Preconstruction Materials Engineer. I carried
16 an engineering title at that time; however, I had not
17 completed my degree.

18 And I think we'll stop there.

19 Q. Okay. Can I ask you to do the same thing
20 with respect to those projects involving what you
21 characterize as geotechnical earthquake engineering?

22 A. (Dr. Bartlett) Fair enough. Or a
23 significant component that involves that?

24 Q. Yes.

25 A. (Dr. Bartlett) I-15 Design-Build Team,

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1 Private Fuels Storage Facility, Kennecott Utah Copper
2 Tailing Impoundment Modernization Project, Bear River
3 Pipeline DMAD and Gunnison Bend Dam Investigations,
4 Seismic Retrofit of Salt Lake City Waste Water Treatment
5 Plant, ITP/H-Area Tank Farm Geotechnical Investigations;
6 Review Team for the Seismic Design of the Defense Waste
7 Processing Facility. That would be all.

8 Q. Now, one last list.

9 A. (Dr. Bartlett) Sure.

10 Q. Which of the projects listed on these first
11 three pages would you -- will be your opinion that
12 involve issues analogous to the ones that are raised on
13 Contention L, Basis 3?

14 A. (Dr. Bartlett) Second page. ITP/H-Area
15 Tank Farm Geotechnical Investigation; Review Team for
16 the Seismic Design of the Defense Waste Processing
17 Facility. Those are the most germane.

18 Q. Would you identify for the record with
19 respect to the ITP/H-Area Tank Farm Geotechnical
20 Investigation, what issues were raised in that
21 particular work that were analogous to the ones involved
22 in Basis 3 of Contention L?

23 A. (Dr. Bartlett) Sure. The issues were
24 raised by the Defense Nuclear -- Defense Nuclear
25 Facility Safety Board, which is a governing --

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1 governing -- was an oversight body within the Department
2 of Energy. Those issues related to design basis ground
3 motion, characterization of strong ground motion,
4 dynamic response, liquefaction, collapse of calcareous
5 materials, and the response to the structures to those
6 different natural phenomena.

7 Q. Could you do the same thing for the work
8 involving the Review Team for the Seismic Design of the
9 Defense Waste Processing Facility?

10 A. (Dr. Bartlett) This facility, the review of
11 this was to look at the SAR that was presented for that
12 facility. Many of the issues would be somewhat similar,
13 at least for the natural phenomena. But it was not
14 actively under review by the Defense Nuclear Facility
15 Safety Board. However, management wanted a review of
16 what had been done in the SAR to see -- the SAR was
17 quite old -- to see what needed to be updated, what
18 additional information may need to be included in it. A
19 summary report was written.

20 Q. I take it that with respect to the work that
21 you just mentioned for the review team, your involvement
22 consisted of seeing what needed to be done to bring the
23 SAR up to date?

24 A. (Dr. Bartlett) Correct, relating to the
25 geotechnical part of the SAR -- the foundations,

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1 foundation design, earthquake.

2 Q. Did your work involve performing new
3 analysis of the performance of the structures under
4 seismic and other conditions?

5 A. (Dr. Bartlett) No, but there was some
6 liquefaction analysis done.

7 Q. Liquefaction not being an issue of concern
8 of PFS; is that correct?

9 A. (Dr. Bartlett) No.

10 Q. And for the ITP/H work, you talked about
11 reviewing issues having to do with the design basis
12 ground motion, dynamic responses and so on. What did
13 your work consist of?

14 A. (Dr. Bartlett) I don't know if I would
15 characterize myself as really reviewing all of these. I
16 thought the intent of the question was to tell you what
17 the project involved and the issues.

18 Q. Exactly. And my question now is, what did
19 you do?

20 A. (Dr. Bartlett) Where did I fit into that
21 puzzle?

22 Q. Exactly.

23 A. (Dr. Bartlett) I see. It was a
24 multi-disciplinary team, several people involved, so it
25 was broken up into a process. My part of the process

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1 was the lead geotechnical engineer for Westinghouse. I
2 have to now start introducing company designations,
3 because there were also cross-company lines. The
4 primary companies involved at the Savannah River site
5 was Westinghouse and Bechtel. However, there are
6 various and a myriad of subcontractors. But those were
7 the two prime, with Westinghouse acting as the prime
8 operations contractor, Bechtel as a construction
9 contractor.

10 The particular group that I was functioning
11 in was both a combination of Bechtel and Westinghouse
12 employees. On the Westinghouse side, I was the lead
13 geotechnical engineer. I think the report probably
14 identifies me as principal investigator. I can't really
15 remember. But I was responsible in reviewing the
16 subsurface data that were collected for the engineering
17 analysis, suggesting any possible new -- new data that
18 may be needed to support the characterization and
19 analyses, and completing portions of the analyses or at
20 least overseeing portions of the analyses, though there
21 were many people doing the analyses. For Westinghouse
22 but not for Bechtel.

23 Q. I understand. And when -- specifically,
24 what did you review?

25 A. (Dr. Bartlett) Our document that we were

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1 generating was a geotechnical investigation document
2 that pieces would be excerpted and put into the SAR. So
3 we were preparing the geotechnical report that would be
4 later edited and included pieces into the SAR. So most
5 of our emphasis was in the ITP I believe H Tank Farm
6 Geotechnical Report. I'm not sure of the exact title.
7 Probably can find it in my references.

8 Q. So that there's a better understanding of
9 what you were doing, at least by me: was there an
10 existing SAR? Was this new work?

11 A. (Dr. Bartlett) This was a new facility, at
12 least the ITP facility.

13 Q. So to analogize it somewhat to PFS, the work
14 that you did will be analogous in some ways to the work
15 that the applicant did in preparing the initial SAR?

16 A. (Dr. Bartlett) Yes. There was a slight
17 difference here. At Savannah River the particular
18 facility was already in operation or beginning, close to
19 the beginning of operation. So we were then looking at
20 seismic issues that had been raised by the Defense
21 Nuclear Facility Safety Board and putting that into SAR
22 format for their review.

23 Q. And I take it that your function was to look
24 at those issues and see how they affected the new
25 facility that was going to be built?

1 A. (Dr. Bartlett) It was already there. The
2 investigations -- the facility already existed, so there
3 were investigations around an existing facility to
4 update the SAR because of issues raised by the Defense
5 Nuclear Facility Safety Board. So it's different in PFS
6 that the facility was already essentially constructed.
7 So we were doing investigations in and around the
8 periphery. There were basically four buried tanks.

9 Q. So I take it one distinction would be
10 perhaps that, with respect to PFS, things still can be
11 done to change --

12 A. (Dr. Bartlett) Correct.

13 Q. -- what hasn't been constructed, whereas
14 there you already had the tank --

15 A. (Dr. Bartlett) We had to deal with the
16 initial geotechnical investigations that had been
17 completed and try to strategically place our
18 investigation in a very congested area in a tank farm,
19 high level waste tank farm.

20 Q. I don't know that I asked you this. If I
21 did, I apologize. With respect to the other project
22 that we were talking about a moment ago, which I believe
23 is the --

24 A. (Dr. Bartlett) Defense waste processing.

25 Q. -- defense waste processing. What did you

1 do?

2 A. (Dr. Bartlett) Again, that was another
3 facility that was already constructed, and the SAR was
4 quite old and there was a need to update it both to
5 newer DOE criteria. And the initial was to review the
6 old SAR, see if there were any obvious things that
7 needed to be further done to demonstrate whether this
8 facility was safe or not. But because the SAR for that
9 facility, as I recall, it was reasonably new, reasonably
10 being within -- it was five years old or so. Most of
11 our review was favorable, except for the design basis
12 ground motion had increased somewhat and we wanted to
13 see what the effect was on that. So I think we -- I
14 alluded that we did some liquefaction calculations, as I
15 recall.

16 Q. Can we go back to your resume, which is
17 Exhibit 48, for a second, to the first page. I see that
18 you list -- the first three projects that you list
19 there, as I understand it, they relate to work for or on
20 Interstate I-15.

21 A. (Dr. Bartlett) First three projects listed?

22 Q. On the right-hand column of page 1.

23 A. (Dr. Bartlett) No. Those are professional
24 experience. Some of them are projects, some of them are
25 actually listing positions that I've held. The top

1 bullet is the assistant professor, civil and
2 environmental engineering. That's my current position.
3 So I wouldn't characterize that as anything to do with
4 I-15, other than we are performing continuing research
5 on I-15 in my position at the university.

6 The second one, yes, has to do with I-15
7 research. The Federal Highways Administration has
8 funded research for the I-15 project, and I prior to
9 coming to the university had spent approximately two and
10 a half years in UDOT research overseeing
11 instrumentation, mainly going into different embankments
12 and foundation systems to observe both their
13 construction and long-term performance, and also
14 overseeing and managing projects that other universities
15 were doing. The others would be Utah State University,
16 University of Utah, and Brigham Young University, and
17 any of their research projects. I was managing and
18 overseeing, facilitating their research.

19 The I-15 Design-Build Team is, yes, directly
20 related to I-15, and at that time I was employed by
21 Woodward-Clyde and was a designer for a geographical
22 location within the project, basically from 8th South to
23 2100 South. So if there are any problems in that part
24 of the interstate, come and see me.

25 And that included design foundation

1 treatments, ground modification, slope stability,
2 settlement considerations, geofoam fills, liquefaction,
3 seismic modeling of embankments, and MSE wall systems.
4 And for the record, that means mechanically stabilized
5 earth.

6 Q. And there was one more project which --

7 A. (Dr. Bartlett) Yes. That is I-15 related.
8 It's down in Utah County. That is the main interchange
9 going to Brigham Young University. And that's being
10 designed internally by UDOT, and they formed a value
11 engineering team. And because of my experience with the
12 I-15 design here in Salt Lake County, they requested I
13 perform the geotechnical assessments of that, or at
14 least look at the value engineering, join the value
15 engineering team for that.

16 Q. I think that these three projects or these
17 three assignments are in reverse chronological order,
18 meaning that the research project manager is the most
19 recent one?

20 A. (Dr. Bartlett) Yes. This is listed most
21 recent at top, and then everything in this list goes
22 chronologically to earlier dates.

23 Q. Maybe we can pinpoint the dates better.

24 A. (Dr. Bartlett) Sure.

25 Q. The first one of them listed as research

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1 project manager, what dates were those?
2 A. (Dr. Bartlett) January '98 to August 2000.
3 Q. And the second one?
4 A. (Dr. Bartlett) I-15 Design-Build Team.
5 That was while I was with Woodward-Clyde, so trying to
6 think. Probably January '97 to January '98. About a
7 year there.
8 Q. And last one, the Value Engineering and
9 Design?
10 A. (Dr. Bartlett) That is not in chronological
11 order. Maybe some are, and some are maybe just in order
12 of importance. I don't know. But that value
13 engineering was done also while I was working as a
14 research project manager for UDOT.
15 Q. So the dates will be --
16 A. (Dr. Bartlett) The dates that I was
17 employed by UDOT are while I was participating on this.
18 I can't remember. It was a two-week assignment or so.
19 Probably sometime in early 1999.
20 Q. So this value engineering was a two-week
21 assignment?
22 A. (Dr. Bartlett) Yes. It's not a long
23 assignment to join a value engineering team.
24 Q. Let's try to understand a little better what
25 you did on these projects.

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1 long-term study to look at both the construction and
2 performance of several foundation systems installed on
3 I-15.
4 Q. Going to the I-15 design-build team project,
5 what did your work there entail?
6 A. There I was a lead designer for a particular
7 geographical segment of the interstate, again from 8th
8 South to 2100 South. Because I am and was at that time
9 a licensed engineer, I was supervising staff engineers
10 in the design calculations that were going to support
11 the geotechnical design.
12 Q. Now, when you made the design calculations,
13 what type of calculations did you do?
14 A. (Dr. Bartlett) Did I do or did my staff do?
15 Q. Well, either do or supervise.
16 A. (Dr. Bartlett) Okay, fair enough. What I
17 supervised were stability calculations -- slope
18 stability calculations, I should say. Bearing capacity
19 calculations. Design calculations to determine what
20 drain spacings. Surcharge heights, looking at general
21 layout of surcharges. Wick drains. We did some
22 calculations involving geofoam. I think those are the
23 major ones.
24 Q. Maybe I can ask you, so the record is clear,
25 what you mean by wick drains.

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1 A. (Dr. Bartlett) Sure.
2 Q. The work as research project manager.
3 A. (Dr. Bartlett) Uh-huh.
4 Q. What did it entail?
5 A. (Dr. Bartlett) Research project manager
6 means managing contracts and the research associated
7 with those contracts. In this case it was overseeing
8 mainly I-15 research, overseeing contracts with Utah
9 State University, University of Utah, and Brigham Young
10 University. Though I did start an in-house study while
11 I was there at UDOT, and so I was also functioning as a
12 PI for an in-house study too.
13 Q. Would it be fair, then, to say that your
14 work for this research project as research project
15 manager was more in a managerial capacity as opposed to
16 doing what I would call hands-on design?
17 A. (Dr. Bartlett) There were no design, but
18 no, it would not be fair to completely characterize me
19 as a project manager. I filled both roles as a project
20 manager and also principal investigator of a fairly
21 major study, which I am currently still the principal
22 investigator on.
23 Q. What study was that?
24 A. (Dr. Bartlett) We call it our Innovative
25 Embankment and Foundation Treatment Study. It's a

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1 A. (Dr. Bartlett) More correct terminology now
2 may be prefabricated vertical drains.
3 Q. And which would those be?
4 A. (Dr. Bartlett) Those are a geosynthetic
5 product that are made to install into clays to
6 accelerate their primary consolidation.
7 Q. Okay. One more on this line. On Value
8 Engineering and Design Team, you said that was a
9 two-week assignment?
10 A. (Dr. Bartlett) Yes.
11 Q. What did you do?
12 A. (Dr. Bartlett) Reviewed their conceptual
13 design of how they wanted to essentially reconstruct the
14 interchange. There were issues again relating to
15 stability, consolidation settlement and liquefaction,
16 and at that point we were making recommendations on kind
17 of project approach and looking at their project
18 approach. And it was a formal process. We made our
19 value engineering recommendations on things that they
20 may do and consider and passed them on as kind of a
21 report, and was dismissed. It's required by the Federal
22 Highway Administration.
23 Q. Earlier on when I asked you about which
24 projects you felt were most germane, if you will, to the
25 issues raised on Basis 3, you didn't list any list of

1 the I-15 activities. Was that an oversight, or is there
2 a reason?

3 A. (Dr. Bartlett) No. Well, those that are
4 still most closely to the process that PFS is following
5 are still the two that I listed as my experience at
6 Savannah River. However, some of these other projects,
7 particularly if they're local, have given me
8 considerable experience I think in the soils and soil
9 behavior of this area. So in conjunction with maybe
10 those that -- I guess I could say they're germane in the
11 sense that they help me understand the behavior of these
12 soils.

13 Q. Let me ask you perhaps a difficult question
14 to answer. In which ways are they not germane to PFS,
15 or how do they differ such that you cannot draw
16 experience from I-15 to PFS?

17 MS. CHANCELLOR: I'm going to object.
18 That's a little broad. That's so broad, I don't know
19 how he can answer it.

20 Q. (By Mr. Travieso-Diaz) Well, you can give
21 me a start, otherwise I'll rephrase it.

22 A. (Dr. Bartlett) Well, one was building a
23 major road, and it's transportation related. There are
24 similar analyses, but some of the analyses that we did
25 may not be germane. One would be slope stability.

1 There are no significant slopes at this site, so slope
2 stability would not be germane to this project. I do
3 not believe you're using any wicks, so wick drain design
4 is not germane. Nor are you using any mechanically
5 stabilized earth walls, so I do not believe that's
6 germane.

7 Q. Was there a difference in the nature of the
8 soils in the I-15 segment you worked on with respect --
9 beside the PFS site?

10 A. (Dr. Bartlett) Yes. I-15 soils are
11 generally saturated, whereas the PFS soils are
12 unsaturated.

13 Q. And in terms of strength, are they softer
14 soils than the ones at the PFS site?

15 A. (Dr. Bartlett) That's what I was trying to
16 determine in my offhand -- the quick calculations that I
17 was doing.

18 Q. All right. Since I brought it up, can I
19 ask, what was your conclusion based on your hand
20 calculation?

21 A. (Dr. Bartlett) Should we go through it
22 point by point?

23 Q. Well, give me a general conclusion.

24 Actually, I'll tell you what. Since we have
25 it here, let me produce it as Exhibit 49.

1 (Exhibit 49 marked.)

2 A. (Dr. Bartlett) I think when I was doing
3 this, I was focused on what currently is referred to as
4 layer 2 at the PFS site.

5 Q. What is now currently described as layer 2?

6 A. (Dr. Bartlett) Yeah, what is currently
7 described as layer 2. So I was trying to again
8 understand the undrained shear strength at the PFS site
9 in layer 2. And I believe most of these correlations
10 except for -- well, we'll see if there's any exceptions.
11 But a lot of these correlations are coming from the
12 Manual on Estimating Soil Properties for Foundation
13 Design, published by the Electric Power Research
14 Institute.

15 For SPT data, one can get a rough idea of
16 undrained shear strength based on penetration
17 resistance. It's probably the most crude way of doing
18 it. And in that upper layer I guess I looked at some of
19 the blow counts there, found some, about five, and went
20 to this chart that you see for SPT data and said, based
21 on this chart, one might expect values between .5 to 1
22 ksf.

23 Q. For the record, when you reference the
24 Terzaghi and Peck, who are you talking about?

25 A. (Dr. Bartlett) Well, it's actually EPRI

1 Manual Table 4-10, which I guess is referencing the
2 original authors of this relationship, which is Terzaghi
3 and Peck. Which particular reference that is, I am not
4 sure. It may be soil mechanics and engineering
5 practice, but I'm guessing.

6 Q. And this is a table that is derived from
7 that --

8 A. (Dr. Bartlett) From Terzaghi and Peck.
9 EPRI is just I think referencing the original work.

10 Q. Can I ask you to tell me, based on this
11 calculation, what your conclusion was with respect to
12 the relative strength of the soils at PFS vis-a-vis
13 those at I-15?

14 A. (Dr. Bartlett) Not sure I really was trying
15 to compare the PFS soils against I-15 soil strengths. I
16 was using my background and knowledge to look at what
17 the PFS soils are. I have not gone back and looked at
18 the -- compared PFS soils against I-15 soils.

19 Q. If I recall, the reason we got into this is
20 because I asked you, are the soils at PFS stronger than
21 those at I-15, and you answered, that's what I was
22 trying to determine in the calculation that I did. So
23 that's what I'm --

24 A. (Dr. Bartlett) Okay.

25 Q. Now that you have the calculation and you

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1 looked at it and you know what the soils at I-15 were
2 like, do you have a view as to whether --
3 A. (Dr. Bartlett) Well, it's difficult because
4 the alignment's 17 miles long. So I'm not going to
5 speak for 17 miles of alignment. I guess, based on my
6 experience, it appears that the soils at PFS, based on
7 the data that I have been given, appear to be a little
8 stiffer at the site of PFS.
9 Q. Stiffer than the ones at I-15?
10 A. (Dr. Bartlett) That's correct.
11 Q. You were talking about -- a moment ago about
12 the various design activities that you did in the
13 project for which you were responsible for a section of
14 I-15. Do you recall those questions?
15 A. (Dr. Bartlett) Yes.
16 Q. Now you talk about things like wick drains
17 designs and so on. As you were performing those
18 designs, were you supported by the work of other people
19 who were doing, for example, soils investigations?
20 A. (Dr. Bartlett) Most certainly.
21 Q. And that was a different group of people
22 from the one that was doing the design?
23 A. (Dr. Bartlett) No, it was the same group.
24 It's just different people within the group that are
25 doing it, different people within Woodward-Clyde.

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1 Q. I understand. But there was a group of
2 people whose function, if you will, was to do soils
3 investigations and --
4 A. (Dr. Bartlett) No. Let me tell you how the
5 design-build process proceeded on I-15.
6 Q. Okay.
7 A. (Dr. Bartlett) It may help you understand
8 this. UDOT took the policy that it would be difficult
9 for, because of the rapid nature which this project had
10 to proceed, that it would be not -- one could not do the
11 geotechnical investigation as part of the design
12 process. So they provided the geotechnical
13 investigations as documents to the winner, the eventual
14 winner of the project. They were given to us as
15 geotechnical investigations. We did not control that at
16 all. They were completed by several consultant firms
17 throughout the valley. So there was a geotechnical
18 investigation report, if you will. I believe we
19 provided that to you on CD ROM.
20 Q. And was that arrangement in which a group of
21 people, however selected, did the investigative work and
22 another group of people did the design, is that common
23 in the projects you have been associated with?
24 MS. CHANCELLOR: Objection. I think you're
25 mischaracterizing his testimony.

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1 MR. TRAVIESO-DIAZ: I'm sorry. If I
2 mischaracterized it, I stand corrected.
3 Q. (By Mr. Travieso-Diaz) If I understood what
4 you just testified, in this particular project the
5 geotechnical work had been assigned to a group of people
6 and the design work was assigned to your group of
7 people. Is that correct?
8 A. (Dr. Bartlett) No.
9 Q. Okay. Please correct me.
10 A. (Dr. Bartlett) The geotechnical data were
11 provided to us prior to the start of the contract.
12 Q. And that geotechnical data had been
13 performed by some other consultant?
14 A. (Dr. Bartlett) Several consultants. Now,
15 we also collected our own, "we" being Woodward-Clyde and
16 our joint firm who was with us doing the geotechnical
17 design, Terracon, we performed even subsequent analyses
18 to covering gaps and uncertainties that we felt in what
19 the baseline geotechnical reports had been provided to
20 us. Is that better?
21 Q. That I think is clear, for me, anyhow. And
22 my question again would be, is it still correct to say
23 that a group of people led by you were performing design
24 functions, such as designing wick drains, and a
25 different group of people, either within the same

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1 organization or other group, was doing the soils
2 investigations?
3 A. (Dr. Bartlett) The only soils
4 investigations that were done after the award of the
5 contract to Woodward-Clyde were some done by
6 Woodward-Clyde and Terracon. They were again to begin
7 to develop the design basis, but once we got into
8 design, we had no time to be doing investigations
9 parallel with design. We had to design with the
10 information that had been provided.
11 Q. I understand now. And those investigations
12 still were done by different -- even within
13 Woodward-Clyde, a different group of engineers or
14 geologists or whatever they're called at the time doing
15 the investigation as opposed to you?
16 MS. CHANCELLOR: Objection. He's testified
17 as to that it was -- well, I think you've
18 mischaracterized his testimony.
19 Q. (By Mr. Travieso-Diaz) Again, if I
20 mischaracterized you, I apologize. My understanding was
21 that -- correct me if I'm wrong in this
22 characterization -- that A, there have been geotechnical
23 investigations that have been done by a different group
24 of people altogether before you were assigned to the
25 project. Am I right so far?

1 A. (Dr. Bartlett) Correct.
2 Q. And B, there was some additional
3 geotechnical work that was done by Woodward-Clyde --
4 A. (Dr. Bartlett) And Terracon.
5 Q. -- and Terracon.
6 A. (Dr. Bartlett) Correct.
7 Q. And my question to you is, that work that
8 was done by Woodward-Clyde and Terracon, was it
9 performed by a different team, if you will, or group of
10 people from the ones led by you that were doing the
11 design?
12 A. (Dr. Bartlett) We're all one firm. I don't
13 understand this team concept.
14 Q. Let me ask the question a different way.
15 Were different people involved in performing those
16 geotechnical investigations that Woodward-Clyde did from
17 the people like yourself that were involved in doing the
18 wick drain design and the other design activities?
19 A. (Dr. Bartlett) Sometimes the subsequent
20 geotechnical investigations done by Terracon and
21 Woodward-Clyde were done by employees within
22 Woodward-Clyde who later became designers as part of the
23 team. We were 24 geotechnical engineers, some of us
24 doing investigations, some of us doing design. That's
25 the best way I can characterize it.

1 My particular responsibility was not to
2 oversee investigations for this project. It was a
3 designer, to take the data that was provided and design
4 with it.
5 Q. All right. Then my other question earlier
6 on that perhaps I didn't phrase properly was, in your
7 experience not only with respect to I-15 but to other
8 projects, is it common to have different groups of
9 people, organizations, or experts, if you will, who are
10 primarily concerned with soils investigations and
11 developing soils there different from the individuals
12 who are engaged in performing the design, based on your
13 general experience?
14 MS. CHANCELLOR: I'm going to object because
15 you haven't defined -- you're asking him for specifics
16 about a general area, projects. And the question is a
17 little --
18 MR. TRAVIESO-DIAZ: I believe that the
19 question was phrased based on his experience on the
20 projects that he has worked on.
21 Q. (By Mr. Travieso-Diaz) And if I said
22 otherwise, please consider the question to be limited to
23 your personal experience.
24 A. (Dr. Bartlett) I've worked in both systems
25 where somebody that is not the designer is collecting

1 the information. I've worked in small firms where I
2 have gone out and collected the data and used it in
3 design. It depends on the team, the complexity of the
4 project, and the nature of the personnel at the time.
5 So I've seen both. My experience generally
6 is I at least have a fairly responsible role in the data
7 that have been collected if I'm going to use it for
8 design, except for the I-15 project. But that's kind of
9 an oddity because it was a contractual document provided
10 to us, and we did do some subsequent design -- excuse
11 me -- investigations. I was not personally overseeing
12 those investigations within the firm at that time.
13 MR. TRAVIESO-DIAZ: Can we go off the record
14 for a second?
15 (Discussion off the record.)
16 Q. (By Mr. Travieso-Diaz) In the projects that
17 you described a moment ago with respect to your
18 experience, have you performed or directed the
19 performance of borings at sites for which construction
20 activities will be conducted later?
21 A. (Dr. Bartlett) Please repeat the question.
22 (The pending question was read.)
23 A. (Dr. Bartlett) Which projects?
24 Q. Of the ones that you have been -- that you
25 have in your resume.

1 A. (Dr. Bartlett) On my resume. Yes, I have.
2 Q. For what projects did you do that?
3 A. (Dr. Bartlett) Research project manager for
4 I-15, as the PI of the embankment study I have directed
5 drilling and subsurface installation of instrumentation.
6 I-15 Design-Build Team, not for
7 investigations for determining soil properties, but I
8 did direct the borings and installation of
9 instrumentation to monitor construction performance.
10 Wasatch County Water Efficiency Project,
11 both borings and test pits, directed them. I was later
12 removed from that project to go to the I-15 team, so I
13 didn't see it to its completion.
14 Bear River Pipeline, there were no drilling
15 at that time. Cainville Dam Investigations did involve
16 drilling and collection of data, and likewise DMAD and
17 Gunnison Dams. Likewise for the seismic retrofit of the
18 Salt Lake Waste Water Treatment Plant. There were also
19 boring and subsurface investigations for the Hurricane
20 Bridge Foundation, likewise for the ITP Tank Farm
21 Geotechnical Investigation, likewise for the hazardous
22 waste landfill closure at Savannah River, likewise for
23 RCRA/CERCLA Investigations for the various hazardous
24 waste areas listed there, though some of them are in
25 different phases. We plan them. I left the RCRA/CERCLA

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1 Investigations group before maybe all of them were
2 carried out, but at least planned them, and some had
3 been implemented or installed.

4 I think that's it, for the most part.

5 Q. Will you describe for the record how borings
6 are conducted, general process for which a boring is
7 done?

8 A. (Dr. Bartlett) Talking about drilling
9 process?

10 Q. Yes.

11 A. (Dr. Bartlett) Do you want to know just in
12 general, or specific types of drilling? There are many
13 types and ways of doing drilling.

14 Q. Well, why don't you just list for us the
15 types of drillings there are.

16 A. (Dr. Bartlett) In this area we sometimes
17 use hollow stem augering. We do also rotary wash, a
18 rotary mud drilling. Coring, double barrel coring.
19 That's probably the most that I've been involved in.

20 Q. Which of these different types of borings
21 are conducted for the specific purpose of taking soil
22 samples?

23 A. (Dr. Bartlett) Hollow stem augering and
24 rotary mud drilling.

25 Q. For what other purposes are borings

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1 types, either hollow stem or mud rotor.

2 Q. Did you review the manner in which the
3 applicant conducted those borings to determine whether
4 he was in conformance with applicable industry
5 standards?

6 A. (Dr. Bartlett) Applicable industry
7 standards is a fairly wide topic.

8 Q. Well, let me ask you the question another
9 way, then. Did you review the way in which applicant
10 conducted its borings at the site?

11 A. (Dr. Bartlett) Not extensively.

12 Q. So I take it you have no issues related to
13 the way the borings themselves were conducted?

14 A. (Dr. Bartlett) We initially raised some
15 issues regarding disturbance; but as far as the drilling
16 procedure, did it yield disturbed samples, there is some
17 indications in a few samples of disturbance, but some
18 samples looked fine.

19 Q. So is it your view that there is a concern
20 with respect to the way those undisturbed samples were
21 taken or not, or what is the state of your view?

22 A. (Dr. Bartlett) Could you please repeat the
23 question?

24 Q. Yes. I think it was not proper to -- not
25 worded very artfully. Let me try it again. Do you

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1 conducted in addition to taking soil samples?

2 A. (Dr. Bartlett) Installing monitoring
3 devices. We use several downhole devices to monitor
4 performance, monitoring wells, pump tests for
5 determining aquifer parameters. We do borings for
6 injection in wells in soils.

7 Q. Do you also do borings to take measurements
8 of soil properties?

9 A. (Dr. Bartlett) There's a type of -- you do
10 borings to install devices to make in situ measurements.

11 Q. And that's what you mean by installation of
12 monitoring devices?

13 A. (Dr. Bartlett) Yes. Well, there are
14 devices that you place to monitor maybe some type of
15 performance that may or may not really give you a
16 property, but there's also in situ tests that you can do
17 that will give you specific type of engineering
18 properties. Some are for monitoring deformation or some
19 other parameter that you're concerned about. Others are
20 specifically for gaining data for design.

21 Q. Do you know whether the applicant at the PFS
22 facility conducted borings at the PFS site?

23 A. (Dr. Bartlett) Yes, they did.

24 Q. What kind of borings did they do?

25 A. (Dr. Bartlett) That I can't -- probably two

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1 currently have a concern with respect to the manner in
2 which undisturbed samples were taken by PFS in the
3 process of doing borings at the PFS site?

4 A. (Dr. Bartlett) This is difficult, because
5 the undisturbed samples were done with Shelby tube
6 sampling, and the amount of disturbance is always
7 relative. Again, some samples do appear fine, others do
8 show signs of disturbance. But it's impossible to
9 complete a geotechnical investigation without
10 introducing some disturbance.

11 We have found for the Bonneville clays in
12 the Salt Lake Valley, where we were sampling them with
13 Shelby tube samples below the water table, that we have
14 introduced significant disturbance to the Shelby tube
15 samples. When I say "we," that means studies that were
16 done by Woodward-Clyde and Chuck Ladd from MIT who they
17 had on retainer to look at these issues.

18 The PFS site has unsaturated soils, and I'm
19 not sure I can extend my knowledge in this valley in
20 saturated soils to the unsaturated soil condition.

21 Q. Are you saying perhaps that the adverse
22 experiences that you related with respect to the soils
23 collection in the valley might not be applicable to the
24 PFS site because of the different type of soil?

25 A. (Dr. Bartlett) Repeat the question.

1 MR. TRAVIESO-DIAZ: Please read it.

2 (The pending question was read.)

3 A. (Dr. Bartlett) I wouldn't characterize them
4 as adverse. We have just noted that the state of the
5 practice is Shelby tube sampling in this valley, and the
6 state of the practice as done by most of the
7 geotechnical firms in this valley has produced some
8 indications of disturbance in the Shelby tube samples.
9 That is based on an assessment by Chuck Ladd using
10 radiography and looking at the consolidation behavior
11 data. Whether I can apply that to PFS is that, quote,
12 adverse conditions, I would not call them. Whether I
13 can apply that knowledge to PFS site or not, I cannot at
14 this time. I do not have the data or information to do
15 that.

16 Q. Have you reviewed the results of tests
17 performed on samples taken at the PFS site to determine
18 whether the samples exhibited evidence of having been
19 disturbed in the process of sample collection?

20 A. (Dr. Bartlett) A cursory review, and some
21 did.

22 Q. And I take it that some did not?

23 A. (Dr. Bartlett) And some did not.

24 Q. Did you further review the ones that did
25 exhibit evidence of disturbance to determine whether

1 encompass the full valley, so there are parts of the
2 Bonneville clays that are in parts of the design, part
3 of the design segment that Terracon did that may be
4 above water table. But my experience in this valley
5 with the Bonneville sediments were below water table.

6 Q. Were any samples taken at PFS below the
7 water table?

8 A. (Dr. Bartlett) Oh, no. Not in the
9 Bonneville.

10 Q. At PFS, I said.

11 A. (Dr. Bartlett) Well, I think water tables
12 down to 120 feet. I think it was initial issue about
13 whether borings went down to that depth. I can't recall
14 in subsequent investigations whether we went below the
15 water table 120 feet. But if we did, there was only a
16 few boreholes that did.

17 Q. As you recall now, and we may talk more
18 about this later, were any of the samples for which you
19 saw test results in the SAR taken from below the water
20 table?

21 A. (Dr. Bartlett) No, not to my knowledge.

22 MR. TRAVIESO-DIAZ: All right. Can we go
23 off the record again?

24 (Discussion off the record.)

25 Q. (By Mr. Travieso-Diaz) Have you performed

1 those that were used as inputs -- the test results as
2 inputs into the design process?

3 A. (Dr. Bartlett) I think that was some of our
4 line of questioning yesterday to try to discover that.

5 Q. And what information did you garner from the
6 discussion yesterday?

7 A. (Dr. Bartlett) I can't remember. It was
8 too long of a day.

9 Q. Let me ask you one more question.

10 A. (Dr. Bartlett) I would have to probably, to
11 answer that question, go back to the specific tests.
12 And that's what we were trying to understand better
13 yesterday is how certain types of tests and borings and
14 where the results were applied.

15 Q. But right now you don't recall where that
16 discussion led you?

17 A. (Dr. Bartlett) No, I don't. I'd have to
18 research it.

19 Q. All right. Now, you referred to the fact
20 that somewhat disturbed samples that were taken in the
21 valley were taken at locations below the water table.
22 Is that correct?

23 A. (Dr. Bartlett) The Bonneville deposits in
24 this valley are below water table. Well, I should
25 qualify that, because my design segment does not

1 or directed the performance of what is referred to as
2 cone penetration tests?

3 A. (Dr. Bartlett) Yes, I have.

4 Q. And would you describe for the record what
5 cone penetration tests are and what their purpose is?

6 A. (Dr. Bartlett) Cone penetration test is
7 another type of in situ test where we push essentially a
8 device, a sensor shaped like a cone. It has pressure
9 transducer to measure the pressure at the tip. It also
10 measures the side friction at the sleeve. Cone
11 penetrometer testing can also involve a piezo cone,
12 which has a pore pressure transducer to measure pore
13 pressure changes due to shearing. It's pushed from a,
14 we call it a cone rig, and used to determine
15 stratigraphy and other engineering correlations with it
16 to determine properties.

17 Q. I should have asked the question in two
18 parts. It would have been easier, because I have to ask
19 you again now. What information typically is obtained
20 by geotechnical analysts of the cone penetration tests?

21 A. (Dr. Bartlett) The base information that
22 comes from the cone is the tip stress, sleeve stress,
23 and pore pressure transducers. One can also get shear
24 wave velocities from a seismic cone. Those are the base
25 data that come from this type of device.

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1 Q. And what design information or soil property
2 information do you get from tip stress and sleeve
3 stress?

4 A. (Dr. Bartlett) There are numerous
5 correlations to engineering properties from those
6 values.

7 Q. And those are?

8 A. (Dr. Bartlett) Shear strength,
9 consolidation parameters, moduli, density, shear wave
10 velocity. Well, the shear wave velocity is really
11 measured directly. Maybe even the time of day if you're
12 lucky.

13 Q. I take it you think these are useful tests?

14 A. (Dr. Bartlett) I think the cone is a useful
15 test. It is useful specifically for determining
16 stratigraphy. One of the challenges a geotechnical
17 engineer has is stratigraphy, and it gives us a good
18 idea of the layering of the system, its relative
19 strengths. When one begins to correlate engineering
20 properties, you have to be careful. And a prudent
21 investigation includes both cone penetrometer data and
22 other types of testing to confirm what the cone
23 penetrometer is telling us. I use it.

24 Q. Do you know whether applicant conducted cone
25 penetration tests at PFS?

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1 we're again above the water table. Though in some clays
2 there still could be enough saturation that we could
3 generate some pore pressures. And I would just say that
4 if I did have a problem with the cone penetrometer data
5 by itself and not the correlations with it is that the
6 pore pressure data may not be reliable for unsaturated
7 soils.

8 Q. Specifically with respect to the cone
9 penetration test data collected at PFS, do you have a
10 concern about the pore pressure data collection? Have
11 you observed anything --

12 A. (Dr. Bartlett) I have a general problem
13 with pore pressure data collected by ConeTec, and
14 specifically in unsaturated soils. Yes, I do. I do not
15 believe the data is reliable.

16 Q. But with respect to the data on this
17 particular parameter collected by ConeTec at PFS, did
18 you review it to determine whether your general concern
19 about ConeTec applies also to their work on this
20 parameter of PFS?

21 A. (Dr. Bartlett) I didn't make that specific
22 review. I guess I would have probably prejudged that
23 data.

24 Q. All right, fair enough. You said a moment
25 ago that a prudent investigator would supplement the

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1 A. (Dr. Bartlett) It did.

2 Q. Based on your review -- well, did you review
3 the way in which they conducted those tests?

4 A. (Dr. Bartlett) Please repeat the question.
5 I'm sorry.

6 Q. Did you examine or review the manner in
7 which those tests were conducted?

8 A. (Dr. Bartlett) They were performed by
9 ConeTec, which is a vendor here locally. They did it
10 according to common ConeTec procedure. I've seen other
11 ConeTec reports. I didn't review it in detail. But
12 we've also used the same people, "we" meaning UDOT and
13 Woodward-Clyde.

14 Q. Do you have any concerns about the manner in
15 which the cone penetration tests were conducted by
16 ConeTec for applicant in this job, by that meaning PFS?

17 A. (Dr. Bartlett) Not particularly. One issue
18 we have had with ConeTec in other sites, and it's
19 probably not that important here, is that pore pressure
20 transducers, they tend to have a problem with keeping
21 their porous stone in the cone tip saturated, and we've
22 noticed that their pore pressure data may not be
23 necessarily reliable.

24 Q. Have you observed the problem here at PFS?

25 A. (Dr. Bartlett) No, not as much, because

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1 cone penetration test data with other types of tests.

2 A. (Dr. Bartlett) Correct.

3 Q. Did the applicant do that at PFS?

4 A. (Dr. Bartlett) Not the way I would do it,
5 but they did do other investigations, yes.

6 Q. Would you explain for the record how what
7 they did differs from the way you would do it?

8 A. (Dr. Bartlett) Normally when I plan an
9 investigation I like to involve the cone penetrometer
10 first. In that way, I do know the layering, the
11 significant layers involved, and have somewhat of an
12 idea of their relative performances and strengths and
13 compressibilities. That then means I have a clear
14 picture of what I'm going to do now when I come in and
15 drill and take samples, and I can focus my
16 investigation.

17 Also, one objection I had with PFS's
18 investigation -- well, first is that the cone was not
19 used first, it was used later. And also that the
20 boreholes were -- the data from where the cone was
21 collected versus where the borehole information are too
22 far apart really to do any meaningful correlations. My
23 experience is I like to keep a borehole in a cone when I
24 do do a parallel investigation generally within five to
25 ten feet of each other.

1 Q. Let me see if I understand your -- the
2 difference between the process that you favor and what
3 PFS did.

4 A. (Dr. Bartlett) That's correct.

5 Q. The differences are, and please correct me
6 if I'm wrong, first, that you would rather have done the
7 cone penetration test first, and PFS did them last?

8 A. (Dr. Bartlett) They did them not last, but
9 they did it somewhere in the middle of the
10 investigation.

11 Q. And second, you have selected the boreholes
12 to be close to the cone penetration locations?

13 A. (Dr. Bartlett) Correct, because what we are
14 then trying to do is later gather samples from those
15 borings and correlate the results from the cone
16 penetrometer to the results of the undisturbed sampling,
17 or whatever we're doing in the borehole. It's not just
18 undisturbed sampling. And when we get too far apart
19 spatially, then one cannot be confident that what we've
20 seen in the cone penetrometer can be correlated directly
21 with what's been observed in the borehole.

22 Q. As you recall, if you recall, how far apart
23 were the cone penetration tests performed of PFS
24 vis-a-vis the boreholes?

25 A. (Dr. Bartlett) Well, there's several cones

1 I don't know how close those are, but reasonably close
2 there.

3 C-2, which is a boring, it's close to CPT,
4 probably three quarters of an inch. So three quarters
5 of 200 feet. Help me, Farhang, with my math. 150. 150
6 feet away, I consider that too far away to be any
7 meaningful correlation there.

8 CPT 32 and A-3, a quarter of an inch times
9 two hundred, so a quarter of 200 would be 50 feet.
10 Again, probably too far away to really try to correlate
11 the two data.

12 Boring B-3 and CPT 20, maybe an eighth of an
13 inch, so 25 feet. That's hard to tell whether, you
14 know, when you begin to speak about how far away do we
15 need to be before we can correlate data, that's a
16 subjective thing. But my experience is I like to get
17 them reasonably close, five to ten feet, whatever
18 operationally you can do in the field. So I'd say it's
19 not as close as I'd like to see.

20 C-3 and CPT 8 are a little more than a half
21 an inch, so they're probably 120 feet apart. That's
22 probably too far to try to correlate those two if we
23 were to try to correlate them.

24 The canister transfer building investigation
25 is much more dense, and there I do see attempts to try

1 and several borings. May I --

2 Q. You can -- if you want to refresh your
3 memory by looking at the SAR --

4 A. (Dr. Bartlett) I would appreciate that.
5 Okay. This is out of the SAR. I just photocopied this.
6 I forgot I had that stuck in the front of the folder
7 there. I'm looking at Figure 2.6-29.

8 Does anybody have an engineering scale with
9 them today?

10 Q. You're asking a lawyer for that?

11 A. (Dr. Bartlett) I can approximate it, if
12 approximate numbers are fine. Just do it --

13 Q. Yes, just give us an approximation.

14 A. (Dr. Bartlett) One inch is about 200 feet.
15 Okay, referring to this figure, we see the CPT done in a
16 grid.

17 Q. For the record, the CPT is --

18 A. (Dr. Bartlett) The cone penetrometer tests
19 were done in a grid.

20 Q. All right.

21 A. (Dr. Bartlett) Okay. C-1 and CPT 39, C-1
22 being a boring, CPT 39 being a cone penetrometer
23 sounding symbols. It's hard to say what their proximity
24 are to scale, but the symbols are touching each other.
25 I don't know if they're right on top of each other. So

1 to do this pairing of boreholes and CPT's. And I'll
2 leave it at that.

3 Q. Based on your review of this Figure 2.6-29
4 of the SAR, would it be your conclusion that there is no
5 uniform spacing between the borings and the CPT -- and
6 the CPT locations?

7 A. (Dr. Bartlett) Correct. It doesn't seem
8 that they're -- it's not consistent. So I would assume
9 the grid was overlaid, the old boring grid, and there
10 wasn't really any attempt to try to put CPT's adjacent
11 to the borings in the storage pad area. So where they
12 fell close to each other was just circumstance.
13 However, I would not say that about the canister
14 transfer building.

15 Q. So the record's clear: the area in which
16 there is a variability, if you will, in distance between
17 the borings and the CPT test is the area where -- the
18 pad emplacement area?

19 A. (Dr. Bartlett) That's correct.

20 Q. And there is no such problem with the
21 canister transfer building area in that the two sets of
22 measurements, if you will, are close to each other?

23 A. (Dr. Bartlett) Well, I do see CPT's
24 reasonably close to boreholes, reasonably close being
25 maybe within 25 feet. However, there are CPT's and

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1 boreholes that are further apart. So I think when we
2 start to begin to discuss whether they are close enough
3 or not, we need to get to specific examples.

4 Q. All right. One more question on this line,
5 as follows. Is it then your testimony that for the area
6 of the pad emplacement area, in some instances the
7 boreholes are as close as you like to see them to the
8 cone penetration tests, but in many instances they're
9 not?

10 A. (Dr. Bartlett) In a few instances they are,
11 and in some instances they're not, Correct.

12 Q. And the same testimony will apply to the
13 canister transfer building except that perhaps the two
14 sets of measurements are generally closer?

15 A. (Dr. Bartlett) Yes. It appears just from a
16 couple that are closely spaced that there was an attempt
17 to try to correlate between borehole and CPT data.

18 MR. TRAVIESO-DIAZ: It's 12:45. Should we
19 break?

20 (Lunch Recess from 12:45 to 1:48 p.m.)

21 MR. TRAVIESO-DIAZ: Back on the record.

22 Q. (By Mr. Travieso-Diaz) Dr. Bartlett, before
23 we continue with the questions we had before lunch, I
24 want to go back to something that we talked about
25 briefly, and I didn't quite get all the questions

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1 disturbance in fine-grained soils, the effects of
2 disturbance can make the results -- effects of
3 disturbance -- or disturbance, let's not say effects.
4 Disturbance can affect the shear strength and
5 consolidation properties, yes.

6 Q. Does it mean that if you determine that a
7 sample is disturbed, that you don't rely on the measured
8 or the tested values for consideration for strength?

9 A. (Dr. Bartlett) I tend not to, yes, because
10 of the disturbance.

11 Q. How can you tell? Can you tell by looking
12 at the test results?

13 A. (Dr. Bartlett) You can. Sometimes it's
14 somewhat qualitative. There are some times that you can
15 look at it quantitatively somewhat. But it's relative
16 disturbance. It's all samples. Even undisturbed
17 samples show some minor signs of disturbance. But it's
18 somewhat a judgment call about whether a disturbance is
19 enough to really majorly affect the results.

20 MR. TRAVIESO-DIAZ: Let me mark for the
21 record this document that I will identify as Exhibit 50.
22 (Exhibit 50 marked.)

23 Q. (By Mr. Travieso-Diaz) For the record, the
24 document that I handed you consists of three plots which
25 are included -- taken from Attachment 6 to Appendix 2A

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1 answered at the time.

2 Do you recall that we were talking about
3 disturbed versus undisturbed samples?

4 A. (Dr. Bartlett) I remember undisturbed,
5 but -- we talked about disturbance. I don't know if we
6 ever talked about disturbed samples.

7 Q. Well, let me just -- if I recall the
8 testimony, one of the differences that you mentioned
9 between the I-15 work that you did and the soils -- and
10 the PFS soils is that in the I-15 investigation you
11 often had to contend or had to deal with the fact that
12 some samples were disturbed.

13 A. (Dr. Bartlett) Okay. I understand the
14 question now.

15 Q. And you said that in contradistinction when
16 you worked with I-15, some samples at PFS appeared to
17 have been disturbed and others were not.

18 A. (Dr. Bartlett) Appeared to show signs of
19 disturbance, yes.

20 Q. Exactly. The two questions that I forgot to
21 ask were the following. What is the significance of a
22 sample being disturbed? Does it affect your ability to
23 rely on it, on things like strength or, you know --
24 well, I'll leave it at that.

25 A. (Dr. Bartlett) If we're talking about

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1 to the PFS SAR. And they are plots of -- the first one
2 is of shear stress versus axial strain for sample --
3 from Boring CTB-1, and the sample was taken on 4/30/99,
4 or the test was taken -- no, it was 4/30/99. The second
5 one is again a plot of shear stress versus axial strain,
6 and the sample is CTB-5, and it was taken 4/29/99.

7 A. (Dr. Bartlett) Uh-huh.

8 Q. And the third one is a sample of strain in
9 percentage versus vertical stress, and that sample is
10 from Boring CTB-N or CTB-N, dated 4/12/99.

11 Could you look at these two plots and, if
12 you can, and I'm not implying you can't, but if you can,
13 can you determine whether any of those samples appear to
14 be disturbed or significantly disturbed?

15 A. (Dr. Bartlett) The first one, and again I'm
16 speculating because we're dealing with a very complex
17 soil here in the upper profile. But the first one seems
18 to rise to a peak rather rapidly and then have a marked
19 drop-off in the peak strength upon axial strain. This
20 does not appear to me really disturbance. However, it
21 does indicate somewhat of a brittle behavior to this
22 soil. The cause of why it's brittle I can only
23 speculate.

24 Q. But would you -- so would you characterize
25 this sample --

1 A. (Dr. Bartlett) That is undisturbed.
2 Q. Undisturbed. Take a look at the second one
3 now.
4 A. (Dr. Bartlett) The second one is definitely
5 disturbed.
6 Q. Okay. And the third?
7 A. (Dr. Bartlett) This is a consolidation
8 test. The other prior two were shear strength tests.
9 And let's see. What depth are we? 8.6 feet, so we're
10 fairly shallow in the profile. Effective stress is
11 going to be well under -- ksf. It does not appear to be
12 disturbed markedly. It looks reasonable.
13 Q. Now, just so the record identifies the
14 samples correctly, the first sample was taken at a depth
15 of 8.4 feet; is that correct?
16 A. (Dr. Bartlett) That's correct.
17 Q. The second was one was taken at 26.7 feet?
18 A. (Dr. Bartlett) That's correct.
19 Q. And the third one was taken at 8.6 feet?
20 A. (Dr. Bartlett) That's correct.
21 Q. All right. Now, going back to the
22 conversation we were having before lunch, and if I
23 recall, we were talking about how did they program for
24 taking samples that was from PFS different from the way
25 you would prefer the tests to be conducted?

1 A. (Dr. Bartlett) Can I do it by giving you an
2 example?
3 Q. Yes. You were telling me two things.
4 Correct me if I'm wrong. One, that the order in which
5 the cone penetration tests and the borings were done at
6 PFS is different from the way you had done it.
7 A. (Dr. Bartlett) Correct. My -- when allowed
8 by a project manager, because sometimes people are under
9 real constraints to -- no matter what project you're on,
10 that if given full charge of an investigation, my
11 tendencies would be to use the cone penetrometer first.
12 And I think I explained the reasons why I would do that.
13 Okay?
14 Then if some of my objectives then were to
15 try to correlate data, if you so chose, then I would
16 place the borings in close proximity -- close being
17 five, no more than ten feet from where the cones -- if
18 my goal was to try to correlate between CPT and borehole
19 data. And that's just the way I have been taught and
20 tend to do those things.
21 Q. Other than those two particular features
22 that we just talked about, is there any other way in
23 which the sampling process was done at PFS that's
24 different than the way you would like to see it?
25 A. (Dr. Bartlett) That's a very broad

1 question, because we have several issues with the
2 sampling program, and we may have to spend time going
3 through the full contention, if you so choose.
4 Q. Well, more generally, we're talking about
5 the way that the program -- we talk first about the
6 process for doing borings.
7 A. (Dr. Bartlett) Yes.
8 Q. And then we talk about the process of doing
9 cone penetration tests. And I asked you before lunch,
10 and I was trying to get back on track here again,
11 whether apart from those two differences in methodology,
12 if you will, is there any other general difference not
13 specific for a given test?
14 A. (Dr. Bartlett) I see somewhat of a grid
15 pattern. I'm not saying that's not appropriate or
16 inappropriate. But the grid here is quite large, and
17 the spacings between the boreholes is quite large. And
18 I'd say likewise for the cone penetrometer. However, I
19 tend to space my cone penetrometer data a little further
20 apart.
21 It seems to me that the borings were the
22 lead investigative tool that was used initially on. And
23 then the reason for the cone, as we heard yesterday, was
24 somewhat in response to request for additional
25 information by the NRC staff to go resolve specific

1 questions that they had.
2 I think one has to also consider depth of
3 investigation. One thing that was not done at this site
4 is the drillings were not done down to bedrock. It's
5 ambiguous how depth -- the depth of bedrock and types of
6 analyses especially involve ground response -- well, at
7 least my frame of reference is the Savannah River. We
8 drilled several hundreds of feet down to bedrock and
9 characterized the soil column all the way from bedrock.
10 That was not done here, so the boreholes were all
11 relatively shallow. We do not have real deep, or at
12 least one or two very deep borings. So that remains an
13 area of uncertainty to me.
14 There's been no -- investigations are
15 usually phased. And in each subsequent phase you have
16 issues that you're trying to resolve and what you're
17 trying to do in those, and I'm not sure I get a sense in
18 reading the documentation why some things were being
19 done and why they were doing additional borings and
20 investigations, other than just to satisfy a few
21 questions from the NRC.
22 Q. With respect to your observation that the
23 borings and the cone penetration tests are often or
24 sometimes too far apart to be able to correlate the
25 data, what is the significance of the fact that you

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1 might not be able to correlate the data as you would
2 like to?

3 A. (Dr. Bartlett) Well, we saw yesterday that
4 cone penetrometer data were used to adjust the shear
5 strengths for layer 4, and if you get too far apart
6 between the data which you're trying to adjust, your
7 adjustment factors may be meaningless.

8 Q. You're saying, if I understand you, and
9 correct me if I'm wrong, that to the extent that you
10 want to be able to refer to cone penetration test data,
11 to adjust some of the information that you get from the
12 boring data --

13 MS. CHANCELLOR: Objection. Is this a
14 question?

15 MR. TRAVIESO-DIAZ: Yes. I'm getting there.

16 Q. (By Mr. Travieso-Diaz) You might not be
17 able to do so because the two sets of measurements are
18 too far apart?

19 A. (Dr. Bartlett) Yes, correct. Because
20 there's lateral variability in this direction, and the
21 further you get apart, the less the data are correlated.
22 So you run the risk of essentially developing
23 correlations upon which there are no -- they don't
24 correlate. So in other words, part of your distance
25 that you space boreholes, whether they be CPT or SPT, is

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1 A. (Dr. Bartlett) So you're asking how many
2 paired boreholes, CPT and boreholes would I do in an
3 investigation to develop correlations?

4 Q. Yes. One to one? One to two? I don't
5 know. I'm trying to get a sense for how you do the
6 correlation.

7 A. (Dr. Bartlett) Well, let's see if this
8 answers your question. If my purpose is correlating
9 data from a borehole, I would always have a CPT adjacent
10 to it.

11 Q. And to the extent that you are trying to
12 correlate cone penetration tests and boreholes,
13 typically how many of those do you do?

14 A. (Dr. Bartlett) It depends on the size of
15 the facility. So there's a density issue now; how many
16 data do I need. And different agencies, whomever you're
17 working for, have different somewhat suggestions. I
18 won't call them requirements. It's usually still left
19 up to the discretion. But they have densities that they
20 suggest to you.

21 Q. Is there any -- talking about agency
22 requirements, is there any NRC guidance or regulations
23 that control the spacing of the placement of boreholes?

24 A. (Dr. Bartlett) Yes, they are.

25 Q. Where would those be?

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1 fundamentally based on your understanding of how much
2 you think the soils are variable, particularly in the
3 lateral direction.

4 Q. So I take it that to the extent that this
5 presents a problem, it's only if you're trying to
6 correlate for some reason to assess the data. Is that
7 fair?

8 A. (Dr. Bartlett) I may have to think about
9 that. I'll answer this way. Yes, if your main premise
10 or what you're trying to do in an investigation is
11 correlation. To me, it's obvious that they have to be
12 very close or reasonably close. If you're using the two
13 types of data to supplement one another, I can see cases
14 where they would not necessarily have to be in close
15 proximity to each other. However, one then has to go
16 back and consider the density of both types of data,
17 because they are different types of data, and whether
18 you're putting in the appropriate number of borings and
19 sampling to fully characterize the site.

20 Q. How many cone penetration tests in your
21 practice do you typically correlate to a single boring?
22 Is there any ratio or any way you correlated the
23 measurements?

24 A. (Dr. Bartlett) If I'm trying to correlate?

25 Q. Yeah.

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1 A. (Dr. Bartlett) I believe they are found in
2 Reg Guide 1.132, Appendix C, I believe.

3 Q. Did you review Appendix C or Reg Guide 1.132
4 to determine whether the program that was put in place
5 at PFS comply with the requirements of that appendix?

6 A. (Dr. Bartlett) Yes, I did.

7 Q. And what was your conclusion?

8 A. (Dr. Bartlett) They did not.

9 Q. In which respect?

10 A. (Dr. Bartlett) There were not enough
11 boreholes. May I qualify that?

12 Q. Okay.

13 A. (Dr. Bartlett) For the pad emplacement
14 area. I'm not sure I would make that statement about
15 the canister transfer building right now. I'd have to,
16 again, look at the -- count the borings again in that
17 footprint.

18 Q. So you're not sure?

19 A. (Dr. Bartlett) Right. And the reason I'm
20 not sure is because when we divide -- when we split this
21 project team up to do the review, I really primarily
22 looked at the storage pad -- or emplacement pad area,
23 excuse me, and Dr. Ostadan looked more at the canister
24 transfer building. However, I have looked at the
25 laboratory testing and boreholes from both areas.

1 Q. May I refer to Dr. Ostadan. Don't think I'm
2 forgetting you. In your review of the canister transfer
3 building, did you develop a view as to whether the
4 number of boreholes that were drilled or that were done
5 by PFS complies with Reg Guide 1.132?

6 A. (Dr. Ostadan) I did not specifically review
7 the investigation performed for the canister transfer
8 building to see whether it's in compliance with the NRC
9 guidelines or not.

10 Q. Okay. Let's move to something else.

11 A. (Dr. Bartlett) Sure.

12 Q. I take it, as we discussed before, that one
13 of the purposes of drilling boreholes is to take samples
14 for later testing in the laboratory?

15 A. (Dr. Bartlett) Yes.

16 Q. And I take it that you have in fact gone
17 through the process of first collecting samples and then
18 having tested them or having them tested?

19 A. (Dr. Bartlett) Generally having them
20 tested, because most of my commercial experience we did
21 not have our own on-site laboratories. Those were sent
22 to either others in the firm or laboratories which we
23 were contracted with. But yes, I have taken samples to
24 submit them for laboratory testing.

25 Q. What kinds of tests are typically run with

1 that they failed to perform that you wish they had?

2 A. (Dr. Bartlett) Restricting ourselves to
3 laboratory testing, correct?

4 Q. Yes, restricting ourselves to laboratory
5 testing for the moment.

6 A. (Dr. Bartlett) Okay. Yeah, I think a
7 direct simple shear test. Some of that might be useful
8 instead of the direct shear. Also strain controlled
9 triaxial testing, cyclic triaxial testing.

10 Q. Why do you feel that they should have done
11 strain controlled triaxial tests?

12 A. (Dr. Bartlett) We have issues with
13 degradation, degrading of the strength and modulus of
14 some of these soils at the level of strains that we see
15 that have been produced by the earthquake. And really
16 we cannot assess whether those degradations are real or
17 not, because the type of testing they perform doesn't
18 really lead us any. They performed --

19 I'm not sure quite what I said. Can I start
20 again?

21 Q. Sure.

22 A. (Dr. Bartlett) Okay. Let me focus on first
23 the direct simple shear test.

24 Q. Okay.

25 A. (Dr. Bartlett) The direct simple shear test

1 soil samples taken from projects such as the ones you
2 have been involved with?

3 A. (Dr. Bartlett) What types of tests or
4 samples?

5 Q. No. No. What type of tests are conducted
6 in the laboratory with respect to samples taken from
7 borings?

8 A. (Dr. Bartlett) Shear strength tests,
9 consolidation tests, general Atterberg and
10 classification tests. Once in a while permeability
11 testing.

12 Q. Has, to your knowledge, applicant performed
13 tests on samples taken from borings on the PFS site?

14 A. (Dr. Bartlett) Yes, they have.

15 Q. What kind of tests did they run?

16 A. (Dr. Bartlett) Regarding shear strength, to
17 my knowledge, they've performed unconsolidated-
18 undrained, UU tests; consolidated-undrained; direct
19 shear. I believe that's all I recall as far as shear
20 strength testing. Consolidation testing, and the
21 oedometer, o-e-d-o-m-e-t-e-r. And then again typical
22 classification tests that we would do -- moisture
23 contents, Atterberg limits, those type of routine tests.

24 Q. In terms of the kinds of tests that the
25 applicant performed, was there any category of tests

1 does not allow really any strain concentrations along
2 one predefined plane. So it may give us a better
3 indication of what the shear strength is across the
4 entire sample. The direct shear test which was
5 performed by the applicant tends to concentrate stresses
6 on one predefined failure plane.

7 Now on to the strain controlled cyclic
8 triaxial tests. Those would give us a better idea, or
9 an idea, really, of how the stiffness or modulus and the
10 strength may degrade or behave at the levels of strain
11 that we see from the shake analysis.

12 A. (Dr. Ostadan) May I add to that?

13 Q. Yes, please.

14 A. (Dr. Ostadan) One of the points raised in
15 Contention I was the soil properties used to take into
16 account soil linearity or the so-called soil curves or
17 generic curves. I have not seen in the package, in the
18 calculation any laboratory data that was developed in
19 order to come out with the site specific soil curves.

20 Q. Let me clarify your answer to make sure that
21 you're saying what I understand you to be saying. Are
22 you saying, Dr. Ostadan, that there is no data developed
23 in the laboratory for specific soil properties for the
24 PFS site?

25 A. (Dr. Ostadan) No, I'm not saying that.

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1 Q. Or are you restricting yourself to a
2 particular type of soil test?

3 A. (Dr. Ostadan) I'm restricting myself to a
4 particular soil test. You asked -- your question was,
5 what other tests should have been done in the
6 laboratory. And my answer to that, in addition to what
7 Dr. Bartlett said, is that cyclic triaxial tests could
8 have been done to develop site specific soil curves as
9 is stated in the Contention L.

10 Q. Is it your testimony that they did not
11 conduct cyclic triaxial tests?

12 A. (Dr. Ostadan) They did not conduct cyclic
13 triaxial tests to develop soil curves.

14 Q. I need you to explain the second part of the
15 answer. What do you mean by "to develop soil curves"?

16 A. (Dr. Ostadan) Soil curves are used
17 primarily in a ground response analysis, such as those
18 done by the applicant here using computer program Shake,
19 S-h-a-k-e. As shown in the calculation currently, the
20 curves are generic curves, published in the literature.

21 Q. When you say that they should have run
22 cyclic triaxial tests to develop soil curves, what would
23 those curves be? Of what? In other words, how would
24 you be plotting the curves?

25 A. (Dr. Ostadan) The curve have two branches,

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1 triaxial tests that they did in compression --

2 A. (Dr. Bartlett) Right.

3 Q. -- they should have done a similar test that
4 was in extension as opposed to compression?

5 A. (Dr. Bartlett) Correct. And I would also
6 add that we would -- we see a conceptual design of a
7 soil mat that we need to also, instead of seeing
8 compression of that soil cement, we also need to
9 understand its behavior and tension. So we need tensile
10 tests done on the proposed design of this soil cement
11 mat.

12 Q. Let me ask you the following question. The
13 simple shear test that you mentioned before, are these
14 commonly performed in the industry? And we're talking
15 about any of these tests, starting with the simple shear
16 tests, specialized tests.

17 A. (Dr. Bartlett) The direct simple shear
18 test, I'm not sure I could call it specialized, but it
19 may be hard to find from a small commercial geotechnical
20 laboratory. Larger laboratories in a fair amount of
21 universities can perform these type of tests.

22 Q. Have you done any of these yourself in
23 your program?

24 A. (Dr. Bartlett) I have not.

25 Q. How about the triaxial extension tests or

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1 actually. There are two types of information present in
2 these curves. One is shear modulus of the soil and the
3 function of shear strength, and it's in a linear curve
4 that shows degradation of the stiffness versus the
5 strain.

6 The second piece of the information is the
7 soil material damping as a function of shear strength
8 that generally shows an increase of damping versus
9 strain.

10 Q. And your testimony is that these type of
11 tests for the purpose of developing this type of curves
12 were not done?

13 A. (Dr. Ostadan) Yes.

14 A. (Dr. Bartlett) May I add to my testimony?

15 Q. Please.

16 A. (Dr. Bartlett) One other test that we
17 discussed a little bit yesterday is the types of
18 triaxial testing that were done were all in compression.
19 I believe also in helping to understand maybe the part
20 of the failure surface that we look at when we look at
21 general bearing capacity that's in -- it actually goes
22 into extension. So the triaxial extension test too
23 would appear to be appropriate for parts of that failure
24 surface.

25 Q. So your testimony is that in addition to the

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1 triaxial tests to measure extension? Are those commonly
2 done in the industry, or are they sort of specialized?

3 A. (Dr. Bartlett) The apparatus can be made to
4 do compression or extension. It doesn't matter.

5 Q. So it can be done with the same --

6 A. (Dr. Bartlett) It can be done, sure.

7 Q. All right. Have you done any such extension
8 tests in the projects that you worked on?

9 A. (Dr. Bartlett) No, I stated earlier that I
10 haven't worked in a geotechnical laboratory. Most of my
11 career, those types of tests have been sent out. They
12 were done for the I-15 project, yes.

13 Q. Any other projects that they were done for?

14 A. (Dr. Bartlett) Not that I recall. They
15 were done specifically for the I-15 project to address
16 the anisotropy in the Bonneville clay.

17 I take that back. I have been associated
18 with the project, it's called the Kennecott Utah Copper
19 Tailings Impoundment Modernization Project. Though my
20 piece of that project was not to do stability analyses,
21 I was involved in doing seepage analyses for that
22 particular project. There were also triaxial extension
23 tests performed.

24 Q. What type of information do you derive from
25 those triaxial extension tests?

1 A. (Dr. Bartlett) The general shear failure
2 surface is a curved envelope. So as that envelope
3 changes its geometry or position, it puts the soil
4 here -- right here underneath the foundation in
5 compression. Here, then there's more of a shearing
6 that's represented more like the direct simple shear
7 failure mode. And then when we go up to near the
8 surface and outward, the failure surface would daylight
9 away from the building, and that puts the soil in
10 extension, not compression. So we try to mimic through
11 our testing program the different modes of failure
12 throughout the failure plane.

13 Q. For what elements or what portions of your
14 design do you seek these various types of information?
15 Is it for bearing capacity or --

16 A. (Dr. Bartlett) Bearing capacity and slope
17 stability is what I've used it for.

18 Q. You wouldn't need to do that for slope
19 stability?

20 A. (Dr. Bartlett) You wouldn't have to do it
21 at this site, but in general, yes, we did it for slope
22 stability and bearing capacity.

23 Q. We were talking laboratory tests, and I
24 needed to ask you, what source of in situ tests are
25 typically performed in projects of the type that you're

1 involved with?

2 A. (Dr. Bartlett) Okay, at least I'll give you
3 some that I've had some experience with. Besides the
4 cone penetrometer, I think we could call that an in situ
5 type of test. The dilatometer, the pressure meter. I
6 guess we could call the vein shear test an in situ test.
7 And I've done some permeability testing that are
8 borehole types or in situ testing, but I'm not sure that
9 those are particularly germane here.

10 Q. Now, which of these in situ tests were
11 performed by applicant in its investigations of the PFS
12 site?

13 A. (Dr. Bartlett) The cone penetrometer, the
14 dilatometer, to the best of my knowledge.

15 Q. Is there any in situ tests that they did not
16 perform that you wish they had?

17 A. (Dr. Bartlett) I haven't really looked at
18 the dilatometer data. In some cases maybe pressure
19 meter data might be as valuable, but at this point, no,
20 I have no really strong feelings towards that.

21 A. (Dr. Ostadan) Can I add to that?

22 A. (Dr. Bartlett) Sure.

23 A. (Dr. Ostadan) After completion of the cone
24 program, the layering at the site was revised from a
25 two-layer system as was originally perceived, especially

1 for 30 feet, to a four-layer system.

2 The seismic refraction test, which is a
3 field test that were performed, predates the seismic
4 cone program. I think it would be prudent to attempt to
5 do a seismic refraction, recognizing the four layers as
6 they have been edicted now, in order to develop shear
7 wave velocity profile in the upper layer across the site
8 to recognize the variations of the shear wave velocity
9 in the lateral direction for dynamic analysis.

10 A. (Dr. Bartlett) May I add to my testimony?

11 Q. Please.

12 A. (Dr. Bartlett) Dr. Ostadan jogged my memory
13 about dynamic properties.

14 We mentioned -- I mentioned earlier this
15 morning that characterization maybe in -- of a deep
16 hole, and in other projects we've used a down-hole
17 suspension logger to characterize deep shear wave
18 velocities and found that type of data quite reliable
19 and useful. So I guess another in situ testing would be
20 suspension logging to get P- and S-wave losses in a deep
21 hole.

22 Q. And is this a test that the applicant did
23 not do?

24 A. (Dr. Bartlett) No, they did not do a deep
25 hole suspension logging test.

1 Q. Again, what type of information do you feel
2 that they failed to obtain that they would have gotten
3 had they done all of these tests?

4 A. (Dr. Bartlett) Shear wave velocities for
5 the deeper layers from a down-hole type of method. They
6 used surface geophysical methods.

7 Q. Are you testifying that they obtained the
8 data using a different methodology, different means?

9 A. (Dr. Bartlett) I am not going to testify on
10 that, because that's really out of my area that I
11 reviewed. I'm just thinking from a geotechnical
12 perspective that quite often we develop ground motions
13 up through a soil column, and one of the useful tools
14 that we have found in the past is a suspension logger.

15 Q. You're not testifying as to whether what
16 they did was adequate for the purpose of determining
17 shear wave velocities?

18 A. (Dr. Bartlett) Not for -- no, that's out of
19 my area. I choose not to.

20 Q. Okay. Let's talk very briefly about, as
21 opposed to the tests that were done, the manner in which
22 those tests that were done were conducted.

23 A. (Dr. Bartlett) Sure.

24 Q. Do you have any concerns or reservations
25 with respect to the way that the applicant did those

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1 laboratory tests that you listed as they have been done?
2 A. (Dr. Bartlett) So we're talking about
3 specifically the way the test was conducted?

4 Q. Right.

5 A. (Dr. Bartlett) One issue we raised
6 yesterday a little bit about is being careful to not
7 allow the sample to dry out. The reason why we're
8 concerned about this, these are partially saturated
9 soils, and any changes in moisture content can affect
10 the shear strength, can raise the shear strength.

11 When we reviewed the direct shear, I was
12 concerned about a sample being consolidated for -- or
13 left for 90 minutes under consolidation weight before it
14 was sheared. It seems like that the consolidation was
15 done within a few minutes. We should have just went
16 ahead and sheared it.

17 We cannot really determine the effect of
18 that because we don't know, you know, whether there was
19 really significant changes in the moisture content or
20 not. But I would think that may have to be re-evaluated
21 in partially saturated soils to make sure that we do not
22 do anything to allow these soils to change moisture
23 content.

24 There was some initial confusion I think at
25 the beginning of the review of some of the first

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1 A. (Dr. Bartlett) Correct.

2 Q. Apart from having a concern, does either of
3 you have any evidence that would lead you to believe
4 that that in fact occurred?

5 A. (Dr. Bartlett) We do not. But there are
6 really, from what we understood yesterday, no data
7 collected to prove either yes or no. So it's
8 inconclusive.

9 Q. I recall that the testimony that I believe
10 it was Mr. Trudeau gave yesterday was to the effect that
11 these samples were sealed.

12 A. (Dr. Bartlett) Correct.

13 Q. Were kept sealed. Is that to you sufficient
14 protection against the possibility of losing moisture?

15 A. (Dr. Bartlett) No. Seals can, especially
16 after two and a half years in a laboratory, not be good,
17 and there is a potential for drying out. I guess we can
18 speculate whether they did or didn't; but in my common
19 practice, to allow a sample to sit for two and a half
20 years before I test it seems a long time. And the
21 chance for drying or -- is increased just because of
22 that long duration.

23 Q. With respect to your concern about the
24 90-minute wait before the actual shearing testing --

25 A. (Dr. Bartlett) Correct.

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1 versions of the SAR about wetting, when we should wet,
2 when we shouldn't, when we were looking at collapsible
3 soils. But I think subsequent RAI's kind of cleared up
4 what was going on with wetting and inundation and those
5 type of things.

6 It would be nice to be able to measure
7 matrix suction, but it's a difficult thing to do. These
8 are unsaturated soils, and it would be nice to know what
9 are those capillary stresses that are in these
10 unsaturated soils, because these soils upon any changes
11 in moisture content could be sensitive to that. Though
12 I haven't had a lot of familiarity with that type of
13 testing, either.

14 Do you wish to add anything?

15 A. (Dr. Ostadan) But maybe as a reminder, one
16 point that was discussed yesterday was the concern about
17 loss of moisture for the samples that was there over two
18 years. And your question was, I believe, what
19 difference you would have liked to see in the way the
20 lab test was conducted. I would have gone out to take
21 fresh samples and tested them.

22 Q. Do either of you -- I know that both of you
23 have expressed a concern about the possibility that the
24 samples may have lost moisture while they were waiting
25 to be tested.

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1 Q. -- Do you -- are the concerns, again, what?
2 That you may lose moisture while you are waiting those
3 90 minutes?

4 A. (Dr. Bartlett) Correct. I don't know if
5 the shear box -- it's not airtight, and so it -- the
6 samples are fairly thin, and if left for prolonged
7 times, they can begin to dry out.

8 Q. Again, to both of you, aside from the
9 concern that this may have happened, do you have any
10 evidence that it did happen?

11 A. (Dr. Bartlett) We do not, other than the
12 concern to not wait so long before one shears.

13 Q. I understand. One type of test that I heard
14 mentioned yesterday that neither of you has referred to
15 is resonant column tests. Is that a type of test you
16 normally do in your soils work?

17 A. (Dr. Bartlett) Depends on the facility and
18 the nature of what's going on. Resonant column
19 testing -- and I'll defer to Dr. Ostadan; I'm going to
20 just speak very briefly -- is done to develop the
21 dynamic properties. And in some projects particularly
22 that we've been involved in the past that involved
23 nuclear safety issues, those types of tests have been
24 done for those sites. If I'm doing a design that may
25 not require nuclear safety issues, maybe one may not

1 choose to do that type of test. So I guess it depends
2 on the safety issues and the complexity of the project.
3 Q. Have you done that type of test in the
4 projects that you have been involved with?
5 A. (Dr. Bartlett) Yes, we have done that.
6 Q. Which projects?
7 A. (Dr. Bartlett) The Savannah River site, the
8 ITP project.
9 Q. And that was an NRC --
10 A. (Dr. Bartlett) That was DOE.
11 Q. DOE, I'm sorry. Yes. And did the applicant
12 do resonance column tests?
13 A. (Dr. Bartlett) We were the applicant.
14 Q. I'm sorry. I'm switching horses on you. I
15 apologize. I'm talking about PFS, did the applicant do
16 residence column tests?
17 A. (Dr. Bartlett) Yes.
18 Q. And are these lab tests or in situ tests?
19 A. (Dr. Bartlett) They're lab tests.
20 Q. Okay. That wasn't clear. And do you have
21 any concern about the way in which applicant did their
22 resonant column test?
23 A. (Dr. Bartlett) I'm not an expert on the
24 resonant column test.
25 Q. How about you, Dr. Ostadan?

1 A. (Dr. Ostadan) I did not study the lab
2 results, but I can state that those tests and those
3 results were not used, and they were looking at the site
4 specific soil curves for shake analysis.
5 Q. What is your understanding of the use to
6 which the results of those tests were put?
7 A. (Dr. Bartlett) I'll speak first, and then
8 he may add to that. As far as we can see, the results
9 of the resonant column tests were not applied.
10 Q. You were talking a moment ago about NRC type
11 projects, and that jogged my memory to ask you, has any
12 of the -- have any of the projects that you have been
13 involved with other than PFS been for a project that was
14 performed under NRC supervision or jurisdiction?
15 A. (Dr. Bartlett) No, not under NRC
16 supervision or direction.
17 Q. Did you seek to familiarize yourself with
18 what the NRC requirements would be that would govern
19 this -- the geotechnical work of PFS?
20 A. (Dr. Bartlett) Yes, at least as cited by
21 the applicant in the documents, wherever they were. At
22 least in my area of review, I would look at what was
23 being cited and stated. While at the Savannah River
24 site, though, we did not fall under NRC jurisdiction.
25 We would also look at NRC Reg Guides and standard review

1 plans in helping prepare our SARs. So yes, some five
2 years ago I did look at those types of Reg Guides,
3 1.132, 1.138.
4 Q. And for purposes of familiarizing yourself
5 with the NRC regulations that might apply or would apply
6 to PFS, what do you do? How do you go about
7 familiarizing yourself with those regulations?
8 A. (Dr. Bartlett) Well, the first approach I
9 had is, as I read the SAR or places where either those
10 guidelines were -- not guidelines -- where things were
11 being cited from the NRC Reg Guides, that I would review
12 that portion that's being cited to see its context in
13 what is going on. My reading of 1.132 and 1.138, I have
14 read probably a year and a half ago. I guess I don't
15 really tend to refer to the guides until I have specific
16 reasons for doing so. I find them -- that they have a
17 lot of detail, and the best thing to do is when -- go to
18 them for specific issues.
19 Q. Do you try to find out, for example, how Reg
20 Guide 1.132 has been applied by NRC in other projects in
21 which geotechnical issues to which the Reg Guide applied
22 may have been used?
23 A. (Dr. Bartlett) I haven't had any
24 involvements in -- for any other NRC projects, so I
25 don't know how I could do that.

1 Q. Did you try to research the available
2 materials from the NRC to determine, for example, if
3 there was another ISFSI in which soils investigations
4 were going by 1.132, how the NRC applied that regulation
5 to that particular facility?
6 A. (Dr. Bartlett) I have not done that.
7 Q. Okay. Can you address that?
8 A. (Dr. Ostadan) Well, I can recall based on
9 experience one issue that surfaced a number of times in
10 dealing with the NRC, that is, the density of boring and
11 sampling. If I recall correctly, Reg Guide 1.134 calls
12 for one boring for every 10,000 square feet. And this
13 is a guide. And following behind this guide, I need to
14 have good justification and be able to present a set of
15 coherent and consistent data that justify additional
16 boring were not needed.
17 Q. Did either of you undertake to determine
18 whether the borings that we're doing at PFS comply with
19 this guidance of one every 10,000 square feet?
20 A. (Dr. Bartlett) We answered that earlier.
21 Q. And the answer was --
22 A. (Dr. Bartlett) My evaluation for the pad
23 emplacement area showed that they do not meet the
24 requirement.
25 Q. They are spaced farther apart?

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1 A. (Dr. Bartlett) They're spaced farther
2 apart. The density of number of borings does not meet
3 in compliance with that. We deferred I think our
4 decision on that for the canister transfer building. I
5 have to kind of look at that.

6 Q. And as far as you recall from your review of
7 the materials with respect to the license of PFS, has
8 the NRC raised a concern with respect to the spacing of
9 boreholes for PFS?

10 MS. CHANCELLOR: Objection. You're asking
11 him to speculate about what NRC has done.

12 MR. TRAVIESO-DIAZ: Well, he has reviewed
13 these materials. He testified he did. My only question
14 is whether he has any recollection of the NRC raising
15 this as an issue.

16 MS. CHANCELLOR: He can answer it to the
17 extent that he knows.

18 A. (Dr. Bartlett) I do not remember.

19 Q. All right. You said that you reviewed the
20 NRC regulations that were cited in SAR. I believe you
21 said that. That is correct?

22 A. (Dr. Bartlett) Yes, for the parts of the
23 SAR that I reviewed.

24 Q. Did you undertake to review other NRC
25 regulations that might apply that were not in the SAR?

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1 MS. CHANCELLOR: Okay.

2 Q. (By Mr. Travieso-Diaz) Let's look at page
3 83, and first look at the paragraph following the
4 caption 3, "Characterization of subsurface soils."

5 A. (Dr. Bartlett) Uh-huh.

6 Q. Do you have that?

7 A. (Dr. Bartlett) Yes, I do.

8 Q. Now, this paragraph indicates that "Perhaps
9 the most significant shortcoming in the license
10 application and SAR is the lack of any rigorous and
11 detailed investigation of subsurface conditions that
12 would be appropriate for any nuclear facility. The
13 level of investigations presented is more typical of
14 very preliminary studies for site screening efforts and
15 not a detailed determination of site suitability for
16 establishing design parameters."

17 A. (Dr. Bartlett) Correct.

18 Q. Now, in light of the work that you testified
19 that the applicant has done since this paragraph was
20 written in 1997, do you believe it still to be accurate?

21 A. (Dr. Bartlett) Yes, we still have
22 significant issues about the details of investigations
23 that have been done for this facility.

24 Q. All right. Let me hand over to you --
25 again, this has already been introduced as an exhibit.

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1 A. (Dr. Ostadan) Let me answer that while
2 you're thinking. I did, several of the NRC documents
3 that relates to my area of expertise. And I,
4 unfortunately, cannot be specific with the SRP number.
5 It's either 371 or 372, in which NRC specifically states
6 that when you have a site with a thin, soft layer on the
7 top, the design motion should be specified on top of the
8 competence soil layer, and I believe this is the case
9 here.

10 Q. Any other NRC regulations that you reviewed
11 apart from the ones that are specifically called for in
12 the SAR?

13 A. (Dr. Ostadan) I cannot recall.

14 Q. Dr. Bartlett, let's go back to Exhibit 3.

15 A. (Dr. Bartlett) Sure.

16 Q. Exhibit 3 was -- we talked about earlier.

17 MR. TRAVIESO-DIAZ: So that you understand,
18 I didn't ask the reporter to mark it because it's
19 already in evidence, and it was put in the first day of
20 the deposition.

21 MS. CHANCELLOR: But Dr. Ostadan has marked
22 up that exhibit. He's made in some pencil marks on it.

23 MR. TRAVIESO-DIAZ: The copy that I have is
24 mine.

25 MR. BARTLETT: This is mine. I've got it.

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1 And for the record, I will identify this as Exhibit 6,
2 and it is the Safety Evaluation Report concerning the
3 Private Fuel Storage facility, Docket Number 72-22.

4 A. (Dr. Bartlett) Uh-huh.

5 Q. I believe this document was prepared in
6 October 1999, although it doesn't have a date. You
7 testified earlier that you did review this document; is
8 that correct?

9 A. (Dr. Bartlett) Yes. My review was just
10 dealing with the issues with Contention L, so I have not
11 gone all the way through the document.

12 Q. I'm sorry. I mischaracterized the document.
13 For the record, I need to clarify it. This document
14 that you have is not the totality of the Safety
15 Evaluation Report prepared by NRC. It's only that
16 portion of the SER that deals with geology and
17 seismology, as you can see from the fifth page in the
18 document which has the number 2-24.

19 A. (Dr. Bartlett) Correct.

20 Q. With that clarification, would this have
21 been the portion of the SER that you reviewed?

22 A. (Dr. Bartlett) Portions of what I've been
23 handed I have reviewed, yes.

24 Q. So you didn't review the entire --

25 A. (Dr. Bartlett) No, I did not. Some of

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1 these areas are outside my expertise.
2 Q. Now, we were talking -- please turn to page
3 2-24.
4 A. (Dr. Bartlett) 2-24, okay. 2-24.
5 Q. Yeah, 2-24 is the fifth page in the exhibit.
6 And now, I believe that there is a number of bullets on
7 page 2-24 that go on through 2-25 and perhaps to the top
8 of 2-26 that appear to be a listing of various
9 applicable NRC regulatory requirements.
10 A. (Dr. Bartlett) I see they're mostly in 10
11 CFR 72, yes.
12 Q. Are you familiar with any of these
13 requirements? I don't believe you cited them before.
14 A. (Dr. Bartlett) I have a copy of 10 CFR 72.
15 I had referred to it a couple times in the SAR. At
16 least in my portions where it was quoted, I went and
17 looked at the appropriate -- in the SAR. I have not
18 done the same for the SER.
19 Q. Well, but my question was with respect to
20 the specific regulations listed on these three pages.
21 Starting with 10 CFR 72.90(A), did you review that
22 particular regulation?
23 A. (Dr. Bartlett) Not recently, no. I don't
24 know if I have. I did read 10 CFR 72 some time ago.
25 Q. And in your review of the applicant's work

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1 MS. CHANCELLOR: Your question was whether
2 he believe that the applicant was in compliance with the
3 regulation.
4 MR. TRAVIESO-DIAZ: Excuse me. Let me ask
5 the question one more time.
6 My question was to him, did he review the
7 work that the applicant did versus the regulations in an
8 effort to determine whether they complied or not. The
9 answer is either yes or no. He reviewed it or didn't.
10 That's all I'm asking him.
11 A. (Dr. Bartlett) At what time frame?
12 Q. Well, you had have been working on this
13 since 1999. From then to now.
14 A. (Dr. Bartlett) Right. So there were times
15 during the review that I would refer to 10 CFR 72 to
16 compare pieces. Have I gone through this exhaustive
17 list, no.
18 Q. And did you in preparing for this deposition
19 try to look at the work that applicant has done and
20 relate it to and try to compare it to the items on these
21 pages?
22 A. (Dr. Bartlett) No, not the items on these
23 pages.
24 Q. Will you turn to page 2-46. That is like
25 halfway through this document, maybe two-thirds of the

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1 on the geotechnical work at the PFS, did you try to
2 compare what they have done versus the items listed on
3 these two pages to see if the work appears to you to
4 comply with the requirements?
5 A. (Dr. Bartlett) No, my major --
6 MS. CHANCELLOR: Objection. Calls for a
7 legal conclusion.
8 MR. TRAVIESO-DIAZ: I'm asking whether he
9 did it, not what the results of his review were.
10 A. (Dr. Bartlett) So you're asking me, did I
11 go through bullet by bullet?
12 Q. No, no. My question is, in your review of
13 the applicant's work, did you seek to compare what they
14 did versus whatever these various regulations say to
15 determine whether the work that was done was in
16 compliance?
17 MS. CHANCELLOR: Objection. Again you're
18 asking for a legal conclusion --
19 MR. TRAVIESO-DIAZ: No, I'm asking --
20 MS. CHANCELLOR: -- whether it was in
21 compliance with the regulations.
22 MR. TRAVIESO-DIAZ: I asked him and I'll ask
23 him again, and I believe it's a proper question, whether
24 he did try to do a comparison to do what the applicant
25 did on what the regulation calls for.

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1 way through. And this page contains a section that has
2 the caption 2.1.64.
3 A. (Dr. Bartlett) Correct.
4 Q. Titled "Stability of subsurface materials."
5 A. (Dr. Bartlett) Correct.
6 Q. Okay. Within the page there is a section
7 with no number that is entitled "Geotechnical site
8 characterization." Do you see that?
9 A. (Dr. Bartlett) I do.
10 Q. Now, in the first paragraph of that section,
11 the NRC writes, "Geotechnical characterization of the
12 site was performed through a combination of field and
13 laboratory testing. The site investigation included 32
14 borings for sampling and standard penetration testing
15 (20 in the pad emplacement area, 10 in the canister
16 transfer building area, and 2 out on the access road)."
17 A. (Dr. Bartlett) Right.
18 Q. Now, do you disagree with the information
19 that is presented by the NRC in these two sentences as
20 to the number of tests that were done?
21 A. (Dr. Bartlett) We could take a moment and
22 count them if you so wish. I haven't done that in my
23 review.
24 Q. Did you in your review try to determine how
25 many borings were done all together?

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1 A. (Dr. Bartlett) Yes, I counted them. I
2 don't remember what the count was.
3 Q. Okay.
4 A. (Dr. Bartlett) So we can -- if we want, we
5 can choose to count them. We can see if this is
6 correct.
7 Q. Do you -- perhaps we'll do that at a break.
8 For the moment, in the interest of time, do you have any
9 reason to disagree with the numbers?
10 A. (Dr. Bartlett) No, not at this point. I'm
11 not trying to be adversarial. I'm just saying I'd
12 prefer, before I go on the record as saying these are
13 correct, I'd like to count them.
14 Q. That's perfectly reasonable.
15 Okay. Again going down in the same
16 paragraph, the NRC says in the next -- to the next
17 sentence, "Also 39 cone penetrometer tests (CPT's) and
18 16 dilatometer tests were performed at locations
19 described in Figures 2.6-18 and 2.6-19 of the SAR,
20 Provision 13." Again, do you have any reason to
21 disagree with those numbers?
22 A. (Dr. Bartlett) No. They appear to be at
23 least in the right number. I can't verify them, but we
24 could count them. But I don't think it's that important
25 at this point.

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1 Q. Let's go now to page 2-48. And looking at
2 the first full paragraph on that page, it reads, "The
3 staff concludes that the geotechnical site
4 characterization information presented in the SAR is
5 adequate for use in other sections of the SAR to develop
6 the design basis for the facility and perform additional
7 safety analysis."
8 Do you see that? It's at the top of the
9 page, before the section --
10 A. (Dr. Bartlett) Okay. Before the discussion
11 of the stability of the cask storage pad foundation,
12 yes.
13 Q. Do you agree or disagree with that
14 statement?
15 MS. CHANCELLOR: Objection. First of all,
16 you should ask if he has an opinion.
17 MR. TRAVIESO-DIAZ: Well, okay.
18 Q. (By Mr. Travieso-Diaz) Do you agree,
19 disagree, or have no opinion with respect to that
20 statement?
21 A. (Dr. Bartlett) I disagree with it.
22 Q. On what basis do you disagree?
23 A. (Dr. Bartlett) First, the site
24 characterization to me involves more than just borings
25 and numbers of boreholes that were put in the ground.

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1 We've already stated that, at least based on the density
2 that we have seen at this site in the pad emplacement
3 area, that it doesn't appear to follow Reg Guide 1.13 --
4 1.132. Also, characterization to me involves -- when we
5 say "geotechnical site characterization," then we are
6 also doing testing, including laboratory testing, to
7 define soil properties.
8 We have serious reservations about the
9 number of laboratory samples that have been done for
10 this particular facility. We see the design of the
11 foundation system is being done on very limited numbers,
12 in which we cannot tell whether these are high values,
13 average values, or low values for the respective layers.
14 It's difficult in reading the SAR whether we can
15 determine based on the layering scheme where exactly
16 these things were done. They have not been tabulated
17 by -- layer by layer. One could do so, but it's
18 extremely inconvenient.
19 We have reservations about the shear wave
20 velocity data. We see some inconsistencies and cannot
21 quite resolve which are right and which are wrong.
22 Well, I won't say wrong. We shouldn't really use the
23 word "wrong." But if there's any potential bias between
24 the two data sets.
25 We have stated the applicant hasn't drilled

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1 any deep borings, at least geotechnical borings, down to
2 the presumed bedrock somewhere between 800 and 500 feet.
3 We don't know where it's at.
4 We see discussions of cementation in layer
5 2. We do not see any objective evidence to show the
6 degree or amounts of cementation or the lack thereof.
7 I need to pause. I'm drawing a blank.
8 Maybe Dr. Ostadan can add something.
9 A. (Dr. Ostadan) I only can add from
10 experience. I think your expert testified yesterday
11 that geotechnical engineers always like to have more
12 data, and I think that is true. We're always
13 constrained to the schedule and budget. However, we
14 have a leverage in our practice if we don't get our wish
15 granted to exercise and recognize the variation and
16 potential scattering of data and bring that element into
17 our design. I think in general that element of our
18 practice has not been rigorously implemented here in the
19 SAR.
20 Q. Can you explain what you mean? I'm not sure
21 I follow you.
22 A. (Dr. Ostadan) Okay. Let me give you an
23 example on ground response analysis. I think in our
24 CSRP, and again, it's either 271 or 2, it requires that
25 variation of dynamics of properties to be recognized in

1 the design. And it specifically states that unless --
2 and I don't remember wording exactly, but this is to the
3 effect that a good amount of investigation has been
4 performed. To capture the variation and scattering of
5 the data, the applicant must change the shear margins by
6 a factor of 2 in their design, meaning that they have to
7 increase the shear modulus by a factor of 2.

8 Now, in this case in the calculation I have
9 reviewed, applicant has varied the sheer modulus by a
10 factor of one and a half.

11 Q. So pardon for interrupting, but so the
12 record is clear: what calculation are you talking about
13 specifically?

14 A. (Dr. Ostadan) I do not remember the
15 calculation number. For example, the Geomatrix
16 calculation for 1D shake analysis. I have not seen any
17 statistical analysis of the dynamic sort of properties
18 to justify the limited variation that was considered in
19 the design.

20 A. (Dr. Bartlett) May I add now?

21 Q. Sure.

22 A. (Dr. Bartlett) One other I think important
23 issue to us is in layer 2. We heard yesterday
24 discussion about cementation in this layer that's maybe
25 giving it some higher shear strength. Another possible

1 strain testing to see if at certain levels of strain,
2 does this either cementation or strength begin to
3 degrade any.

4 These are not inclusive of maybe all my
5 concern, but they're the best of what I can remember
6 right now.

7 Q. And I take it they're probably the most
8 important ones?

9 A. (Dr. Bartlett) That I recall right now,
10 yes.

11 Q. Not holding you to the list. I'm trying to
12 understand.

13 A. (Dr. Bartlett) Sure.

14 Q. Did you seek to look at what the NRC had
15 done in the SER with respect to these various areas of
16 concern to determine how the NRC had --

17 MS. CHANCELLOR: Could you clarify? Do you
18 mean the SER that came out this October or the earlier
19 SER?

20 MR. TRAVIESO-DIAZ: The document I have
21 before us as Exhibit 6.

22 A. (Dr. Bartlett) Yes. At least related to
23 some of these issues, stability of cask storage
24 foundation, storage pad foundation, stability against
25 bearing capacity failure under static loading, stability

1 mechanism again for higher shear strength may be just
2 simple changes in moisture content. We live in the arid
3 west, and depending on the seasons, these shallow layers
4 can be exposed to significant drying and significant
5 wetting depending on environmental changes.

6 It would be useful to see if there are
7 correlations going on between moisture content and
8 undrained shear strength. It would be another mechanism
9 that could cause these soils to be somewhat stiffer than
10 my previous experience, but yet could, due to now
11 unsaturated flow in the shallow surface, gain moisture
12 content. They probably will never be resaturated, but
13 gain moisture content and lose some of this apparent
14 stiffness or strength. We don't understand whether this
15 is occurring or not. The applicant has not investigated
16 this and is using a mechanism of cementation to explain
17 why these appear to be overconsolidated and stiffer in
18 the upper part of the profile.

19 Another useful thing would be -- is to look
20 at not only laboratory data, which has been the basis
21 for design, but also look at other types of correlations
22 to maybe resolve this issue.

23 Q. I'm sorry. I didn't mean to cut you off.

24 A. (Dr. Bartlett) Sure. And I think we've
25 already mentioned again maybe the use of cyclic triaxial

1 against excessive settlement under static loading,
2 stability against sliding under dynamic loading,
3 stability against bearing capacity failure under dynamic
4 loading, stability of the canister transfer building
5 foundation. I'm not sure I looked quite thoroughly at
6 the canister transfer building, because I -- conclusions
7 in the SER, I do recall going through the cask storage
8 pad foundation sections.

9 Q. Did the NRC raise any concerns in the areas
10 that both of you have listed or any of the -- in any of
11 the areas that the two of you have listed in the SER?

12 A. (Dr. Bartlett) No, and I was disappointed.

13 Q. Okay. Whether you were disappointed or not,
14 was it fair to say you disagree with the treatment that
15 the NRC gave to the various sections you just mentioned?

16 A. (Dr. Bartlett) I do. I'm not sure they
17 understand key issues.

18 MR. TRAVIESO-DIAZ: This might be a good
19 time to take a break.

20 (Recess from 3:04 to 3:16 p.m.)

21 Q. (By Mr. Travieso-Diaz) Okay, let's go back
22 to Exhibit 3 again.

23 A. (Dr. Bartlett) Contention L.

24 Q. (By Mr. Travieso-Diaz) Okay. Again, let's
25 take a look at now the paragraph that's numbered -- has

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1 the number "a" entitled "Subsurface investigations." You
2 have that?

3 A. (Dr. Bartlett) Yes.

4 Q. Let's take a look at the first sentence in
5 that paragraph that says that "The location plans for
6 completed subsurface investigations, cross-sections, and
7 profiles showing subsurface soil and rock layering at
8 the site contained in the license application is
9 deficient in that these data could not be compared with
10 the Applicant's boring logs." Do you see that?

11 A. (Dr. Bartlett) Sure.

12 Q. Is this paragraph accurate today in light of
13 the additional soils work the applicant has conducted?

14 A. (Dr. Bartlett) I'm struggling with in the
15 sentence it refers to "these data." I'm not sure
16 exactly what "these data" are referring to. Could be
17 possibly to the location plans or maybe referring to the
18 subsurface investigations, cross-sections, and profiles.
19 I know I'm responsible for this, but I did not author
20 it.

21 Q. That's why I was asking you earlier whether
22 you talked to Mr. White to determine what he meant in
23 the sentence.

24 A. (Dr. Bartlett) I would say the location
25 plans seem adequate. I haven't seen any problems with

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1 here.

2 A. (Dr. Bartlett) I think when it uses the
3 terminology "cross-section" and "profiles," comparing
4 back to the applicant's logs, there are issues regarding
5 whether one could determine the appropriate
6 cross-section, layering, stratigraphy, if you will, from
7 the boring logs. I would answer that at least in the
8 zone where the cone penetrometer was performed, that
9 layering, cross-sections, and profiles I assume is
10 somewhat related to a cross-section, and still
11 some two-dimensional view of the subsurface profile
12 is -- at least for determining the layering at the site
13 is sufficient.

14 Now, when we talk about the deeper profile,
15 deeper than where the cone penetrometer could go, you
16 probably still have difficulty determining the exact
17 layering. The borings were done and sampled at
18 approximately five-foot intervals, and we've already
19 mentioned that they go to approximately a hundred feet.
20 So there are deeper parts of the profile that remain
21 undefined, and specifically "rock" is not defined.

22 Q. Since the author of this paragraph is not
23 here, let's just try to look at some of the things that
24 are said, see if we can make sense out of them.

25 A. (Dr. Bartlett) Sure.

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1 the location plans showing borehole locations and
2 cross-sections and whatnot.

3 Q. This sentence appears to raise a question
4 whether you can correlate the location plans and the
5 actual boring logs. Do you see that?

6 A. (Dr. Bartlett) I'm going to read on to see
7 if I can get the sense of what's going on here.

8 A. (Dr. Ostadan) Can I answer?

9 Q. Sure.

10 A. (Dr. Ostadan) I believe the statement that
11 is deficient, identifying rock layering at the site --

12 Q. Where are you reading from? The sentence
13 that says "Profiles showing subsurface soil and rock
14 layering at the site"?

15 A. (Dr. Ostadan) "-- and rock layering at the
16 site."

17 MS. CHANCELLOR: It's the second line.

18 Q. Yes.

19 A. (Dr. Ostadan) Right.

20 Q. And what inference did you draw from that?

21 A. (Dr. Ostadan) I think we just didn't know
22 where the rock is at the site.

23 Q. But this appears to say that you couldn't
24 correlate that with the applicant's boring logs. That's
25 what I'm trying to understand, what is being claimed

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1 Q. I'm going to mark these two documents
2 together for simplicity as a single exhibit, and that
3 will be Exhibit 51.

4 (Exhibit 51 marked.)

5 Q. (By Mr. Travieso-Diaz) Let me define what
6 I'm giving you for the record first. Just to make sure
7 everybody has the right document. I have marked as
8 Exhibit --

9 MS. CHANCELLOR: I've got two pages.

10 MR. TRAVIESO-DIAZ: I'm sorry. Let me
11 identify what I have, and then you tell me what you do
12 not have. Okay?

13 This document consists of three pages.
14 First page is Figure 2.6-2, entitled Plot Plan and
15 Locations of Geotechnical Investigations, Sheet 1 of 2,
16 Revision 0.

17 MS. CHANCELLOR: I've got that.

18 MR. TRAVIESO-DIAZ: Okay, let's see. The
19 second page is sheet 2 of the same drawing that I just
20 identified. The third page of the exhibit is a
21 different drawing. It's titled Figure 2.6-5, Foundation
22 Profile A-A Looking Northeast, and it's Revision 0.

23 Now, does everybody have that?

24 Q. (By Mr. Travieso-Diaz) Dr. Bartlett, will
25 you review these documents and confirm for me, if you

1 can, that what I have given you is the location plot
2 plan and the foundation profiles as they existed in the
3 SAR when it was initially filed?
4 A. (Dr. Bartlett) Well, it was a long time ago
5 since I saw the initial SAR, but it looks consistent
6 with what I remember from the original SAR.
7 Q. And in the original SAR, if this is in fact,
8 which I believe they are the documents --
9 A. (Dr. Bartlett) They have Rev. 0, so yes.
10 Q. And I take it that at the time there was
11 only one foundation profile for the site, and that will
12 be Figure 2.6-5?
13 A. (Dr. Bartlett) Correct. That's as I recall
14 it, yes.
15 Q. And there was only one location plan, which
16 is Figure 2.6-2, even though it was in two pages?
17 A. (Dr. Bartlett) I can't find the second page
18 of it. You're saying 2.6-2, one of two. I'm missing
19 sheet 2.
20 MS. CHANCELLOR: I have an extra sheet 2.
21 MR. TRAVIESO-DIAZ: Oh, that's what
22 happened. She got one more.
23 MS. CHANCELLOR: Here it is.
24 I'd just like to make a comment that
25 yesterday we introduced as Exhibit -- Exhibit 38, and I

1 Q. There were more than one?
2 A. (Dr. Bartlett) Yes, there were obviously
3 more than one, yes. On the order of ten to fifteen,
4 perhaps. I'd have to count them.
5 Q. All right. This is not a test?
6 A. (Dr. Bartlett) Fair enough.
7 MR. TRAVIESO-DIAZ: I want to mark for the
8 record what I will call Exhibit 52.
9 (Exhibit 52 marked.)
10 And again, I will describe for the record
11 what Exhibit 52 is. It is a two-page document --
12 actually it's not a two-page document. I stand
13 corrected. It's a three-page document comprised of the
14 following parts. The first -- the first page of the
15 document is Figure 2.6-2, Plot Plan and Locations of the
16 Geotechnical Investigations, Sheet 1 of 2. And this is
17 Revision 8.
18 The second page of the document is Figure
19 2.6-18 -- and by the way, all these references I'm
20 making are to the SAR -- and is entitled Location of
21 Geotechnical Investigations for Canister Transfer
22 Building.
23 And the third page -- and this is Revision
24 6. And the third page is titled Figure 2.6-19, and it
25 is titled Location of Cone Penetration and Dilatometer

1 believe it's the same version, SAR Figure 2.6 -- it's
2 revision 8. Beg your pardon.
3 MR. TRAVIESO-DIAZ: And also --
4 MS. CHANCELLOR: It's revision 8. I beg
5 your pardon.
6 MR. TRAVIESO-DIAZ: I don't believe Exhibit
7 38 has a second sheet. This is the complete document.
8 MS. CHANCELLOR: You're right.
9 Q. (By Mr. Travieso-Diaz) So I take it that
10 this was the document -- these were the two documents
11 that characterized or contained the plot plan and the
12 foundation profile at the time that the first sentence
13 of paragraph A was written?
14 A. (Dr. Bartlett) Yes, that would be correct.
15 Q. Do you know how many location plans are
16 there in the current version of the SAR?
17 A. (Dr. Bartlett) No. I haven't counted
18 those.
19 Q. How many foundation profiles?
20 A. (Dr. Bartlett) Foundation profiles, do you
21 mean cross-sections?
22 Q. Yes, you're right. Another was to Figure
23 2.6-5.
24 A. (Dr. Bartlett) We could count them. I
25 haven't counted them, but I do remember seeing them.

1 Tests. And again, that is Revision 8. Is that correct?
2 A. (Dr. Bartlett) Yes, I see it.
3 Q. Would you say that we now have in the
4 current version of the SAR three location plans against
5 the one that we have when the original SAR was filed?
6 A. (Dr. Bartlett) Yeah.
7 MR. TRAVIESO-DIAZ: All right. I am going
8 to mark for the record as Exhibit 53 a document that
9 actually consists of 14 pages together as a single
10 exhibit.
11 (Exhibit 53 marked.)
12 And Exhibit 53 I will identify for the
13 record as being Figure 2.6-5 of the SAR, entitled Pad
14 Emplacement Area, Foundation Profile A-A', Sheet 1 of
15 14, Revision 8. The second page is Pad Emplacement
16 Area, Foundation Profile B-B', Sheet 2 of 14. And I'm
17 not going to identify the rest of them, but there are 12
18 more sheets that are part of Figure 2.6-5 of the SAR,
19 and they're all marked Revision 8. Is that correct?
20 A. (Dr. Bartlett) Correct.
21 Q. And is it your understanding that Exhibit 53
22 represents what's available in the SAR now in terms of
23 foundation profiles?
24 A. (Dr. Bartlett) Yes, that's what I recall
25 when I read this.

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1 Q. And these are the foundation profiles just
2 for the pad emplacement area. Is that correct?
3 A. (Dr. Bartlett) Yes, appear to be. I see
4 the pads. I see them all labeled that way, so I have no
5 reason to believe otherwise.
6 MR. TRAVIESO-DIAZ: And I will mark as
7 Exhibit 54 --
8 (Exhibit 54 marked.)
9 MR. TRAVIESO-DIAZ: I will identify for the
10 record, Exhibit 54 consists of three drawings which are
11 entitled as follows. Again, they are from the SAR. The
12 first one is called Canister Transfer Building
13 Foundation Profile 1-1' Looking North. The second one
14 is entitled Figure 2.6-22, Canister Transfer Building
15 Foundation Profile 2-2' Looking North. And the third
16 one is 2.6-23, Canister Transfer Building Foundation
17 Profile 3-3' Looking East. And they are all marked
18 revision 6. Is that correct?
19 A. (Dr. Bartlett) Correct.
20 Q. And the documents that comprise Exhibit 54
21 are foundation profiles for the canister transfer
22 building?
23 A. (Dr. Bartlett) Correct.
24 Q. As opposed to the ones in Exhibit 53 which
25 were for the pad emplacement area?

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1 A. (Dr. Bartlett) That's correct.
2 Q. If you take the documents that comprise
3 Exhibit 53 and 54 together --
4 A. (Dr. Bartlett) Sure.
5 Q. -- and compare them to the document that was
6 previously marked as Exhibit 52 --
7 A. (Dr. Bartlett) Correct.
8 Q. -- sheet 1, the first page. Strike that
9 question, please.
10 Looking at -- try this again. You're
11 looking at Exhibit 51. The last page of Exhibit 51,
12 which, as we said earlier, was Foundation Profile A-A'
13 Looking Northeast.
14 A. (Dr. Bartlett) Okay.
15 Q. Will it be fair to say that whereas in the
16 original SAR there was only one foundation profile for
17 the pad emplacement area --
18 A. (Dr. Bartlett) Uh-huh.
19 Q. -- there are now a total of seventeen
20 foundation profiles for both the pad emplacement area
21 and the canister transfer building?
22 A. (Dr. Bartlett) Appears your numbers are
23 correct.
24 Q. All right. Now, looking at let's say the
25 first page of Exhibit 53.

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1 A. (Dr. Bartlett) Yes.
2 Q. Now, looking at that drawing -- pull it out
3 for a second. I see that -- first of all, let me see if
4 you can help me identify what this figure shows.
5 A. (Dr. Bartlett) Well, I'll read you the
6 title. We're on Exhibit 53, Figure 2.6-5, Sheet 1 of
7 14?
8 Q. Correct, yes.
9 A. (Dr. Bartlett) Pad emplacement Area
10 Foundation Profile A-A', the figure shows what we would
11 call a cross-section, which shows the -- at the surface
12 the approximate depths of the pads. It's on an
13 exaggerated scale, I can tell that. Then underneath
14 that we see the CPT data presented and a layering system
15 established for the CPT data. And in conjunction with
16 that, I imagine superimposed on this cross-section,
17 because they probably don't all fall on the same line,
18 some nearby borehole data. And that comprises it looks
19 like standard penetration testing, soil descriptions
20 according to the Unified Soil Classification System, and
21 some descriptions of these units based somewhat on the
22 Unified Soil Classification Systems.
23 I see that profile developed in the upper
24 30, 35 feet. Below that the cone penetrometer does not
25 go. I assume probably because it hit refusal, could not

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1 be pushed any deeper. And then the rest of the deeper
2 stratigraphy is relied upon now by the borehole data
3 itself. When I mean "the borehole data," I mean the SPT
4 data and also the unified soil classification systems.
5 Two of those boreholes terminate at approximately 70
6 feet. One goes down to approximately 100 feet, maybe
7 the other one slightly deeper, 100, 110 feet. These are
8 just guesses, at least looking at it quickly. And the
9 layering is not as well developed, with question marks
10 showing potential layering, but it's really not layered,
11 at least by this drawing.
12 And that's about all I see.
13 Do you want to add to that, Dr. Ostadan?
14 A. (Dr. Ostadan) No.
15 Q. Before I ask you the next question, just to
16 clarify, you used the word "refusal." Could you explain
17 for the record what the word "refusal" means?
18 A. (Dr. Bartlett) What refusal means is the
19 people that perform the cone penetrometer test, when you
20 get into very dense layers you have a chance of either
21 damaging their device or their rig. So usually at their
22 discretion they tell you whether they think they can
23 penetrate this layer or if they need to maybe stop. And
24 I'm assuming that the reason why this is terminating in
25 the fairly shallow profile is because the sediments

1 under that are denser, stiffer.
2 Q. How do you measure refusal? In terms of
3 what?
4 A. (Dr. Bartlett) Well, they can tell you what
5 the tip resistance as a refusal, but it's usually a
6 judgment call by the operator knowing his equipment and
7 his device when he runs a risk of seriously damaging his
8 equipment. So he defines refusal himself. We usually
9 don't. We do not like to damage their equipment,
10 because they charge us for it.
11 Q. Obviously that means that the soil at that
12 point is so hard that it's difficult to penetrate?
13 A. (Dr. Bartlett) It's much denser, yes. And
14 it can be sometimes a function of penetration. Even
15 though you get significantly deep, sometimes the layers
16 may not be quite as dense, but you've lost a lot of your
17 capacity to push just because of the depth and the side
18 friction along the cone. So it's not always an
19 indication of dense layers, but it generally is.
20 Especially for a shallow investigation like this, I can
21 tell. I know this rig has capabilities in softer
22 sediments of going deeper. So it obviously I think hit
23 refusal on this silty sand/sandy silt layer. And the
24 blow counts show that they're reasonably high, quite
25 high in that zone.

1 Q. I need to ask you a few more -- even though
2 you did a good job, I need to ask you a few more
3 qualifications for the person who looks at this drawing.
4 A. (Dr. Bartlett) Okay.
5 Q. First look at the legend on the right side,
6 on the top right-hand side of the drawing. You see next
7 to something that bears a square with a number 10 an
8 arrow that says SPT N value?
9 A. (Dr. Bartlett) Yes, I do.
10 Q. Could you explain what that means?
11 A. (Dr. Bartlett) That is what we call the N
12 value or blow count value from the standard penetration
13 test.
14 Q. What does it measure?
15 A. (Dr. Bartlett) It measures the number of
16 blows to drive the split spoon sampler up one foot.
17 Q. And I take it that there is more or less
18 direct correlation between the N value and the hardness
19 of the soil. Is that correct?
20 A. (Dr. Bartlett) Not sure I'd say hardness,
21 but yes, density.
22 Q. Density. For example, a soil with an N of
23 10 would be less dense than a soil with an N of 135?
24 Just looking at the legend.
25 A. (Dr. Bartlett) Yes. For the same depth and

1 same type of material, yes.
2 Q. Now, please tell me, as long as we're
3 looking at that particular portion with the legend, I
4 see that that legend correlates a number of black
5 squares and a line with those N numbers.
6 A. (Dr. Bartlett) Correct. That just shows
7 the intervals where the sample was -- the test was
8 performed. And usually we would retrieve the sample and
9 bring it to the surface, too, so that -- of where the
10 sample was retrieved.
11 Q. Looking again for purposes of whoever reads
12 this, at the first of the lines in -- starting from the
13 left of the drawing, sitting underneath a caption, of
14 which I will ask you in a minute, is a CPT-36?
15 A. (Dr. Bartlett) Yes, I see that.
16 Q. You see that line that goes down from what
17 appears to be like 4460, and goes all the way down to
18 like a little bit beyond 4460?
19 A. (Dr. Bartlett) That indicates the depth of
20 the borehole.
21 Q. And now you have a series of numbers next to
22 black squares, like a number 23 and then a number 13.
23 A. (Dr. Bartlett) Those are the SPT N values.
24 Q. Would that tell you or the reader that in
25 that borehole they took a measurement, if you will, if I

1 can use that term, a little bit below 4460 and it took
2 23 blows, if you will, to advance the required distance?
3 A. (Dr. Bartlett) That is correct.
4 Q. And then they went down, it looks like maybe
5 five more feet?
6 A. (Dr. Bartlett) I believe these are
7 five-foot intervals, yes.
8 Q. And then they drew and it took 13?
9 A. (Dr. Bartlett) Correct.
10 Q. And all the way down to the last one, which
11 was like a hundred, and then has a slash and then has 6
12 inches. By the way, greater than hundred, what does
13 that mean?
14 A. (Dr. Bartlett) That means they counted a
15 number of blows to drive it six inches. It was greater
16 than a hundred, so they gave up.
17 Q. All right. So it took --
18 A. (Dr. Bartlett) That means it's very dense.
19 For all practical purposes, you're beating your brains
20 out trying to drive the sampler deeper, and there's no
21 need to.
22 Q. Is that greater than a hundred in any way
23 related to the refusal point that you mentioned before?
24 A. (Dr. Bartlett) Excuse me. The unit weight?
25 Q. No, the number greater than 100, the N

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1 number greater than 100.

2 A. (Dr. Bartlett) It means there was at least
3 100 blow counts in that six inches.

4 Q. Is that in any way related to the refusal
5 point that you mentioned before?

6 A. (Dr. Bartlett) Well, you can get refusal in
7 the SPT tube, but it's a different criteria that we
8 would use for the CPT.

9 Q. Let me ask you this. Could you by looking
10 at this first figure -- by the way, from what hole was
11 this drawn? Can you tell? Is there a label there that
12 tells you which it is?

13 A. (Dr. Bartlett) Because this is borehole
14 data, it would be done for A-1.

15 Q. All right. Would you expect that if you
16 look at the borehole log for Borehole A-1 that you have
17 essentially the same information as you see here in this
18 line?

19 A. (Dr. Bartlett) Correct, but more.

20 Q. Of course, yes. So do you believe that to
21 the extent that this first paragraph here on page 83a is
22 talking about the inability to correlate boring logs and
23 profiles, that that's no longer a problem, that you can
24 do it by looking at this figure?

25 A. (Dr. Bartlett) Yes, I sense some initial

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1 fairly close. We could refer to where the
2 cross-section's taken. Let's see. It's A-A', so we're
3 now referring to Exhibit 52, Figure 2.6-2. And we see
4 marked on that A-A', so that appears to follow pretty
5 much diagonally across the pad area, meaning diagonally
6 from northwest to southeast, following the line of the
7 borehole data.

8 Q. Now --

9 A. (Dr. Bartlett) And then the CPT data, I
10 guess we could see how close it falls onto that
11 cross-section line if we chose.

12 Q. All right. Staying with this for a second
13 just for clarification. You're saying that if we take a
14 look at Exhibit 52, which is Figure 2.6-2, the current
15 version for Revision 8, and I look on that drawing at
16 where it is marked A-1, that point, which I take it
17 represents a borehole?

18 A. (Dr. Bartlett) Yes.

19 Q. That point is the same point as or
20 correlates to the point marked A-1 on Figure 53?

21 A. (Dr. Bartlett) Yes, reasonably closely to
22 the scale of the drawings we're looking at.

23 Q. I understand. But if I was looking at these
24 two sets of drawings and I wanted to correlate where
25 Borehole A-1 was in my location plan vis-a-vis the

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1 frustration that the reviewer had in trying to look at
2 the plans, the cross-sections, and correlate them back
3 to the borehole data.

4 Q. All right. But to the extent that that
5 frustration may have been legitimate in 1997, is that a
6 frustration today?

7 A. (Dr. Bartlett) I haven't experienced that,
8 no.

9 Q. Okay. Let's finish trying to describe what
10 this drawing is, because we'll be talking about it
11 later. Now, you said that A-1, for the first one,
12 characterizes or describes which particular borehole
13 you're talking about.

14 A. (Dr. Bartlett) Correct.

15 Q. And then I see a little further down the
16 page another vertical line that has B-2. Would that
17 mean that that was for Borehole B-2?

18 A. (Dr. Bartlett) Yes, it would be for B-2.

19 Q. And then the next one I guess is C-3?

20 A. (Dr. Bartlett) C-3, yes.

21 Q. And the other one is D-4?

22 A. (Dr. Bartlett) Correct.

23 Q. Now, what does CPT-36 next to A-1 mean? If
24 you know.

25 A. (Dr. Bartlett) Spatially they must be

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1 foundation profile, I just have to look at these two
2 drawings and they will match that way?

3 A. (Dr. Bartlett) Yes. One could easily
4 determine for practical purposes where the boring falls
5 on the plan view shown in Figure 2.6-2.

6 Q. So you wouldn't have any difficulty
7 correlating these two sets of drawings, and by that I
8 mean, what's now Exhibit 52, page 1 and Exhibit 53, page
9 1, in terms of location?

10 A. (Dr. Bartlett) In terms of location.

11 Q. Okay. Now, can you do the same thing --
12 well, strike that. Finish first trying to describe what
13 is here.

14 There is a continuous line, broken line,
15 that starts a little above 4460 on the left and runs all
16 the way to almost 4480 on the right.

17 A. (Dr. Bartlett) I see it.

18 Q. What does the line represent? Do you know?

19 A. (Dr. Bartlett) That represents an inferred
20 layer. Usually when they're being inferred, we dash
21 them. If we're fairly confident about them, they would
22 be solid lines. At least that's standard practice.

23 Q. But I'm talking about the solid line at the
24 very top.

25 A. (Dr. Bartlett) I went above you, sorry.

1 I'm one line down.
2 The solid line on top, the solid, thin line,
3 represents ground surface.
4 Q. So that would be the undisturbed ground
5 surface?
6 A. (Dr. Bartlett) Correct, at the time of the
7 survey when these were prepared.
8 Q. And again, if you wanted to know what the
9 surface looked like in terms of the topography, I don't
10 know if that's the correct word, at the time that this
11 survey was taken, you just need to look at this?
12 A. (Dr. Bartlett) Correct, to the nearest
13 foot.
14 Q. All right. Now, again for purposes of
15 understanding what's in this drawing, there is a set of
16 dashed lines -- by the way, are you -- I don't know if
17 this drawing allows us to make a determination, but
18 would that be the actual grade at the time this drawing
19 was made, or the anticipated grade of this area once
20 construction is finished? If you know.
21 A. (Dr. Bartlett) That I might have to check
22 into. I was assuming it was the grade at the time the
23 drawing was prepared. It may represent the finished
24 grade.
25 Q. Now, there is a series of what appear to be

1 Eolian silt.
2 Q. And the name below?
3 A. (Dr. Bartlett) Is a silty clay/clayey silt.
4 Q. And those names appear to be reproduced
5 throughout each horizontal band, like, for example --
6 A. (Dr. Bartlett) Downward?
7 Q. No, no. From left to right.
8 A. (Dr. Bartlett) Oh, yes. They're
9 periodically reproduced. I imagine that's just for
10 reader's ease. Though once in a while there may be
11 lateral changes and we might see a change in those
12 names.
13 Q. But in this drawing it appears --
14 A. (Dr. Bartlett) I don't see any of those in
15 this type of drawing except when we get deeper.
16 Q. All right. And so that we can clarify what
17 we have been talking about before and may be talking
18 about later, I see one, two, three, four, five -- six
19 continuous -- and by that I mean continuous going from
20 left to right -- dashed lines, and then two lines that
21 start a short distance and then they end.
22 A. (Dr. Bartlett) Correct.
23 Q. If you can explain what these various lines
24 are, what they mean. Could you do it?
25 A. (Dr. Bartlett) The ones that start and then

1 rectangles throughout the start of the surface and go
2 down a few feet?
3 A. (Dr. Bartlett) Correct.
4 Q. What would those rectangles represent?
5 A. (Dr. Bartlett) Those are projections of the
6 pads into the cross-section.
7 Q. Why is it that some of them look bigger than
8 the others?
9 A. (Dr. Bartlett) Because we're cutting at
10 different angles across these.
11 Q. Oh, I see. Okay. Now to the question that
12 I believe you were referring to. There is a dashed line
13 that is sort of parallel to the surface, but it's, what,
14 appears to be like five foot underground.
15 A. (Dr. Bartlett) I see it. Yes, I see it.
16 Q. What does that line represent?
17 A. (Dr. Bartlett) That represents an inferred
18 layer boundary.
19 Q. And it's a boundary between what and what?
20 A. (Dr. Bartlett) Changes in material type.
21 Q. And is there something that identifies
22 what -- do those layers have names?
23 A. (Dr. Bartlett) Yes, sir, their names.
24 Q. Okay. What are their names?
25 A. (Dr. Bartlett) The name above the line is

1 terminate with question marks?
2 Q. We'll get to those. The other ones, would
3 you -- your understanding be that the ones that do go
4 from end to end are intended to represent what you
5 call -- what do you call them? Inferred?
6 A. (Dr. Bartlett) Inferred layer boundaries,
7 yes.
8 Q. All right. So this drawing would --
9 A. (Dr. Bartlett) -- infer that those are
10 continuous across this cross-section.
11 Q. And it has essentially seven such layers?
12 A. (Dr. Bartlett) One, two, three, four --
13 five that I count that are continuous.
14 Q. Oh. You mean the one that starts -- there's
15 one that starts off --
16 A. (Dr. Bartlett) I'm counting layers, not
17 lines now.
18 Q. Oh, Okay. All right. So you believe
19 five --
20 A. (Dr. Bartlett) Five layers.
21 Q. And those would be --
22 A. (Dr. Bartlett) Eolian silt; underneath it
23 the silty clay/clayey silt; underneath it the clayey
24 silt/silt; underneath it the clayey silt/silty clay; and
25 underneath that, the silty sand/sandy silt.

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1 That was a lot of soil description in a very
2 quick manner.

3 Q. Okay. Now, if I recall, we were talking --
4 first of all, would you identify which of these layers
5 that you mentioned about fall within the first 30 feet
6 of subsoil?

7 A. (Dr. Bartlett) Let's see -- 30, 35 feet.
8 There would be all of those five that I just mentioned.

9 Q. I thought that earlier we talked about there
10 being four layers characterized for this site, and you
11 mention now there are five.

12 A. (Dr. Bartlett) I think we've added that
13 silty sand/sandy silt at the bottom. Our discussions
14 yesterday only went down to the depth of this clayey
15 silt/silty clay. So -- but with the cone data there are
16 really five I think we need to discuss. We may not have
17 discussed them all yesterday.

18 Q. But to correlate the conversations on both
19 days --

20 A. (Dr. Bartlett) Right.

21 Q. -- what we're talking about here in this
22 exhibit was a depiction of the four layers that were
23 discussed yesterday --

24 A. (Dr. Bartlett) Correct.

25 Q. -- and an additional layer called silty

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1 record complete, what does it mean when that line
2 branches out horizontally at the level between 4430 and
3 4440? Do you see what I'm talking about?

4 A. (Dr. Bartlett) That is when the cone
5 penetrometer has reached its maximum or its resistance,
6 what we called refusal earlier.

7 Q. This is where if you went farther you might
8 break equipment?

9 A. (Dr. Bartlett) Yes.

10 Q. And you quit because when you get to the
11 horizontal line you are risking not being able to get --

12 A. (Dr. Bartlett) Continuing getting data and
13 other issues.

14 MR. TRUDEAU: Big bills.

15 Q. And I take it, then, that that layer of
16 which you have that particular phenomenon, the soil is
17 very dense?

18 A. (Dr. Bartlett) It's very dense.

19 Q. All right. Now, one more thing. I'm sorry.
20 Just looking at the legend on the right.

21 A. (Dr. Bartlett) Correct.

22 Q. That wiggly line on the right, does that
23 correspond to the wiggly lines on the left that we just
24 talked about?

25 A. (Dr. Bartlett) The only ones that I see on

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1 sand/sandy silt?

2 A. (Dr. Bartlett) Correct. That underlays
3 layer 4.

4 Q. One more thing, I think, and then we can
5 move on, which is, I see a wiggly line, if I can use the
6 term, that starts on, say, for example, in Boring A-1,
7 that starts at the first point of 23.

8 A. (Dr. Bartlett) Yes, I see.

9 Q. And goes down to almost 4430 and then
10 branches out horizontally.

11 A. (Dr. Bartlett) Right.

12 Q. What does that line represent?

13 A. (Dr. Bartlett) That is the tip resistance
14 from the cone penetrometer.

15 Q. All right. So that would be -- and for what
16 cone penetrometer location would that be?

17 A. (Dr. Bartlett) It is labeled CPT-36, and
18 then underneath it it says 82 SW.

19 Q. And what would be whatever that location for
20 that cone penetrometer is, would represent, and that
21 wiggly line represents the readings that you obtained
22 for that location?

23 A. (Dr. Bartlett) Correct, inferred onto this
24 cross-section.

25 Q. Just, again, out of interest in having the

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1 the left on the cross-section are to me the tip
2 resistance, which is labeled QT. The other lines there,
3 UD would refer to the pore pressure measurements, and FS
4 would be the sleeve measurements, and I don't see those
5 data projected on this -- excuse me. I need to look
6 more closely. Sorry.

7 Q. May I invite you to look at B-2?

8 A. (Dr. Bartlett) Yes, I see them now. The
9 scale -- I just missed them because their -- their scale
10 compared to the tip resistance is much different. I see
11 them. They're not of much use, but I see them.

12 Q. But in any event, that -- so the three sets
13 of lines that you get across each of these cone
14 penetration test holes represent the three parameters,
15 if you will, in the case that you have three, that are
16 obtained through the use of the cone penetrometer?

17 A. (Dr. Bartlett) The three basic parameters,
18 yes, right. For a piezo cone, p-i-e-z-o.

19 Q. Piezometer?

20 A. (Dr. Bartlett) Yes.

21 Q. Only so the record is complete, is it true
22 that the other 13 drawings that you have that comprise
23 this set have analogous information?

24 A. (Dr. Bartlett) They are, but they're
25 colored.

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1 Q. They're colored. You have to ask --
2 MR. TRUDEAU: Bigger scale.
3 A. (Dr. Bartlett) And bigger scale, yes.
4 Q. You have to ask the applicant why they chose
5 to have the one of them in black and white and the other
6 one's in color.
7 A. (Dr. Bartlett) Obviously you had a big
8 budget and you could afford color.
9 Q. As long as we're talking about color and we
10 have some of these which are in color, what do you
11 understand the colors to mean?
12 A. (Dr. Bartlett) They infer soil behavior
13 types.
14 Q. All right. Bear with me one second.
15 Okay. If you will take a look now to Figure
16 2.6-19, which is the third page of Exhibit 52, the one
17 that is entitled Locations of Cone Penetration and
18 Dilatometer Tests.
19 A. (Dr. Bartlett) Correct.
20 Q. If you take -- and let's do this just for
21 one. If you try to compare the figure in 2.6-19 against
22 the Figure 2.6-5, sheet 1, that we just looked at --
23 A. (Dr. Bartlett) Correct, the cross-section.
24 Q. Yes. And if I tried to locate the cone test
25 location CPT-36 that is listed on Figure 2.6-5 --

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1 Look at the second sentence in that paragraph --
2 A. (Dr. Bartlett) Yes.
3 Q. -- that says, "Structure specific cross
4 sections and profiles were not prepared utilizing the
5 boring logs."
6 A. (Dr. Bartlett) That is correct.
7 Q. Is that correct still today?
8 A. (Dr. Bartlett) That is.
9 Q. And do you consider that to be a deficiency
10 in any way?
11 A. (Dr. Bartlett) The use here of "structure"
12 implies to me now -- I'm speaking from my geological
13 background, not my geotechnical background -- a
14 structural cross-section where all elevations have to be
15 preserved to show a potential offset or displacement
16 within a section or to give the true geometries of
17 those. These are not structural specific cross-sections
18 according to that definition.
19 Q. What are you missing by not having this
20 information?
21 A. (Dr. Bartlett) The projection -- it's been
22 a number of years since I prepared a structural specific
23 cross-section, and probably since Barry Solomon's here,
24 he can maybe give you -- oh, excuse me.
25 Structure specific cross-sections now show

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1 A. (Dr. Bartlett) Correct.
2 Q. I could go perhaps to Figure 2.6-19 and look
3 at the top left corner of the drawing where it says
4 SEIS, CPT-36, DMT-16?
5 A. (Dr. Bartlett) Correct.
6 Q. So I could again correlate the locations
7 between the cone penetrometer tests and the foundation
8 profiles just by comparing the two drawings?
9 A. (Dr. Bartlett) Yes.
10 Q. Now, these drawings that we have been
11 looking at, and by that I mean Exhibit 52, 53, and 54,
12 refer to either the pad emplacement area or the canister
13 transfer building; is that correct?
14 A. (Dr. Bartlett) Correct.
15 Q. Is it correct to say that both the pad
16 emplacement area and the canister transfer building are
17 classified as safety-related structures?
18 A. (Dr. Bartlett) Yes.
19 Q. Are there any other safety-related
20 structures at the PFS site that you know of?
21 A. (Dr. Bartlett) Not that I'm aware of.
22 Q. All right. Let's move on back to Exhibit 3.
23 A. (Dr. Bartlett) Exhibit 3, SAR -- I mean,
24 the Contention L.
25 Q. Contention L, the one you didn't write.

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1 the -- any geological structure and the true elevations
2 and layers of these with very minimal to no projections
3 onto a cross-sectional line.
4 Q. All right. Apart from --
5 A. (Dr. Bartlett) So we're trying to now
6 understand not only the layering system but the
7 elevations and how they relate from one set of data to
8 another. And these are not in geological terms
9 structural cross-sections, these are geotechnical
10 cross-sections.
11 Q. Do you know if any, as you called them I
12 believe structural cross-sections, were prepared outside
13 these drawings?
14 A. (Dr. Bartlett) There may have been. I
15 guess the best place to look would be the Geomatrix
16 report.
17 Q. Why don't we do that.
18 MR. TRAVIESO-DIAZ: Let's mark these as
19 Exhibit what, 55.
20 (Exhibit 55 marked.)
21 I will identify for the record this Exhibit
22 55 consists of two drawings. The first one is entitled
23 Map of North Wall Trench T-2, Private Fuel Storage
24 Facility, Skull Valley, Utah, plate -- Geomatrix Plate
25 3. And the second one is Cross-Section D-D' Showing

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1 Stratigraphy Inferred From Borehole Data Across Site,
2 Geomatrix Plate No. 4.
3 And I will further identify for the record
4 that one of these, which I believe is Plate 4, was
5 previously marked as part of Exhibit 17, which I have
6 here if anybody wants to refer to it. I didn't make
7 copies of Exhibit 17 because the plates are in color and
8 they are extremely hard and expensive to reproduce.
9 A. (Dr. Bartlett) Okay, budget wasn't big
10 enough. We understand. We think in gray, various
11 shades of gray.
12 Q. (By Mr. Travieso-Diaz) Exactly. What I'm
13 saying is, it is not a true complete reproduction
14 because it's not in color.
15 A. (Dr. Bartlett) Correct, but color may not
16 be -- if we get any confusion about what is --
17 MS. CHANCELLOR: I've got an additional
18 copy, too, of 17.
19 A. (Dr. Bartlett) Fair enough.
20 Q. (By Mr. Travieso-Diaz) Let's hope we don't
21 have to go to that. But in any event, if you take a
22 look at the two drawings that together have been marked
23 as Exhibit 55, would you characterize this as being
24 structural profiles of the type that you testified about
25 a minute ago?

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1 A. (Dr. Bartlett) I have not extensively
2 reviewed this document. This is a trench wall log, but
3 I think the Contention was referring more to development
4 of structural cross-sectional maps from the borehole
5 data. So I'm a little confused why you're asking that
6 question for trenching.
7 Q. I don't know, because I don't understand the
8 contention. What I'm trying to figure out is, what do
9 you feel is missing, taking into account that you not
10 only have the foundation profile that we talked about
11 earlier, but that you have this additional information.
12 I'm just trying to understand what else ought to be
13 there that isn't.
14 A. (Dr. Bartlett) I think we've moved into the
15 realm of the geology and geological interpretation, and
16 so I'm reluctant to comment about the adequacy or
17 inadequacy of what I've been shown. But it is a trench
18 log and in its strictest sense is not a cross-sectional,
19 structural cross-sectional -- structural cross-section.
20 Q. All right.
21 A. (Dr. Bartlett) Though it has some aspects
22 similar to that, yes.
23 Q. Well, how about Plate 4, though? Is Plate 4
24 a structural cross-section? Does it have everything
25 that you said should be there?

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1 A. (Dr. Bartlett) Well, let's look. I see two
2 parts to that: C-15, C-14. Are those labeled what those
3 things mean? They appear to be labeled --
4 Q. Do you want to look at the colored one?
5 Maybe you can make out better what it's saying or
6 showing. Maybe I need to give you one more piece of
7 information.
8 A. (Dr. Bartlett) Fair enough. How about the
9 answer?
10 MR. TRAVIESO-DIAZ: Can we take a two-second
11 break? Because I think that's in the other room.
12 A. (Dr. Bartlett) Fair enough.
13 Q. (By Mr. Travieso-Diaz) see, if you take a
14 look -- we can say this on the record. It says,
15 location of boreholes, test pits, and plates shown on
16 Plate 1.
17 A. (Dr. Bartlett) Correct. So let's find
18 Plate 1.
19 Q. In fact, my trusted expert here has -- this
20 is part of Exhibit 17. I didn't copy it because I was
21 not smart enough to figure out we needed it. Would
22 looking at Plate 1 help you understand what the legends
23 on Plate 4 are?
24 A. (Dr. Bartlett) We're still trying to figure
25 out what these "C" labelings mean atop these lines.

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1 Yeah, those.
2 MR. TRUDEAU: Those are borings, Geomatrix
3 borings in their report.
4 A. (Dr. Bartlett) Okay, Geomatrix borings.
5 Okay, now we understand that those mean borings.
6 Q. Well, in fact, perhaps if you look at Table
7 1, you will have something here that will help you.
8 A. (Dr. Bartlett) Okay. There they are.
9 Sorry, we didn't see that. Okay, we see the C's on
10 there now.
11 Q. All right. So the record is capturing this
12 as it's going on, you were able to determine on Plate 4
13 that the legend there that had the series of figures
14 with C dash numbers --
15 A. (Dr. Bartlett) Right.
16 Q. -- corresponded to boreholes drilled by
17 Geomatrix?
18 A. (Dr. Bartlett) Correct.
19 Q. By the way, the Geomatrix trench that is
20 shown on Plate 3 and the boreholes that are shown on
21 Plate 4 and on Plate 1, those represent additional
22 location in which geotechnical data was taken?
23 A. (Dr. Bartlett) I'm not sure I would
24 characterize it as geotechnical data. Better
25 characterized as geological data.

Deposition of: Dr. Steven F. Bartlett & Dr. Farhang Ostadan
Taken: November 16, 2000

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1 Q. How about the trench? Let's look at the
2 trench on Plate 3.
3 A. (Dr. Bartlett) Sure, why not?
4 Q. Do you want to look at the color one? I
5 think that may be better.
6 A. (Dr. Bartlett) It might be.
7 Q. Plate 6. I have it here.
8 I'm going to get killed for doing this,
9 breaking up an exhibit I might not be able to
10 reconstruct here.
11 Okay, we'll go with the black and white.
12 A. (Dr. Bartlett) That's fine. I think we can
13 understand it.
14 Q. The question is, isn't it a fact that Plate
15 3 shows you -- gives you information on, first, what the
16 ground surface looks like or will look like before
17 excavation and after?
18 A. (Dr. Bartlett) I do see the surface line.
19 I'm not sure whether it was existing surface at the time
20 of the investigation. Probably that's what I would
21 assume it was.
22 Q. Now, going down from the surface line, there
23 is a number of different shades of gray, because this is
24 a black and white picture, profiles.
25 A. (Dr. Bartlett) I see that.

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1 Q. And you look at the legend down --
2 A. (Dr. Bartlett) Correct.
3 Q. Could you try to match, if you can, this
4 legend with -- that has, as I believe, it talks about
5 Eolian deposits --
6 A. (Dr. Bartlett) Correct.
7 Q. "Bonneville deep-water (blocky) facies"?
8 A. (Dr. Bartlett) Facies.
9 Q. Oh, facies, f-a-c-i-e-s.
10 A. (Dr. Bartlett) Correct.
11 Q. Would you say that this trench drawing shows
12 you, at least for the area covered by the trench, what
13 the different soil layers look like?
14 A. (Dr. Bartlett) Yes. It represents at least
15 the geological interpretation of those layers, their
16 thicknesses, and some minor features about their
17 internal structure.
18 Q. All right. And could you correlate -- I
19 guess we would not have a corresponding drawing, but
20 would this set of, if you will, layers that are
21 identified here, are they the same layers as are
22 identified on Exhibit 53?
23 A. (Dr. Bartlett) They have slightly different
24 names here. We could go through and check them if you
25 would like. What I'm saying is the legend here that's

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1 presented in geological terms, I see terminology that's
2 different than what I see on the engineering
3 cross-sections.
4 Q. Would that be perhaps because differing
5 groups of engineering disciplines may have different
6 names for the same?
7 A. (Dr. Bartlett) That's not unusual.
8 Q. All right. Okay. Now, looking at this
9 trench on Plate 4 --
10 A. (Dr. Bartlett) We have not talked to
11 geologists that classify according to a unified
12 classification system, and I don't think we ever will,
13 so...
14 That was facetious.
15 Q. And tell me again, because I'm not sure I
16 understand, what do you believe between Exhibits 51
17 through 54 and the materials that I show you on two 55
18 is missing in terms of information that would allow you
19 to characterize the subsurface of the PFS site?
20 Anything else that you think should be provided that is
21 not there?
22 A. (Dr. Bartlett) Well, my focus has been on
23 geotechnical data. So I'm not going to make any
24 inferences about adequacy of these cross-sections based
25 on geological terms. I do see the layering systems

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1 presented. I can infer their thicknesses from this and
2 somewhat about significant features that the geologists
3 mapped in their trenches, namely, fractures, in-field
4 fractures. Seems that they were most interested in
5 obtaining the strike and dip or the orientation of
6 those, and then they did a rose diagram to figure out if
7 there was any preferential orientation to this data.
8 That's what I see.
9 Q. Now, let's go back again just so we can move
10 to the bottom line. We were talking about the sentence
11 in Exhibit 3 that said, "Structure specific cross
12 sections and profiles were not prepared utilizing the
13 boring log records." And you said that that is a true
14 statement. And my question to you is, in light of all
15 the information that I just displayed before you, does
16 it matter? Or how does it matter? Is this a
17 significant concern?
18 A. (Dr. Bartlett) When this Contention was
19 written, structure specific cross-sections and profiles
20 were not prepared using the boring logs or from the
21 boring logs that were obtained during the first phase of
22 the investigation. This Geomatrix report postdates
23 that, postdates this statement; and whether
24 structure-specific cross-section profiles were not
25 prepared using the boring logs from the current data as

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1 it now exists, including the CPT and the borings done by
2 Geomatrix, the shallow borings we see, I'm going to
3 defer whether we've really met that or not, because
4 again, we're in the realm of geology and that's really
5 outside of my review.

6 Q. Okay. I'm trying to understand, to what
7 extent did you personally regard this statement here in
8 Contention L?

9 A. (Dr. Bartlett) I did not draft this
10 statement.

11 Q. I understand, but it's on the record now.
12 I'm trying to get your interpretation as to how
13 significant you considered this observation to be.

14 MS. CHANCELLOR: Objection. He already said
15 he's deferred to somebody else.

16 MR. TRAVIESO-DIAZ: I'm asking for his
17 opinion if he has one.

18 A. (Dr. Bartlett) I think that along the lines
19 of where the trenches were investigated, these seem to
20 be reasonable and consistent types of data and
21 presentation of them. Whether all borehole data
22 including the geotechnical and geological investigations
23 have been compiled and reconciled in site-specific
24 structural cross-sections, I don't see that all here,
25 but again, I haven't reviewed this report.

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1 Q. Well, assuming this statement is still true
2 today, does it concern you? Is it something that causes
3 you concern as to the state of the investigation of the
4 site performed by PFS?

5 A. (Dr. Bartlett) Probably not from a
6 geotechnical perspective, but geologists have other
7 reasons for wanting to know the orientation of these
8 layers, which could infer dips, faults and other things.
9 And so there -- these are not geotechnical
10 cross-sections, they are geological cross-sections. I'm
11 going to defer from trying to really say whether I --
12 what was the question? I'm not sure I'm answering it.

13 Q. Okay. I only want to know, since you are
14 the person who's explaining to us this contention,
15 whether you personally have a concern with this
16 particular observation made in this paragraph. That's
17 all I want to know.

18 A. (Dr. Bartlett) I personally don't have a
19 concern. Others may on the team.

20 Q. All right. And others will be who?

21 A. (Dr. Bartlett) Barry Solomon, that prepared
22 part of this document.

23 Q. All right. Let's move to the next sentence
24 on that page. It says, "Only a generalization of the
25 boring logs were used to establish the site geologic

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1 characterization." Do you believe that statement to be
2 correct today?

3 A. (Dr. Bartlett) I think what it means, a
4 generalization of the boring logs was used to establish
5 the site geological characterization. Again, since the
6 words "site geological characterization," I'm going to
7 defer.

8 Q. Do you know whether it was true at the time
9 it was written, was accurate at the time it was written?

10 MS. CHANCELLOR: Objection. You're asking
11 him to speculate about --

12 MR. TRAVIESO-DIAZ: If he doesn't know, he
13 can say easily, "I don't know."

14 A. (Dr. Bartlett) I don't know if it was true.
15 I don't know if --

16 Q. Do you know if it's true today?

17 A. (Dr. Bartlett) I do not know if it's true
18 today. Again, the answer I think would be in the
19 Geomatrix report to that question, and I have not
20 reviewed it.

21 Q. Would you believe that these two statements
22 would relate more as you're talking about the geology of
23 the site as opposed to --

24 A. (Dr. Bartlett) Geotechnical.

25 Q. -- geotechnical issues?

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1 A. (Dr. Bartlett) It seems to me that these
2 are more geological, not geotechnical issues, yes.

3 Q. Do you understand that the scope of Issue 3
4 to be addressing geotechnical issues?

5 A. (Dr. Bartlett) Could you repeat the
6 question?

7 MR. TRAVIESO-DIAZ: Could you read it back?
8 (The pending question was read.)

9 A. (Dr. Bartlett) Issue 3?

10 Q. Yes, what we have begun to look at,
11 discussion on page 83 of Exhibit 3.

12 A. (Dr. Bartlett) I don't see, at least in the
13 description of 3, geological or geotechnical used.

14 Q. All right.

15 A. (Dr. Bartlett) But in 3a, where they start
16 referring to the sections, the words "geological" are
17 used.

18 Q. All right.

19 A. (Dr. Bartlett) That's what I see.

20 Q. Let's go to -- I'm sorry. I didn't mean to
21 interrupt you. Let's go to the next sentence of this
22 paragraph that starts on the bottom of page 83, goes up
23 to the top of page 84.

24 A. (Dr. Bartlett) Fair enough.

25 Q. It says, "It is not possible to ascertain

1 whether or not all of the data collected, particularly
2 data on zones of soft/loose conditions encountered in
3 the explorations, have been used to characterize
4 subsurface conditions and to establish design values."

5 Let me stop there for a moment. Is that
6 statement that I just read you, this portion of the
7 sentence, true today?

8 A. (Dr. Bartlett) I have a hard time
9 interpreting whether the sentence is true without
10 completing the sentence.

11 Q. The reason I stopped is because I believe
12 that what follows, you already told us that was
13 resolved. The sentence that starts after the "and," or
14 the clause that starts after the "and." So that's why I
15 stopped. You can read the whole sentence if you will.

16 A. (Dr. Bartlett) Fair enough. If I could do
17 that. I forgot that part, so...

18 Q. I'm sorry. That's where I stopped.

19 A. (Dr. Bartlett) I do not agree with your
20 interpretation that everything that -- in the second
21 half of that sentence that we have agreed that we are
22 not concerned about.

23 Q. Okay. In what respect do you believe that
24 it is not possible to ascertain?

25 A. (Dr. Bartlett) My characterization this

1 A. (Dr. Bartlett) Yes, please. I'm having a
2 hard time with it.

3 Q. If I understood your last answer, you said
4 that to the extent that we're talking about the
5 characterization of subsurface conditions, you don't
6 have a problem that all data collected have been used to
7 do that. But you are restricting yourself to that, and
8 I presume that you meant that with respect to the use of
9 those data to establish design values, you may still
10 have a problem or a concern. Is that fair?

11 A. (Dr. Bartlett) What I am stating is that
12 thickness is a design value. We use it in calculations
13 of settlements and other things. And inasmuch as
14 thickness is a design value, the data that we have seem
15 to be sufficient to estimate the thickness of the
16 sediments, and I think I restricted that this morning in
17 the upper 30 to 35 feet where the cone penetrometer data
18 were collected. There are some uncertainties of
19 thicknesses of layers deeper in the profile.

20 Q. I think I understand now. Thank you very
21 much.

22 Let's go to -- would you like to take a
23 break now?

24 A. (Dr. Bartlett) Your call. Yeah, it might
25 be good for just a few minutes.

1 morning, as I recall it, and I underlined this in
2 pencil, so that's why I am going back to that, is that
3 we -- it talks about uncertainties with the estimation
4 of the thickness. And I agreed that I -- from these
5 cone penetrometer data that there's not a great
6 uncertainty in the estimation of thickness. But this
7 sentence also talks about "and to establish design
8 values." And so inasmuch as we're talking only about
9 estimation of thicknesses of design value, I do not see
10 any significant issues.

11 MR. TRAVIESO-DIAZ: Could you read the
12 answer back again? I don't think I followed it
13 entirely.

14 (The record was read.)

15 Q. (By Mr. Travieso-Diaz) Are you saying that
16 you still believe that it is not possible to ascertain
17 whether or not all data collected has been used to
18 establish design values? Is that the part you have a
19 problem with?

20 A. (Dr. Bartlett) I'm sorry.

21 MR. TRAVIESO-DIAZ: I'm sorry. I think I
22 got it right, but could you read it?

23 (The pending question was read.)

24 Q. (By Mr. Travieso-Diaz) Can I rephrase the
25 question?

1 (Recess from 4:31 to 4:42 p.m.)

2 Q. (By Mr. Travieso-Diaz) Before the break you
3 mentioned something, I don't recall the precise words,
4 to the effect that the boundary, the actual boundary
5 between the layers was of some significance or some
6 interest?

7 A. (Dr. Bartlett) The thickness.

8 Q. Of the layers?

9 A. (Dr. Bartlett) Of the layers is a design
10 value, because we have to use it in settlement
11 calculations. We're also inferring how continuous in
12 the vertical direction might be properties because those
13 layers. So it is a design value, at least in the upper
14 profile where the cone penetrometer's been taken. From
15 a geotechnical viewpoint, the estimation of thickness
16 throughout this pad emplacement area and the canister
17 transfer building do not seem to be significant issues,
18 but only with regard to the thickness.

19 Q. All right. Let me show you another exhibit
20 here.

21 (Exhibit 56 marked.)

22 I'm showing you what has been marked as
23 Exhibit 56.

24 A. (Dr. Bartlett) Correct.

25 Q. And I will identify it for the record as

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1 being Section 2.6.1.12.1 of the SAR, entitled "Stability
2 and Settlement Analyses--Cask Storage Pads." This
3 section -- this exhibit goes from pages 2.6-46 to 2.6-54
4 of the SAR. And for the moment I'm going to ask you to
5 look at page 2.6-49 and to the last paragraph on that
6 page. Do you see that paragraph?

7 A. (Dr. Bartlett) Beginning with "analyses"?

8 Q. Exactly, yes. You have that.

9 A. (Dr. Bartlett) Yes.

10 Q. As I read this paragraph, it appears to say
11 that in performing bearing capacity analysis, the
12 applicant assumed that the top 30 feet of subsurface
13 soil was uniform, and assigned to that layer the minimal
14 value of strength measured in the tests that were taken
15 on depths -- that were performed on samples obtained
16 from depths of approximately 10 to 12 feet. Do you see
17 that?

18 A. (Dr. Bartlett) Yes, the UU test. I see
19 that.

20 Q. Correct. Is it your understanding that in
21 fact based on this sentence and of what Mr. Trudeau
22 testified yesterday, that that is what the applicant
23 did?

24 A. (Dr. Bartlett) They used a minimum value of
25 the UU test with an undrained shear strength of 2.2 ksf.

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1 That's the best of my recollection. We can review the
2 calculation, but I don't think it's necessary.

3 Q. Assuming that in fact that is what they did,
4 would any concerns as to whether the boundary between
5 the various layers that are comprised in the upper 30
6 feet have any significance, at least insofar as this
7 calculation is concerned?

8 A. (Dr. Bartlett) I don't understand the
9 question.

10 Q. All right. This is what I understand
11 applicant did. They measured strength in the layer from
12 locations of depths of approximately 10 to 12 feet.

13 A. (Dr. Bartlett) Correct.

14 Q. And they selected the minimum value of
15 strength that was shown by those tests.

16 A. (Dr. Bartlett) Correct.

17 Q. It's reported here as 2.2 thousand pounds
18 per square feet.

19 A. (Dr. Bartlett) Correct.

20 Q. And they used that as the presumed strength
21 of the entire top 30 feet of subsoil. Is that what they
22 did?

23 A. (Dr. Bartlett) That's apparently what they
24 did.

25 Q. All right. And assuming that's what they

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1 did, would that choice of design parameters resolve or
2 address any concerns there might be with respect to what
3 the thickness or the location or the layers that are
4 comprised in the upper 30 feet would be?

5 Do you understand the question?

6 A. (Dr. Bartlett) No.

7 Q. Okay. Let me ask the question differently.
8 Assuming that they picked the lowest value of strength
9 that was available and what was perceived as being the
10 least strong layer --

11 A. (Dr. Bartlett) Okay.

12 Q. -- okay? And they used that as their design
13 value of strength in their analysis of bearing capacity.

14 A. (Dr. Bartlett) Okay.

15 Q. Assuming they did that.

16 A. (Dr. Bartlett) Uh-huh.

17 Q. Would that choice, that decision, resolve
18 any concerns there might be, at least with respect to
19 that calculation, as to what the relative locations or
20 the various layers comprised the 30 feet would be? Do
21 you care whether one layer is five feet or six feet or
22 seven feet if you're going to take the lowest value and
23 use it for all three?

24 A. (Dr. Bartlett) Let me interpret what I read
25 here.

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1 Q. Okay.

2 A. (Dr. Bartlett) That a sample was taken
3 approximately 10 to 12 feet, presumably in layer 2. We
4 must be careful when we look at that 10- to 12-foot
5 depth to make sure that that was layer 2. Because it's
6 my recollection layer 2 can sometimes end as shallow as
7 eight feet. So there's a little bit of uncertainty of
8 whether this exactly came from layer 2. So we first
9 need to ascertain that.

10 Then it's the minimum value coming from a
11 set of UU tests where the state has always contended
12 that the quantity and number of triaxial testing done in
13 this area has been insufficient for a design facility of
14 this size. I cannot tell whether it is the minimum
15 value in layer 2. I have insufficient data to determine
16 whether it's the minimum, maximum, mean, or if it even
17 is actually from layer 2.

18 Q. All right. So -- and this becomes a
19 hypothetical question because you don't have the answers
20 to all these items that you said. But assuming
21 hypothetically that the lowest value that was in fact
22 measured in this upper 30 feet corresponded to the
23 measurements of 10 to 12 feet and was this value 2.2,
24 with those assumptions, assuming the things that you
25 don't have to assume because you don't know --

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1 MS. CHANCELLOR: I'm going to object. This
2 is going to call for lots of speculation.

3 MR. TRAVIESO-DIAZ: Well, I would ask him --
4 I would like him to answer if he can.

5 Q. (By Mr. Travieso-Diaz) Assuming -- with
6 those assumptions, would that design choice obviate the
7 concern that you may have defined your layers not
8 completely accurate?

9 A. (Dr. Bartlett) No. Because we discussed
10 yesterday that even if we assume that the 2.2 ksf
11 represents the minimum value for this layer and that we
12 assume that the minimum is of layer 2, we talked about
13 yesterday that there are still free field ground motions
14 that have to be resisted by this particular structure
15 and that some of this 2.2 ksf capacity will not be
16 available, the full capacity will not be able to resist
17 the motions of the structure. And we still have issues
18 with this value even at 2.2 ksf.

19 Q. All right. Okay.

20 A. (Dr. Bartlett) Do you want to add to that,
21 Dr. Ostadan?

22 A. (Dr. Ostadan) Yes. I think -- just a
23 reminder, you discussed anisotropy and some cone
24 penetrometer testing, and whether the shear strength
25 under extension would be different or not.

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1 A. (Dr. Bartlett) Yes, I remember now. Also
2 an additional issue is the types of testing done were
3 triaxial compression, and we've talked this morning and
4 somewhat yesterday in our line of questioning about the
5 need to consider anisotropy and that this 2.2 ksf may
6 not represent the average shear strength mobilized along
7 the failure plane.

8 Q. All right. Let's move to the first full
9 paragraph -- first sentence in the first full paragraph
10 of page 84 of Exhibit 3.

11 A. (Dr. Bartlett) Excuse me. Did we finish
12 our discussion of the last sentence on 83? I don't
13 recall.

14 Q. I believe so, because you talked about the
15 first half of the sentence, and you have told me earlier
16 in the day that the second half, having estimated the
17 thickness, was no longer a concern.

18 A. (Dr. Bartlett) Yes. And restricted it to
19 thickness, yes.

20 Q. So that's why I believe we have finished
21 that section. So let's just move to the next one that
22 says that -- I'm going to paraphrase it slightly -- that
23 the SAR section 2.6 defining geologic features is not
24 acceptable because the discussions, maps, profiles of
25 the site stratigraphy, structural geology, geologic

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1 history, and engineering geology are not complete and
2 are not supported by investigations sufficiently
3 detailed to obtain an unambiguous representation of the
4 site geology.

5 Now, do you believe that sentence that I
6 read you to be correct today?

7 A. (Dr. Bartlett) That's beyond my expertise
8 and scope of review.

9 Q. Based on your expertise, is there any
10 portion of that sentence that you believe to be correct
11 today?

12 MS. CHANCELLOR: Objection. He already
13 testified it's beyond his scope.

14 Q. From where you sit as the designated expert
15 on this Issue 3, would that, the matters raised in that
16 sentence, if true, be of certain to you?

17 A. (Dr. Bartlett) If they were true, they
18 would be a concern to me.

19 Q. How would they be a concern to you?

20 A. (Dr. Bartlett) One must understand the
21 geology of a site in performing the interpretation of
22 what has occurred and the geological processes that have
23 acted upon this site.

24 Q. All right. And you don't know in fact
25 whether this assertion is still true. Is that correct?

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1 A. (Dr. Bartlett) Right.

2 Q. All right. Now, the next sentence says,
3 "The maps do not provide the requisite detail to
4 evaluate the assumed geologic conditions stated in the
5 text." First of all, can you help me, tell me what maps
6 are being described here?

7 A. (Dr. Bartlett) Well, again, with using the
8 adjective "geologic," I assume it would be referring to
9 geologic maps.

10 Q. What would be -- what would geologic maps
11 be?

12 A. (Dr. Bartlett) Mapping of the surficial
13 geologic units.

14 Q. And do you know the extent to which those
15 maps have been prepared since SAR -- since this
16 contention was written?

17 A. (Dr. Bartlett) I have not reviewed those
18 maps.

19 Q. All right. So you have no knowledge as to
20 this particular sentence?

21 A. (Dr. Bartlett) That's correct.

22 Q. Assuming this sentence was correct, would it
23 present a concern to you?

24 A. (Dr. Bartlett) Geologic maps can be used to
25 interpret features, for example, faults or surficial

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1 geological features that could have implications and
2 interest to the past history and potential future
3 history of this site.

4 Q. Now, I'm going to ask you to read the next
5 two sentences together, because I believe that -- and
6 correct me, but I believe you need to read them
7 together. The first sentence says, "The maps do not
8 provide the requisite detail to evaluate the assumed
9 geological conditions stated in the text." And then the
10 next sentence says, "For example, only 25 borings were
11 taken across the site, and from this a single
12 generalized geologic profile in an obtuse angle across
13 the canister fuel storage facility is presented." And
14 the citation is given to SAR Figure 2.6-5.

15 A. (Dr. Bartlett) Correct.

16 Q. You see that?

17 A. (Dr. Bartlett) Yes, I do.

18 Q. Here's my problem.

19 A. (Dr. Bartlett) I see your problem.

20 Q. SAR Figure 2.6-5 I do not believe is a
21 geologic map, is it?

22 A. (Dr. Bartlett) It's probably a profile, I
23 would assume.

24 Q. In fact, let's just not assume. Let's take
25 a look at -- never assume when you can prove. Let's

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1 take a look at Exhibit 51, and let's take a look at
2 Figure 2.6-5, which is the third figure on the page.

3 A. (Dr. Bartlett) I see it.

4 Q. Okay. Does that look like a geologic map to
5 you?

6 A. (Dr. Bartlett) No, that's a geotechnical
7 cross-section.

8 Q. Right. And in fact, if now we look at the
9 same Figure 2.6-5 as it sits today, it's 17 maps; is
10 that correct? Or 14 and three maps.

11 A. (Dr. Bartlett) What I sense is happening
12 here in this is that the geologist reviewed the original
13 SAR and did not find the data that they needed to make
14 their geological interpretations off of what is truly a
15 geotechnical profile.

16 Q. All right. But what my concern is, are we
17 talking here about a geological concern or a
18 geotechnical concern? To the extent that he's talking
19 about SAR Figure 2.6-5, that would indicate to me that
20 he's talking about geotechnical, not a geological
21 concern.

22 A. (Dr. Bartlett) And again, it may have been
23 the only profile presented in the original SAR, and so
24 it was perceived as both a geotechnical and a geological
25 cross-section because it did show some type of layering.

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1 Q. All right. When it says here that "a single
2 generalized geologic profile in an obtuse angle across
3 the canister fuel storage facility is presented," can
4 you go back again -- I'm sorry to keep going back to it,
5 but let's go back again to that Figure 2.6-5.

6 A. (Dr. Bartlett) Sure.

7 Q. It's defined as Foundation Profile A-A'
8 Looking Northeast, and if you will correlate for me
9 perhaps with Figure 2.6-2 from the same exhibit.

10 A. (Dr. Bartlett) I see it, okay. The
11 cross-sectional line, I see it.

12 Q. All right. Is the line A-A' on 2.6-2 at an
13 obtuse angle? Is that what he's talking about?

14 A. (Dr. Bartlett) I believe so. On an angle
15 that's not perpendicular or parallel to the main -- to
16 the building.

17 Q. Assuming that that's what he's talking
18 about, that he's concerned there's only one of these
19 lines, isn't it true that you now have, just for the pad
20 emplacement area, 14, and there are two diagonal cuts
21 and like half of those go east/west and half of those go
22 north/south?

23 A. (Dr. Bartlett) Correct. Those are
24 geotechnical cross-sections.

25 Q. Well, what I'm trying to understand, and

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1 maybe you can help me, whether this concern now is still
2 viable in light of all the additional information that
3 we have.

4 A. (Dr. Bartlett) This, by using the term
5 "generalized geological profile," to a geotechnical
6 profile.

7 Q. Okay. If the wording of this particular
8 sentence was changed from geologic to geotechnical
9 profile, would you believe it's accurate today?

10 A. (Dr. Bartlett) In the extent that we've
11 discussed our feelings of adequacy and inadequacy of the
12 geotechnical profiles in this area, which we've had
13 conversations, we've discussed those. Whether those
14 same cross-sections meet the needs for a geological
15 interpretation, I will not interpret that.

16 Q. From your standpoint, would those be
17 sufficient?

18 A. (Dr. Bartlett) They may not be. They're
19 geotechnical data, primarily, not geological data.

20 Q. But from a geotechnical standpoint, would
21 they be sufficient?

22 A. (Dr. Bartlett) The cross-sections of the
23 test?

24 Q. Yeah.

25 A. (Dr. Bartlett) We've discussed about their

1 adequacy, about delineating the stratigraphy in the
2 upper five layers.
3 Q. Right, thirty feet.
4 A. (Dr. Bartlett) We've discussed some
5 inadequacies we see even in the geotechnical perspective
6 with depth.
7 Q. Below the top 30 feet?
8 A. (Dr. Bartlett) Yes, below the cone
9 penetrometer data, CPT data.
10 Q. All right. And let's move on to the next
11 sentence, that says, and I read, "The geologic profile
12 cannot be correlated with surface topography, geological
13 deposition soil characteristics, or seismic profiling
14 completed for the site." Do you know whether that is an
15 accurate statement today?
16 A. (Dr. Bartlett) Again, it uses the word
17 "geological profile"; and inasmuch as I haven't really
18 reviewed the main geological report for this site, which
19 is the Geomatrix report, I defer from really answering
20 any of those.
21 Q. And again, as you sit here today, would you
22 consider this to be a concern to you?
23 A. (Dr. Bartlett) If one cannot correlate
24 surface topography, geological deposition, soil
25 characteristics, and deeper seismic profiling for the

1 site, it would be difficult to develop cross-sections
2 that would show significant geological features, and
3 those missing details could be important to this site.
4 Q. Okay. But to you is this a concern?
5 A. (Dr. Bartlett) From a geotechnical
6 perspective?
7 Q. Yes.
8 A. (Dr. Bartlett) I'm not understanding that
9 question. This is discussing geological data.
10 Q. Correct. I understand that you're not
11 testifying as to what a geologist's concern might be
12 with this statement. But as a geotechnical expert,
13 would this statement in itself pose a concern to you?
14 A. (Dr. Bartlett) Yes. It might infer also,
15 particularly with a couple aspects regarding seismic
16 profiling, we also need some of those same types of data
17 to develop shear wave velocity models. And so if those
18 were incomplete, we would have difficulty also
19 completing our analyses and characterizations.
20 It mentions soil characteristics. And even
21 though -- if those soil characteristics are
22 geotechnical, then I am concerned that they're -- that
23 we need to better quantify the soil characteristics.
24 Q. Well, you would not turn to the geological
25 profile to do that, would you?

1 A. (Dr. Bartlett) You bet I would.
2 Q. I thought you would be looking at the
3 geotechnical profiles that we were looking at before.
4 A. (Dr. Bartlett) I'm also trained as a
5 geologist, and I always look at a geological profile
6 before I start my geotechnical investigations.
7 Q. Oh, so you have expertise in geology?
8 A. (Dr. Bartlett) I have a degree in geology.
9 Q. I see.
10 A. (Dr. Bartlett) But I am not the state's
11 expert on that Geomatrix report.
12 Q. So your deferring on geology questions is
13 not based on lack of knowledge, but it not your assumed
14 role in this --
15 A. (Dr. Bartlett) I've practice as a
16 geotechnical engineer for most of my profession. My
17 geological skills are still there, but a little bit
18 distant.
19 Q. Maybe you can help me, then, on the next
20 sentence that says, "Details missing include the
21 interrelationship of the subsurface conditions with the
22 geologic history of the site." Would you just translate
23 that for me and tell me what it means?
24 A. (Dr. Bartlett) I think what this is trying
25 to do is establish the interrelationship of the

1 subsurface conditions and the profiles or cross-sections
2 we talked about with the geological history: what are
3 the geological origins of those units, what are their
4 ages, how were they deposited, what are their
5 characteristics from a geological perspective.
6 Q. To ask the question differently, would this
7 mean a correlation with a particular subsoil level and
8 the time in geological history in which that level was
9 deposited?
10 A. (Dr. Bartlett) That's part of it, but it
11 means more than that.
12 Q. What else does it mean?
13 A. (Dr. Bartlett) Could mean its physical
14 characteristics. Could mean any anomalies or
15 differences or subtle difference in this layering.
16 Could mean also -- since it's a general term, subsurface
17 conditions, it could mean faulting and fracturing or
18 issues related to potential instability that's been
19 recorded in the geological history of these sediments.
20 It means many things.
21 Q. All right. Let's go back and take a look at
22 Exhibit 50. I'm sorry, I didn't mean to cut you off.
23 Are you finished?
24 A. (Dr. Bartlett) No, no. That's enough.
25 Q. Let's take a look at Exhibit 55. Black and

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1 white version, Plate 3. Do you have that? Take a look
2 at Plate 3. On the bottom left corner there is a
3 section that is entitled "Unit Descriptions."

4 A. (Dr. Bartlett) Correct.

5 Q. And to my untrained eye it appears to
6 correlate each of the subsurface soil layers to a
7 particular period in geological history. Is that the
8 way you read it?

9 A. (Dr. Bartlett) That is a geological
10 interpretation of these measurements.

11 Q. Is that what the sentence we just read in
12 Exhibit 3 was missing?

13 A. (Dr. Bartlett) I've lost the sentence.

14 Q. I'm sorry. We are talking about the last
15 sentence on the first full long paragraph on page 84,
16 which reads, "Details missing include the
17 interrelationship" -- I'm sorry. You need to look at
18 Plate 3, I believe.

19 A. (Dr. Bartlett) I need to quit looking at
20 the SAR and get back to Contention L. Okay.

21 Q. Actually, while you're doing that, let me
22 mark Exhibit 57.

23 (Exhibit 57 marked.)

24 For the record, Exhibit 57 is Section

25 2.6.4.1 --

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1 these three documents, either separately or together,
2 would you give me your view as to whether in fact the
3 interrelationship between the subsurface conditions and
4 the geologic history at the site has now been provided?
5 That's my question.

6 A. (Dr. Bartlett) Again, this is outside the
7 area of my review.

8 Q. But you are a geologist and you can read the
9 drawing like Plate 3 and see if it in fact ties --

10 A. (Dr. Bartlett) I can; but reading a report
11 of this scope and extent takes time, and trying to give
12 off-the-cuff interpretations, I may misrepresent this
13 data. I can see geological data, I can see a trench log
14 that's in the middle of the pad emplacement area.

15 However, this paragraph that we've been focusing on in
16 the middle of page 84 also discusses the collection of
17 data in the area. Talks about a concern of no really
18 geological data in the canister fuel storage facility.
19 That would be the pad emplacement area that we've been
20 talking about.

21 Q. Make I can ask the question more simply.
22 Looking at the three exhibits that I've put before you,
23 55, 57, and 58 -- and 55 is Plate 3. Would you testify
24 that in fact there is still missing information by
25 applicant on the interrelationship of the subsurface

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1 A. (Dr. Bartlett) Correct.

2 Q. -- of the SAR entitled Geologic Features
3 That Could Affect Foundations.

4 A. (Dr. Bartlett) I see that.

5 Q. All right. Taking a look at either Exhibit
6 55 or Exhibit 57 or both, will you tell me whether in
7 fact the data that is asked for or identified as being
8 missing in that sentence is no longer missing?

9 A. (Dr. Bartlett) Since it mentions earlier in
10 the paragraph about an obtuse angle to the canister
11 transfer building, I think we need to also check to see
12 where these are physically. As I recall, these are down
13 in the center of the storage pad. Again, I haven't
14 reviewed the report.

15 MS. CHANCELLOR: What do you need, Steve?

16 DR. BARTLETT: That shows the layout of
17 where these trenches are.

18 Q. (By Mr. Travieso-Diaz) Let me give you
19 another document that may help you.

20 (Exhibit 58 marked.)

21 I am showing you also what is identified as
22 Exhibit 58, which is Section 2.6.1 of the SAR. That
23 goes from page 2.6-1 to 2.6-4, which is entitled "Basic
24 Geologic and Seismic Information."

25 (By Mr. Travieso-Diaz) Using any one of

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1 conditions for the geologic history of the site?

2 MS. CHANCELLOR: I'm going to object.

3 That's been asked and answered.

4 MR. TRAVIESO-DIAZ: But he was also asked
5 this sentence with the one before. I'm asking him
6 specifically as to the statement that is made here, that
7 there is no information on the interrelationship of the
8 subsurface conditions for geologic history of the site.

9 Q. (By Mr. Travieso-Diaz) And my question is
10 whether the documents that are put in front of you
11 provide that information.

12 A. (Dr. Bartlett) I will tell you what I see,
13 based on what's placed before me with no review.

14 MS. CHANCELLOR: I'm going to caution the
15 witness that he shouldn't speculate.

16 A. (Dr. Bartlett) I see a trench log with
17 geological data and interpretations of layers in the
18 geological context. Whether these are adequate,
19 inadequate, meets this, it's out of my area of review.

20 Q. Maybe you read more into my question than
21 what I meant. I didn't ask you to opine to the adequacy
22 of the materials that are put before you. My question
23 was, this statement makes the assertion that that
24 information doesn't exist. That's the way I read it.
25 Do you read it the same way? "Details missing include

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1 the interrelationship of the subsurface conditions with
2 the geologic history of the site."
3 A. (Dr. Bartlett) No, it doesn't infer the
4 data are missing. It infers that the interrelationships
5 are missing. The interpretation is missing of the data.
6 Q. I'm sorry. Take a look, for example, at
7 Plate 3 on Exhibit 55. Doesn't that plate contain an
8 interpretation of the subsurface layers?
9 A. (Dr. Bartlett) It contains an
10 interpretation of data, but the geological data are
11 many, not just the trench logs, and there's no really
12 discussion of the interrelationship of the geological
13 data.
14 Q. Does the unit description on Exhibit 55,
15 Plate 3 provide a correlation between each of the layers
16 of soil that are presenting the top of the plate with a
17 description of what also this document believed to be
18 various geologic areas -- eras?
19 A. (Dr. Bartlett) But that's not the complete
20 interpretation of the interrelationship of all
21 geological data, how they fit together.
22 MS. CHANCELLOR: I'm going to have a
23 continuing objection to this line of questioning. The
24 witness has testified it's beyond his scope. You're
25 asking him questions about documents he hasn't reviewed,

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1 and I'm going to go on the record as either beyond the
2 scope of his review or asked and answered.
3 MR. TRAVIESO-DIAZ: I'll go on the record as
4 stating that to the extent that you have provided a
5 witness who is going to be the expert in this
6 contention, he ought to be able to address the matters
7 raised in the contention unless they are dropped. And I
8 think I have every right to explore whether he
9 understands this particular sentence, which may or may
10 not have been true at a time previous to today, and
11 that's what I'm trying to find out. Because if his
12 opinion is that this particular sentence is still true
13 when it's litigated -- if he doesn't think it's true,
14 then we don't need to go over it, and that's the reason
15 I ask the questions. And I think I'm entitled to have
16 an answer to the question. So that's my position on
17 this, and that's what I'm asking.
18 DR. BARTLETT: Let's have a break.
19 MR. TRAVIESO-DIAZ: All right, let's have a
20 break.
21 (Recess from 5:18 to 5:24 p.m.)
22 Q. (By Mr. Travieso-Diaz) If you can stand it,
23 let me ask you one more question on this subject. As a
24 geotechnical engineer, what use, if any, would you have
25 for the geological history of a particular set of soil

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1 layers? Do you use that information in any way?
2 A. (Dr. Bartlett) You bet.
3 Q. How?
4 A. (Dr. Bartlett) Qualitatively in that it
5 helps me understand the geological origins of this site;
6 and being trained as a geologist, I can also infer
7 something about their engineering properties.
8 Q. And did you look at the Plate 3 that I
9 showed you a moment ago when you were doing that, since
10 it's useful to you?
11 A. (Dr. Bartlett) It tells me something about,
12 yes, the Bonneville sediments.
13 Q. Did you look at it before I showed it to you
14 today?
15 A. (Dr. Bartlett) I was provided the Geomatrix
16 report. I have it. Whether I looked at that particular
17 plate or not, I'm not particularly sure. I guess I
18 can't recall whether I distinctly looked at that plate.
19 Q. You said that qualitatively it may be of
20 some help to you. Quantitatively, in terms of your
21 evaluations, do you use it in any way?
22 A. (Dr. Bartlett) Quantitatively, no; but
23 qualitatively, having also studied that same
24 Bonneville -- the same set of Bonneville deposits in
25 this valley, I could understand at least that they're in

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1 the same sequences, that they're roughly the same
2 thicknesses. And also we've seen this Bonneville
3 sediment, that it tends to have a clayier upper profile,
4 more siltier intermediate profile, and then a deeper,
5 clayier profile again. And that's consistent with my
6 knowledge at the Bonneville here, and also in Skull
7 Valley. But engineering-wise, no, because those are far
8 enough apart that once you do site-specific
9 investigations, you determine the properties.
10 Q. Thank you.
11 A. (Dr. Bartlett) It fits in my framework the
12 way the -- the world makes sense.
13 Q. And having looked at table -- Plate 3 and in
14 connection -- in conjunction with all the other drawings
15 that you have looked, does that Plate 3 make sense to
16 you compared to the other things that you have seen? Is
17 there an inconsistency between the way that Geomatrix
18 has characterized the subsurface conditions and the
19 geologic history with what your analysis shows?
20 A. (Dr. Bartlett) I haven't compared,
21 obviously, the individual layerings and where Geomatrix
22 has broken a layer corresponding where the geotechnical
23 borings and layers have been broken. The Eolian
24 deposits are on the surface; the geotechnical report
25 identifies them as such. The Bonneville deposits are

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1 not necessarily identified on the geotechnical reports
2 as Bonneville. But we see a Bonneville deep-water
3 facies that's described in geological context: light
4 gray, mottled white; very fine sand-clayey silt;
5 irregular coarse angular blocky structure; plastic,
6 sticky; abundant ostracods; manganese, iron oxide
7 staining, so on and so forth.

8 It seems consistent with what I would expect
9 to be the upper Bonneville and probably layer 2 from the
10 geotechnical report, but we could verify if these
11 contact boundaries matched the geotechnical report,
12 which I have not done.

13 We see another Bonneville deep-water facies
14 underlying that described as pale brown, fine sandy
15 silt; fines upward; upward bedded; thinly laminated,
16 abundant ostracods. I'd have to check that. I'm not
17 sure if that's layer 3 in our correlation. Possibly.
18 And then the deeper layers.

19 But having a geotechnical profile and a
20 geological profile, I think I could interpret between
21 the two.

22 Q. All right. Now, let's look at now to the
23 next sentence on Exhibit 3, which is in the last
24 paragraph on the page. The sentence starts with
25 "further." Let me read it for the record.

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1 "Further, the application does not discuss
2 the geochemical effects of the environment (weather and
3 rain water) on the physical and strength characteristics
4 of the soil and rock at the ISFSI site, particularly if
5 there is potential for geochemical weathering and
6 leaching of soils and rocks at the storage site."

7 A. (Dr. Bartlett) Correct.

8 Q. Is this sentence that I read you accurate as
9 of today?

10 A. (Dr. Bartlett) We discussed yesterday about
11 the potential of cementation in layer 2. And mentioned
12 that we had not seen any geochemical analyses for the
13 amount of calcium carbonate, CaCO₃, subscripted 3.
14 Also, the soils can have other leachable solubles.
15 Whether the Geomatrix report discusses these or looks at
16 those, I cannot comment on. I have not seen that in the
17 geotechnical parts of the SAR. And is there a potential
18 for weather and leaching of soils -- let's see.

19 One thing I want to make a comment, at least
20 on the weather and rain on the physical and strength
21 characteristics of the soils, as we talked about this
22 being an unsaturated soil; however, it goes through
23 repeated cycles of wetting and drying just due to
24 surficial waters. Those can be runoff. They're not
25 permanent, ponded waters. And we do believe these

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1 clays, particularly in layer 2, can be susceptible to
2 drying and wetting which will change their physical
3 strength.

4 The potential for geochemical weathering,
5 that's probably implying some loss of cementation either
6 of the soils or perhaps of the deeper rock, which I'm
7 not sure what the deeper rock is here, whether it's
8 calcarious.

9 And then again, and leaching of the soils,
10 again, the loss of soluble salts and materials out of
11 the soils.

12 Q. Let me first ask you -- I'm sorry. I'm not
13 sure whether that answer, complete as it was, answered
14 my question, which was, do you believe this paragraph to
15 be still accurate up to this date?

16 A. (Dr. Bartlett) I believe there are still
17 issues related to this paragraph.

18 Q. Now, going to the first part of the
19 paragraph that says the application does not discuss
20 various things that are following in the sentence that I
21 read you. "The application does not discuss"; is that
22 correct?

23 A. (Dr. Bartlett) My recollection of reading
24 the geological section of the SAR, where I believe this
25 would have been discussed, I cannot comment on that,

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1 because I did not in preparation for this deposition
2 read I think the appropriate sections of the SAR to
3 support this.

4 Q. I think you have before you Exhibit 57.
5 Take a look at it. Would you look at Section 2.6.4.1
6 that starts on page 96 and goes to page 97.

7 A. (Dr. Bartlett) Correct.

8 Q. Does this section contain a discussion of
9 geochemical effects of the environment at the site?

10 A. (Dr. Bartlett) Exhibit 57, correct?

11 Q. Yes.

12 A. (Dr. Bartlett) It discusses the potential
13 for karst topography and says that "there is no history
14 of karst development in the region." It says, "There is
15 no evidence of any significant soluble mineral deposits
16 in the unconsolidated materials," but then does not
17 support with any suggestion that analyses and testing
18 were done to support that statement.

19 And then it reports I guess that there is no
20 evidence of soluble mineral deposits in the
21 unconsolidated materials beneath the site for at least
22 20 -- let me state it again. There is no evidence of
23 any significant soluble minerals deposited in the
24 unconsolidated materials beneath the site to at least a
25 depth of 225 feet. Again, I do not see any reference to

1 reports that would support that statement.
2 There are soluble mineral deposits in our
3 soils, generally. And it says, "no record from water
4 wells," and I'm not sure water wells do the proper
5 geochemistry analyses. "In the valley indicates the
6 presence of similar materials at greater depths." So
7 it's using data in the greater realm of the valley. I'm
8 not sure exactly the location of these water wells and
9 how close they are to the PFS site.

10 And then it states, "Evaporites associated
11 with the waning stages of Lake Bonneville and the Great
12 Salt Lake were not deposited here as the area remained
13 above the extent of saline stages of these lakes." It
14 still doesn't preclude that there are other types of
15 soluble salts in this soil.

16 Q. To make the discussion clearer between us,
17 first, put aside for the moment the adequacy or the
18 background that may exist for statements on Section
19 2.6.4.1.

20 A. (Dr. Bartlett) But that's my main point is
21 I think we're not only discussing in this contention
22 whether there are -- you asked me whether there are
23 statements about that, but I'm saying the SAR does make
24 statements about types of deposits that are potentially
25 soluble, but --

1 Q. But please hear me out, because I'm asking
2 you something different.

3 A. (Dr. Bartlett) Sure.

4 Q. The contention says the application does not
5 discuss various things, and I'm showing you a document
6 that appears to me to indicate that it discusses those
7 sort of things; whether well or poorly is a different
8 story. Is this a true statement as of today: the
9 application does not discuss the geochemical effects of
10 the environment?

11 A. (Dr. Bartlett) It essentially does not
12 discuss the geochemical effects of the environment. It
13 just basically says that there are no issues. There may
14 still be issues with environment, geochemical effects of
15 the environment on the physical strength and
16 characteristics of the soil and rock. It's not just a
17 matter of saying whether they are discussing them.

18 This sentence the way I read it implies that
19 it does not discuss the effects. Effects, we talk about
20 cause and effect. How does the rain water or the
21 weather affect the physical properties and strength of
22 these soils? It does not discuss that. It just goes on
23 and doesn't discuss any potential effects on the soil.
24 We've given you an example that the physical strength of
25 the soil can be changed by -- due to moisture content on

1 the surficial, the surficial soils, and it doesn't
2 discuss that.

3 I don't think we're just limited ourselves
4 to karstic topography and evaporites. And I'm not
5 sure -- I guess that's all I have to say.

6 Q. Let me ask you the following question. Do
7 you know whether there are studies or analyses by a
8 member of the PFS design team that provided information
9 on which this paragraph was based?

10 A. (Dr. Bartlett) Please repeat the question.

11 Q. Yes. The paragraph that you have been
12 referring to, the two paragraphs in Section 2.6.4.1.

13 A. (Dr. Bartlett) Correct.

14 Q. Do you know whether there are any analyses
15 performed by someone on behalf of PFS that provides the
16 basis for the statements that are made in these two
17 paragraphs?

18 MS. CHANCELLOR: Objection. That's too
19 vague. I mean, there's a stack of documents like --
20 there's an entire body of documents that's been
21 generated by PFS. To ask him if somewhere in all the
22 documents that PFS has produced whether there's any
23 information to support this statement I think is
24 overbroad.

25 MR. TRAVIESO-DIAZ: Excuse me, but I believe

1 the question was prefaced by the words "do you know
2 whether there are." And I believe phrased that way, the
3 question is not overbroad at all. Either he knows that
4 there are or he doesn't know.

5 Q. (By Mr. Travieso-Diaz) Do you know whether
6 there are such studies?

7 MS. CHANCELLOR: I'll still object, but you
8 may answer.

9 A. (Dr. Bartlett) I do not know if there are
10 studies supporting these statements. Normally when one
11 makes statements one references reports or studies, and
12 I see no referencing going on here. So I can only
13 accept them at face value, not knowing the basis of what
14 these statements are.

15 Q. Fair enough. Based on your personal
16 experience, which I believe you talked about earlier of
17 drafting SAR's, isn't it true that when you put
18 information of this nature in an SAR, you are expected
19 to have background material that provide the basis for
20 the statement?

21 A. (Dr. Bartlett) Yes, and I referenced it.

22 Q. And do you know whether there are references
23 for this section?

24 A. (Dr. Bartlett) Perhaps, but I can't
25 correlate this paragraph with references that --

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1 generally we would cite the report and the year, or the
2 appropriate appendix to review to see if these
3 statements have basis.

4 Q. Let me ask you now as to the content of
5 these two paragraphs as opposed to whether they exist.
6 First question I have for you is, have you reviewed the
7 meteorology of the PFS site?

8 A. (Dr. Bartlett) Meteorology?

9 Q. Yes.

10 A. (Dr. Bartlett) No, I didn't review that.

11 Q. Can you cite for me what the annual
12 precipitation of the site is?

13 A. (Dr. Bartlett) Well, I live in the adjacent
14 valley. It's somewhere around nine inches, plus or
15 minus three or four.

16 Q. And the seasonal?

17 A. (Dr. Bartlett) And the seasonal --

18 Q. Yes.

19 A. (Dr. Bartlett) -- variations?

20 Q. Yes.

21 A. (Dr. Bartlett) I don't know the seasonal
22 variations.

23 Q. Would you need to know the seasonal
24 variations to determine the extent to which rain water
25 may percolate down to --

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1 A. (Dr. Bartlett) No. It's really the
2 snowfall that controls here, because we amass snowfall
3 in the winter and in the spring we have a thaw, and our
4 soils tend to get the moistest in the spring during the
5 thaw when the snows melt. So we store six to eight
6 months of snow in the mountains, and we get -- our soils
7 get the wettest in the spring. Generally, except in odd
8 years.

9 Q. We know that. Did you investigate the
10 amount of snow melt, if you will, I think that's the
11 proper term, that would be available in the typical
12 spring at the surface of Skull Valley to percolate down
13 to lower layers of the soil?

14 A. (Dr. Bartlett) No.

15 Q. So without that information, could you tell
16 whether there is a concern about potentially having loss
17 of cementation in the lower level?

18 A. (Dr. Bartlett) I don't have to be a
19 meteorologist. These are clayey soils. I've driven on
20 them and gotten stuck in them in the spring. So it
21 seems to me -- fine, we can talk about whether there's
22 meteorological cycles, but the shallow surficial levels
23 do get wet during the spring and their moisture content
24 changes.

25 Q. And they get wet from what? Snow runoff

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1 from the mountains?

2 A. (Dr. Bartlett) Snow runoff and, yeah, just
3 melting and sheet flow sometimes. And sometimes large
4 precipitation events that occur in April and -- March
5 and April here when we're right on the verge between
6 snow and rain.

7 Q. How far are the closest mountains to the
8 site?

9 A. (Dr. Bartlett) Closest mountains to the
10 site?

11 Q. Yes.

12 A. (Dr. Bartlett) Approximately six miles to
13 the Stansburys. I don't know how far it is to the Cedar
14 Hills Mountains.

15 Q. And basically you're familiar with this area
16 you just testified about. Would you expect that that
17 snow runoff from the mountains six miles away would
18 create significant amounts of water at this site?

19 A. (Dr. Bartlett) Sure. You should have been
20 in here in 1983 and '84 when we had 200 percent annual
21 snow pack in our mountains. Everything was wet. I saw
22 sheet flow over alluvial fans and flooding in several
23 communities.

24 Q. By the way, let me ask you about specific
25 area of the site, which is the pad emplacement area.

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1 A. (Dr. Bartlett) Sure.

2 Q. You're aware of the testimony that has been
3 given, there is going to be soil cement built on --

4 A. (Dr. Bartlett) I am aware of that, yes.

5 Q. If you have soil cement underneath the
6 foundations, would that tend to resolve your concern
7 about potential loss of cementation of the layers below?

8 A. (Dr. Bartlett) I have really insufficient
9 data to talk about that, but remember that we're talking
10 about unsaturated flow, and it doesn't always have to be
11 driven by sheets of water flowing over the surface.

12 What can happen when you place a concrete foundation
13 that provides a barrier to further drying -- what we
14 would call evapotranspiration -- and simply due to
15 capillary action of these soils, you can have migration,
16 if you will, of water underneath these areas from the
17 surficial waters. I've seen it before. I've placed
18 things on the ground, come back later, and they're damp.

19 Q. Is it your testimony that it is a possible
20 scenario that you will have water migrating some
21 distance from the concrete, the soil cement pad?

22 A. (Dr. Bartlett) I'm not sure. We've talked
23 about the soil cement mixture. It's at a conceptual
24 stage. I know nothing about its permeability, its
25 ability to be a barrier or lack thereof to water

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1 underneath these pads. I cannot comment whether it's
2 going to really effectively, if you will, stop any water
3 from getting underneath these pads.

4 A. (Dr. Ostadan) May I add? I think your
5 expert testified yesterday that this is at the
6 conceptual stage. We did discuss the behavior of the
7 soil cement on the seismic loading, and if I recall
8 correctly, your expert testified that the bonding within
9 the pad in the soil cement could potentially break if
10 the stress exceeds the strength. We discussed shrinkage
11 and cracking of the soil cement. So I believe all those
12 issues would have a role in the topic we're discussing.

13 A. (Dr. Bartlett) I cannot hypothesize about
14 whether this will really provide an impermeable barrier
15 to such a large area.

16 Q. Let me ask you the following question. Have
17 you designed soil cement structures?

18 A. (Dr. Bartlett) I have not.

19 Q. Is it your expectation that a soil cement
20 foundation will be permeable, conduct -- will let water
21 get through?

22 A. (Dr. Bartlett) I do not know.

23 Q. Okay. So you don't know. Let me ask you a
24 different question. Are you aware that the design of
25 the PFS facility as currently envisioned includes --

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1 of the site that will collect the water that comes from
2 the mountains or whatever.

3 A. (Dr. Bartlett) Let's go with the
4 assumption, then, it's an impermeable barrier. Is that
5 what you're wanting to do?

6 Q. I'm just saying it's a water collection
7 system.

8 A. (Dr. Bartlett) No. I'm talking about what
9 is the nature of the pad -- I mean, the soil cement mat,
10 I think it was referred to yesterday. Is it permeable
11 or impermeable? Let's just assume. I need to know
12 whether -- we have to assume whether it's permeable or
13 impermeable for this discussion.

14 Q. For the discussion of the water collection
15 system?

16 A. (Dr. Bartlett) Yeah. You're asking me to
17 conjecture about things, so I need to define the bounds
18 of which I'm conjecturing.

19 Q. Do you believe it's a conjecture that there
20 is going to be a water collection system at the site?

21 A. (Dr. Bartlett) I'm not worried about the
22 water collection system right now because I'm going to
23 introduce another mechanism for a way the water can get
24 down, even if you have your water collection system in
25 place.

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1 A. (Dr. Bartlett) May I add to your statement?
2 However, you implied that it will -- permeability is not
3 the only mechanism of transportation of water. There's
4 still cracking, and there can be flow through cracks.
5 And you've essentially created now -- if it is truly a
6 low permeability barrier, you've essentially created
7 what we would term a parking lot. And water can pond on
8 any low spots if it is truly impermeable, and now
9 migrate downward through the cracks.

10 So, you know, we're hypothesizing. We do
11 not know much about how this is going to behave.

12 Q. One more question. I think this one we know
13 about. Are you aware that part of the design of the PFS
14 is a water collection system that will take that water
15 back from the mountains that melt away from the
16 structures? Are you aware that that is a design
17 feature?

18 A. (Dr. Bartlett) Correct.

19 Q. And how do you postulate, then, that the
20 water is going to get underneath the pad, underneath the
21 canister building? How does it get there?

22 A. (Dr. Bartlett) Under the pads or canister
23 building? Which one?

24 Q. Whichever. Okay, let's say the pads. If
25 there is a water collection system around the perimeter

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1 Q. Please.

2 A. (Dr. Bartlett) Okay. Is the pad, the soil
3 cement pads -- not the pads -- the soil cement mat that
4 we talked about yesterday which we talked about being
5 now continuous between all the pads, is it essentially
6 permeable or impermeable?

7 Q. Your pick. You are the witness.

8 A. (Dr. Bartlett) I don't know. That's why
9 I'm saying you haven't provided us the data to assess
10 this, so I need to -- if we're going to conjecture, I
11 need you to define the bounds of which we're going to
12 conjecture.

13 Q. Well, but -- then let me ask you the
14 question this way. Are you saying that the concerns of
15 potential water infiltration and loss of cementation of
16 the lower layers of the site is at this point
17 conjecture?

18 A. (Dr. Bartlett) Please repeat it.

19 MR. TRAVIESO-DIAZ: Read it back. I never
20 can say the same thing twice.

21 (The pending question was read.)

22 A. (Dr. Bartlett) I think we were talking
23 about ways that water could get down through this soil
24 cement system. You brought out the point that there is
25 going to be a collection system for the surface runoff.

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1 If the soil cement itself is essentially
2 impermeable, which I do not know, I have no data to
3 either confirm or deny that, then it will essentially be
4 a very continuous, large area. If due to cracking of
5 that impermeable barrier, water will still penetrate
6 through it. There is also water migration through
7 cracks even through an impermeable barrier. If it is
8 permeable, then it simply just permeates through.

9 Q. Explain to me or for the record how in your
10 postulated scenario the water gets past the water
11 collection system and gets underneath the pads.

12 A. (Dr. Bartlett) The water comes from snow
13 that accumulates and melts in the spring.

14 Q. Yes.

15 A. (Dr. Bartlett) It's already got past your
16 water collection system. It's resting in the whole pad
17 emplacement area.

18 Q. You're saying now, talking about snow that
19 is resting on the surface of the pad?

20 A. (Dr. Bartlett) Sure.

21 Q. And you're postulating that it's going
22 to percolate?

23 A. (Dr. Bartlett) Melt.

24 Q. It's going to melt, it's going to become
25 water.

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1 A. (Dr. Bartlett) And percolate.

2 Q. And percolate through the foundations --

3 A. (Dr. Bartlett) Either through cracks
4 around, in the soil cement.

5 Q. So your postulation is that the water
6 present on top of the pads will migrate through cracks
7 through the foundations, and then it will reach the
8 level below the foundation. Is that --

9 A. (Dr. Bartlett) May I hear the question?
(The pending question was read.)

11 A. (Dr. Bartlett) Not through cracks through
12 the foundation. The foundation implies to me the pads
13 themselves. We're talking about the soil cement mat
14 that's around. It's either cracks in that soil cement
15 mat or gaps that form between the pad foundations and
16 the soil cement. We can't preclude that they're not
17 going to form. We've talked about mechanisms of
18 creating tensile cracking within that mat. It's a very
19 large mat and it's unreinforced.

20 Q. Based on your experience, can you give me an
21 estimate how long it would take to create a crack of the
22 type you're describing on a concrete --

23 A. (Dr. Bartlett) Cementitious materials can
24 crack upon drying. That's how they cure. Concrete
25 cracks.

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1 Q. So you expect that there could be concrete
2 cracks from the beginning?

3 A. (Dr. Bartlett) Well, these are not concrete
4 cracks. They are soil cement.

5 Q. Soil cement cracks, yes.

6 A. (Dr. Bartlett) Yeah, as they dry, I'm sure.

7 Q. Are you postulating -- how deep do you
8 postulate those cracks to be?

9 MS. CHANCELLOR: I'm going to object. We're
10 really getting into the speculative area, because we're
11 talking about a conceptual design. You're asking him
12 based on his conjecture as to what this conceptual
13 design is. Now you're asking him speculation on
14 speculation to postulate how deep these cracks will be.
15 I think we're just stretching the bounds too far.

16 MR. TRAVIESO-DIAZ: I understand your
17 problem, but now you have to understand mine. He has
18 expressed a potential concern, and I want to understand
19 whether he has any actual basis today for that concern
20 or whether it's a hypothetical concern. If he can tell
21 me that it is all hypothetical, it may not become a
22 concern once he knows how the designs develops.

23 A. (Dr. Bartlett) Cracks develop. We have
24 concrete cracks. This has cementitious material in the
25 soil cement. It can be susceptible to shrinkage,

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1 cracking. It may not be completely stabilized. It's a
2 very large area. You have heavy equipment running over
3 it.

4 I can -- we can continue to speculate
5 mechanisms, but I think the important part is if it's
6 part of your strategy that this is an impermeable
7 barrier, then I believe that it would have to be
8 demonstrated to us that it really behaves as that and it
9 doesn't crack.

10 Q. And the crack would have to essentially run
11 through the entirety of the soil cement?

12 A. (Dr. Bartlett) Not necessarily, no. It can
13 come down and -- partly come down through one crack and
14 then migrate laterally through differences in your lifts
15 and then go to another. I mean, it doesn't have to be
16 one vertical crack.

17 Q. So you have to assume also that the lifts
18 are uneven for this to happen, that the lifts, that the
19 concrete or soil cement lifts are uneven so the crack
20 can propagate through them, or --

21 A. (Dr. Bartlett) Your initial materials that
22 you're going to do this with are not purely homogeneous,
23 so there will be differences in strength and
24 characteristics of this. How significant those are, I
25 do not know. But we also have tension cracks that will

1 form right at the soil cement/pad interface. There's a
2 vertical face. Those are very dissimilar materials. I
3 can see water migrating down that.

4 Q. One more question and we'll move to
5 something else.

6 A. (Dr. Bartlett) Sure.

7 Q. Is it your experience that from the quality
8 assurance standpoint when concrete placements are made
9 that in fact inspections are made to make sure that the
10 lifts exhibit no cracks or exhibit no discontinuities
11 and that there are not significant cracks in the
12 placements?

13 A. (Dr. Bartlett) I think we've been talking
14 about post-construction cracking, not construction
15 cracking. But I have no experience with construction
16 cracking. It may occur, it may not.

17 Q. So the cracks that you're postulating will
18 occur after the site is --

19 A. (Dr. Bartlett) Our last discussion over the
20 last ten minutes has been really more post-construction.

21 Q. By the way, how long is this facility going
22 to be in operation? Do you know?

23 A. (Dr. Bartlett) Well, that depends upon I
24 guess a potential for renewal. But as long as maybe 40
25 years.

1 Q. And the phenomena we're talking about here,
2 like geochemical weathering and migration of water
3 through cracks, are these things that happen
4 continuously or develop over time?

5 A. (Dr. Bartlett) They can happen relatively
6 quickly. We have concrete bridge decks here on I-15 of
7 high quality concrete that are already cracking and
8 showing water coming down through concrete decks and
9 appearing on the underside of decks through migrations
10 from microfracturing. It's very common.

11 A. (Dr. Ostadan) I'd like to add to that. The
12 condition of concrete cracking is also reflected in the
13 guidelines of KSE 498 or 487, specifically asks for
14 concentration to concrete cracking for design.

15 Q. Let me ask you the question now about the
16 consequences of the phenomena that you have testified
17 that could happen.

18 A. (Dr. Bartlett) Sure.

19 Q. Let me see if I understand. The concern
20 would be that water through one of the various
21 mechanisms that you have been talking about could get
22 through to what layer of the soil?

23 A. (Dr. Bartlett) To layer 2, I think.

24 Q. What would be the significance of having the
25 water reach layer 2?

1 A. (Dr. Bartlett) If the water gets there then
2 the moisture content changes, and these clays then can
3 be susceptible to loss of strength just due to increases
4 of moisture content. That could affect the engineering
5 stability calculations if these do intend to increase in
6 moisture content with time versus what -- versus the
7 time at which they were sampled. That's our baseline is
8 what was the moisture content at the time at which they
9 were sampled. The question we're asking is, are there
10 potential for significant changes in water content, how
11 may that affect the shear strength primarily of these
12 clays.

13 Q. I believe you're familiar -- we haven't
14 talked about it yet -- with the shear strength tests
15 that were performed for the PFS site?

16 A. (Dr. Bartlett) I am.

17 Q. And I take it you're also familiar with the
18 test results, with the results of those tests?

19 A. (Dr. Bartlett) I know in general what the
20 values are of those tests. I'm not sure I could
21 specifically cite for any individual facility what the
22 design values are.

23 Q. No need.

24 A. (Dr. Bartlett) I know the range of about
25 where they are.

1 Q. But my question actually was a different
2 one.

3 A. (Dr. Bartlett) Oh, sure.

4 Q. Do you have any recollection as to whether
5 the samples that were tested for strength had different
6 degrees of moisture content?

7 A. (Dr. Bartlett) I haven't researched that
8 through to see what the moisture contents were for the
9 particular samples at the time they were tested. But
10 again, that seems not -- the important question to me is
11 not what they were when they sampled, but could they
12 increase or decrease with time now due to environmental
13 conditions.

14 Q. Yes, but let me ask you a different
15 question, which is slightly different. I take it, then,
16 that since you didn't look into the moisture content of
17 the sample from this viewpoint, you cannot tell me now
18 whether you make any difference in test of the strength
19 of the sample that was tested, the degree to which it
20 had higher or lower moisture content?

21 A. (Dr. Bartlett) Please repeat the question.

22 Q. Rather than having this poor court reporter
23 try it, let me say it again.

24 You testified a moment ago that you didn't
25 look at the test results with an eye towards the

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1 moisture content of the sample. Is that correct?
2 A. (Dr. Bartlett) I paid some attention to it,
3 yes, but I can't recall definite conclusions about it
4 because I wanted to see if these were plastic materials
5 with higher water contents versus maybe non type of
6 plastic materials with lower water contents.
7 Q. And as long as you're saying that, your
8 recommendation was what?
9 A. (Dr. Bartlett) They're partially saturated.
10 To what degree, I guess I could look at -- we saw a
11 table yesterday of average saturations and water
12 contents. We could refer to it in generalities to see
13 what those were.
14 Q. So my question was -- the one that I didn't
15 want to have read back again -- did you look at the
16 extent to which, if any, there was a difference in the
17 measured strength of the samples depending on the water
18 content?
19 A. (Dr. Bartlett) No. That was one of the
20 things we'd like PFS to do for us is to see if there is
21 potential differences in strength due to water content.
22 Q. Okay. But you will agree with me based on
23 your recollection that --
24 A. (Dr. Bartlett) They have a moisture content
25 that corresponds to the sample.

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1 Q. Right.
2 A. (Dr. Bartlett) And they have done a test.
3 What we are asking is, can that strength change with
4 some changes in water content. PFS has maintained that
5 we need to test it at the water content from which we
6 retrieve the sample. That will assume the moisture
7 content will stay constant with time. We are not sure
8 that that's going to be true or not.
9 Q. My question was, from one sample to the
10 next, assume Sample A had 20 percent higher water
11 content than Sample B. Is there any difference that you
12 can detect on the measure of strength of those two
13 samples?
14 A. (Dr. Bartlett) With 20 percent changes in
15 water content?
16 Q. Yes.
17 A. (Dr. Bartlett) Markedly. Not from your
18 data, but yes, I can show -- I cannot show, but the
19 water content will affect the strength of that sample.
20 Q. But based on the actual test data collected
21 at the PFS site, do you have any recollection of
22 comparing two samples with differing water content and
23 detecting significant difference in strength?
24 A. (Dr. Bartlett) For these particular two
25 samples?

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1 Q. Yes.
2 A. (Dr. Bartlett) Do we need to worry also
3 about from which layers they are and also from what
4 depths they're coming from? Because there's other
5 factors besides water content that affects strength.
6 Q. Assume they're from the same layer, to
7 narrow it down somewhat.
8 A. (Dr. Bartlett) So this is a hypothetical
9 set of data? We're not taking about real data?
10 Q. No, I'm talking about real data that is
11 reflected in attachments to the SAR. And you can tell
12 me, if the answer is I don't remember, that you don't
13 remember whether the amount of water content in the
14 sample had a significant effect in the measure of
15 strength. That's what I'm asking you.
16 A. (Dr. Bartlett) Give us a moment and we'll
17 research that.
18 MS. CHANCELLOR: Can we go off the record
19 for a minute?
20 (Discussion off the record.)
21 A. (Dr. Bartlett) The issue is, could
22 potential higher moisture contents indicate themselves
23 in lower undrained shear strengths for unit 2? Is that
24 what we're --
25 Q. Yeah, for measured samples that you have

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1 data from for PFS.
2 A. (Dr. Bartlett) Correct. Let's go to
3 Appendix B of Attachment --
4 Q. Are you just get a boring number, a boring
5 sample?
6 A. (Dr. Bartlett) Can you do it from that?
7 I'm looking at CTB-1. First figure --
8 Q. Do you have a sample number?
9 A. (Dr. Bartlett) Sample number U-3D. This
10 sample has a water content of 47.9 percent. And also
11 it's a consolidated-undrained triaxial test, we should
12 say that. And we have plotted on the Y axis shear
13 stress in kips per square foot. We have -- kips,
14 k-i-p-s. Ksf. And on the X axis, axial strain percent.
15 And we see that from the stress drain curves that the
16 peak strength for this particular phi is somewhere
17 between 2.8 and 2.9 ksf.
18 Now, in that same attachment, go to a -- and
19 by the way, I might note it shows somewhat of a brittle
20 behavior to me. It reaches a peak and drops off
21 dramatically on larger strain.
22 When we go to Boring CTB-N, it's seven
23 pages --
24 MR. TRUDEAU: Sample.
25 A. (Dr. Bartlett) -- U-2B. I should have

1 added, too, the depth from the previous sample was 8.4
2 feet, so it's probably within layer 2. It's -- at least
3 the depth range seems appropriate.

4 When we look at this sample, which has a
5 water content of 65.4, the peak strength is a much
6 larger strain, and it is at about 2.4 ksf.

7 Q. Does that mean that the second sample is
8 stronger than the first?

9 A. (Dr. Bartlett) This means that the second
10 sample is weaker than the first.

11 Q. I am reminded to ask you, if you look at the
12 void ratios for the two samples, if there is a
13 significant difference also in the void ratio?

14 A. (Dr. Bartlett) One is 1.73, one is 2.76.

15 Q. Could the higher void ratio in the second
16 sample result in lower strength?

17 A. (Dr. Bartlett) It could. Generally also
18 unstrained shear strength is correlated with void
19 ratios, but the data are inclusive.

20 Q. Oh, one more question. We're talking about
21 water infiltration. I presume that your concern is
22 water coming from above, not water coming from below.

23 A. (Dr. Bartlett) No, it's not coming from the
24 ground water.

25 Q. I wanted to get that clear.

1 we have talked about loss of shear strength due to
2 straining, due to cyclic motion. Some people use that
3 as collapse, too.

4 Q. Actually, it may sound like bragging, but I
5 was using the term the way you were, so --

6 A. (Dr. Bartlett) Fair enough. So if we're
7 restricting ourselves to collapsible soils in the sense
8 of wetting and collapse under static loads. There was
9 an RAI about this. I think our main concern was the
10 Eolian deposits. Those would be treated with soil
11 cement, and I assume that will fix that problem.

12 Q. I apologize. I was not paying attention but
13 looking at something else.

14 Let us move on Exhibit 3 to paragraph B on
15 top of page 85. I'm referring to the paragraph that
16 starts with the letter b and the caption "Sampling and
17 analysis." Going on to the second sentence, which I
18 believe the first sentence -- well, just going to the
19 second sentence.

20 A. (Dr. Bartlett) Okay.

21 Q. Starts with "However." Do you see that?

22 A. (Dr. Bartlett) Yes, I do.

23 Q. It says that "PFS's sampling program is not
24 adequate in quantity (number of samples)" --

25 A. (Dr. Bartlett) Correct.

1 A. (Dr. Bartlett) Sure. We have that
2 situation on buying beach front property.

3 Q. So that I understand one more aspect of your
4 concern about water, your concern is that the soils will
5 lose strength. Are you concerned that it will collapse
6 altogether?

7 A. (Dr. Bartlett) In the sense we're using
8 "collapse," I guess I'd better make sure you and I are
9 using "collapse" in the right terminology, if collapse
10 means something to me from --

11 Q. What collapse means to you, just to make
12 sure we're not talking past each other.

13 A. (Dr. Bartlett) Collapse -- we do have
14 collapsible soils in the west that are due to wetting
15 and -- either collapse upon just wetting, or wetting and
16 application of load, or just once in a while just the
17 application of a load. I believe the main layer of
18 concern for collapse was the Eolian silts.

19 Q. Layer 2 we were talking about?

20 A. (Dr. Bartlett) Layer 2 in my experience in
21 the Bonneville is not really characterized as a
22 collapsible soil. However, I must kind of reframe my
23 knowledge to the Bonneville as a collapsible soil to
24 this valley where it's saturated. But the Bonneville is
25 not known as a particularly collapsible soil. However,

1 Q. -- "and quality (suitable recovery of
2 disturbed and undisturbed samples)," and there is a
3 footnote, 20, which I'm not going to read, "to ensure
4 that all materials that are critical for geotechnical
5 evaluation of the site have been adequately sampled."

6 Is this a concern that's accurate today?

7 A. (Dr. Bartlett) As we still have issues
8 regarding the number of samples that have been
9 performed, particularly in regards to strength
10 characterization, and the quality of sampling --
11 "suitable recovery of disturbed and undisturbed
12 samples." Again, we've talked this morning about
13 disturbed versus undisturbed samples. In this context
14 "disturbed" I believe is meaning split spoon sampling,
15 and "undisturbed samples" would be for this case the
16 Shelby tube sample.

17 I'm not sure sample quality is a large issue
18 to us anymore, but certainly the number of samples and
19 how they represent the lateral variability of these
20 materials throughout the pad emplacement area and the
21 canister transfer building area are still issues.

22 Q. How about the suitable recovery of disturbed
23 and undisturbed samples? Is that unusual for you still?

24 A. (Dr. Bartlett) I think the recovery is --
25 you lose samples, but it seems like there's -- for a

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1 particular borehole that disturbed and undisturbed
2 samples were recovered and brought to the surface.

3 Q. Would it be correct if we -- to simplify
4 this discussion that as far as this paragraph is
5 concerned, your current area of concern is restricted to
6 the quantity of samples being sufficient?

7 A. (Dr. Bartlett) And how representative that
8 quantity --

9 MS CHANCELLOR: Could I clarify? Are you
10 talking about the entire paragraph or just the sentence?

11 MR. TRAVIESO-DIAZ: No, no, the sentence.

12 MS. CHANCELLOR: You said paragraph.

13 MR. TRAVIESO-DIAZ: I misspoke, as I tend to
14 do.

15 A. (Dr. Bartlett) The quality of the number of
16 the samples, and it implies there to ensure that all
17 critical materials have been properly represented and
18 evaluated. So it's an assessment of not only the
19 number, but is that number representative of the layer
20 in its entirety throughout the whole area of the pad
21 emplacement and canister transfer building.

22 Q. Fair enough. Now, could you describe a
23 little bit more what the concern is as to the number of
24 samples?

25 A. (Dr. Bartlett) There's been very limited

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1 variability in the lateral sense.

2 Q. You remember when we talked earlier about
3 the statement in the SER as to the number of samples
4 that were tested that you couldn't confirm?

5 A. (Dr. Bartlett) Sure.

6 Q. Could you give me today a number as to how
7 many more of each type of samples you believe would be
8 sufficient to make the sample program more adequate?

9 A. (Dr. Bartlett) My job is not really to
10 determine how well you should characterize. I am saying
11 right now I cannot make an assessment, based on the
12 current data that's presented, whether these represent
13 the soil properties throughout the emplacement area. So
14 I would advise you to go back and look at what your
15 potential variability is.

16 And there are still formal ways, they are
17 called geostatistical methods, in which you can decide
18 whether you have representative numbers of samples or
19 not. But it's key to what is your lateral variation.
20 And you have cone penetrometer data that suggest what is
21 your potential for lateral variation. We have not seen
22 any formal assessment of that data.

23 Q. In fact do you have a view as to whether
24 there's lateral variation --

25 A. (Dr. Bartlett) I do.

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1 sampling. Excuse me, not sampling. There's been very
2 limited number of specific samples tested to determine
3 shear strength properties and other types of engineering
4 properties. We discussed this morning about the number
5 of boreholes that should be required. We also believe
6 there should be a representative number of samples from
7 each borehole that are tested to fully characterize
8 this. We appear to be basing our design on a few tests,
9 very few tests that do not fully give us an idea of
10 what's the variability of this, particularly layer 2.

11 Q. So the record is clear: are you saying that
12 not enough samples were taken or that not enough samples
13 were tested?

14 A. (Dr. Bartlett) Both.

15 Q. And as to the first part, as to the not
16 enough samples were taken, how many more samples -- or
17 how would you go about determining how many more samples
18 you needed before you had an adequate sampling program?

19 A. (Dr. Bartlett) To answer that question, you
20 have to really go into statistics and understand the
21 variability and how many samples you have to take to
22 capture that variability.

23 Now, in highly variable sediments, you have
24 to take lots of samples. In homogeneous samples it's
25 not as much. But there is a formal method of assessing

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1 Q. -- across the site in terms of the soil
2 calculations?

3 A. (Dr. Bartlett) I do. That's why I prepared
4 the plots that we showed you yesterday -- gave you
5 yesterday.

6 Q. All right. And what is your view?

7 A. (Dr. Bartlett) In the critical layer, at
8 least for shear strength and sliding stability analysis,
9 and Dr. Ostadan might have other comments beyond mine,
10 that I try to get an understanding of the lateral
11 variability of tip resistance in the key layer, layer 2.

12 Maybe if I look at my plots I can tell you
13 roughly what those conclusions were about, what the
14 potential lateral variability may be.

15 MR. TRAVIESO-DIAZ: I wasn't listening. I'm
16 sorry. Can you read the answer back?

17 (The answer was read.)

18 Q. (By Mr. Travieso-Diaz) I'm sorry. When you
19 said "look at my plots" --

20 A. (Dr. Bartlett) Those were plots that I
21 prepared of -- kind of composite plots of the CPT data,
22 and they were provided yesterday.

23 Q. That's what I was trying to understand.

24 A. (Dr. Bartlett) The hand drawn --

25 Q. That's where I lost you.

1 MR. TRAVIESO-DIAZ: Just go off the record
2 for a second while we look for those.

3 Let's go back on the record.

4 I'm going to mark as Exhibit 59 a document
5 that I cannot identify because I didn't prepare it, but
6 I'm going to ask the witness to identify. I would say
7 for the record that it consists of one, two, three,
8 four, five, six, seven -- eight pages of plots, hand
9 plots, and also further state for the record that this
10 document was provided to me by Counsel for the state
11 yesterday.

12 (Exhibit 59 marked.)

13 And for the record, the reason they're not
14 colored is I couldn't get copies in color in the time we
15 had, so we're going through black and white copies.

16 Q. (By Mr. Travieso-Diaz) Now, could you
17 explain to us, identify what this Exhibit 59 is?

18 A. (Dr. Bartlett) These are the CPT data, and
19 plotted is the tip resistance. These are actually data
20 from the SAR that have been enlarged on a photocopier,
21 and then I traced over them with a pen. It's just a way
22 to try to see what is the variation from CPT to CPT
23 across -- I think all CPT's are represented here. At
24 least it goes to CPT-39. I did this roughly in groups
25 of five, because if you get too many lines it gets

1 reproduction of those plots.

2 Q. Well, you said by hand reproduction. How
3 did you do it?

4 A. (Dr. Bartlett) I simply took the plot,
5 enlarged it on the photocopier, then laid an overhead
6 transparency on top of it and traced down the tip
7 stress.

8 Q. All right. Now, let's take a look at the
9 first document in this package, which --

10 MS. CHANCELLOR: Could I just go on the
11 record? What Dr. Bartlett actually prepared were
12 transparencies, and what I gave you was a color photo of
13 the transparency because I couldn't reproduce this
14 transparency.

15 MR. TRAVIESO-DIAZ: Well, let me ask the
16 witness so that we know what's the best source.

17 Q. (By Mr. Travieso-Diaz) Would the best
18 source for the original copy of the record be the
19 transparency as opposed to the color copy?

20 A. (Dr. Bartlett) The best source of the
21 original?

22 Q. Yeah, the best --

23 A. (Dr. Bartlett) I would say the color
24 photocopies. I think they're adequate. I don't think
25 they've been distorted markedly.

1 difficult to even understand what they mean.

2 Maybe it would be easier to do this plot by
3 plot, if you so choose.

4 Q. Before we go plot by plot, let me see if we
5 can get some description in the record of how this
6 particular document was prepared. First, what was your
7 original source for the preparation of these plots?

8 A. (Dr. Bartlett) Your diagrams in the SAR,
9 CPT diagrams in the SAR.

10 Q. The diagrams, do you mean the foundation
11 plots that we looked at before?

12 A. (Dr. Bartlett) No, these came from
13 actually -- no, these did not come from the SAR. These
14 came from the ConeTec report. Excuse me. These were
15 the plots from the ConeTec and then enlarged on the
16 photocopier.

17 Q. And when you say "from ConeTec," again, for
18 the record, what is that you're talking about?

19 A. (Dr. Bartlett) The ConeTec report to
20 provide the cone penetrometer data.

21 Q. So this is taken from the report done by the
22 contractor that performed the cone penetration tests?

23 A. (Dr. Bartlett) That's correct.

24 Q. And this is a reproduction of those plots?

25 A. (Dr. Bartlett) This is -- yeah, hand

1 Q. Fine. Now, let us look at the first of
2 these sets of plots.

3 A. (Dr. Bartlett) Sure.

4 Q. For some reason, the way I have them, the
5 first one is for CPT-6 through 10.

6 A. (Dr. Bartlett) No. Actually, the first one
7 should be CPT-1 through 5.

8 Q. But the way that this document is numbered,
9 the first one that appears is 6 through 10. On my copy,
10 anyhow.

11 A. (Dr. Bartlett) Yeah, they're just out of
12 order.

13 Q. All right. So you are directing my
14 attention, then, to the last page of the exhibit?

15 A. (Dr. Bartlett) I always, just for some
16 reason, want to start at one.

17 Q. No problem. Just so the record is clear as
18 to what we're talking about.

19 A. (Dr. Bartlett) Let's go through the plot
20 leg with CPT-1 through 5, and it's in brown in the color
21 versions.

22 Q. Are all the plots in brown?

23 A. (Dr. Bartlett) All of the CPT-1 through 5
24 are all plotted in brown, yes.

25 Q. So you don't lose any quality just by having

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1 black and white?

2 A. (Dr. Bartlett) No, I wouldn't think so.
3 For our discussion it doesn't matter.

4 Q. Now, tell me, what were you seeking to
5 accomplish in preparing this plot? Starting with the 1
6 on the last page of the exhibit.

7 A. (Dr. Bartlett) What I was trying to
8 accomplish is understand kind of in a composite plot
9 sense what are the ranges of tip stresses -- in layer 2
10 predominantly is where I was focusing my attention --
11 which varies, but can be roughly from three feet to
12 eight to ten feet down.

13 Q. Okay. Now we need more clarification on the
14 record. You have plotted on the vertical axis distances
15 that, as I read them, are zero, 5 feet, 10 feet, 15
16 feet?

17 A. (Dr. Bartlett) Right. Those are depths
18 below the ground surface.

19 Q. So ground would be zero?

20 A. (Dr. Bartlett) Ground would be zero.

21 Q. And 5 would be 5 feet below ground?

22 A. (Dr. Bartlett) Correct.

23 Q. And your testimony a moment ago is that,
24 while you were concerned with layer 2, that would be
25 where on this plot?

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1 plot, if we look -- and, again, there's uncertainty with
2 the thickness of the line, admittedly. This is the only
3 color markers I had that work on transparencies, and it
4 was important to me not only to look at one individual
5 group, but I wanted to be able to superimpose different
6 groups upon each other through the transparencies.

7 But if we look at this first one, CPT-1
8 through 5, at approximately three feet down just right
9 underneath the silt layers, the low tip stress -- we're
10 in units, so it looks like it must be -- 75 divided by
11 5 -- 15's. Anyway, we're in units of 15 TSF for each
12 mark on this plot. And you can see a trace there at
13 approximately 3 to 5 feet that has a tip stress slightly
14 lower, around 15 PSF.

15 At the other side in that same three- to
16 five-foot interval, we can see a layer that's picking
17 up -- well, it has a resistance maybe more on the order
18 of 40 -- excuse me, not 40. About 30, maybe slightly
19 higher than 30. So that tells me that the tip stresses
20 in that zone could vary by a factor of approximately 2.

21 Q. Okay. You're talking specifically at the
22 width, if you will, that lies between the lowest edge on
23 the left side of your plot and the highest or the one at
24 extreme right of the plot for viewing depth?

25 A. (Dr. Bartlett) I'm trying not to look at

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1 A. (Dr. Bartlett) For the first plot it looks
2 like it's about -- beginning about three feet and ending
3 somewhere around 10 feet.

4 Q. All right. So it's three to ten?

5 A. (Dr. Bartlett) Three to ten, approximately.

6 Q. Now, tell me what information you gathered
7 by preparing this plot. What did you learn?

8 A. (Dr. Bartlett) First we can begin to see,
9 at least for these five cone penetrometers which have
10 been superimposed on each other, the beginning of the
11 ranges of tip stresses in layer 2.

12 Q. And where in that particular figure, which
13 is CPT-1 through 5, are you looking at? You're looking
14 at what ranges of vertical location?

15 A. (Dr. Bartlett) In the vertical location
16 we're looking still at the interval between 3 and 10
17 feet.

18 Q. And the horizontal location, what do you
19 see? The horizontal I believe is pressure in tons per
20 square foot. Is that it?

21 A. (Dr. Bartlett) Pressure is fine. Tip
22 stress, yes.

23 Q. Tip stress, okay. And just describe for me
24 what you learned or what you believe this plot shows.

25 A. (Dr. Bartlett) Well, for this particular

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1 the edge of the lines, because this is a fat marker. So
2 I'm looking at more the center of the line to the far
3 left, and I'm looking somewhat at the center of the line
4 to the far right through that interval.

5 Q. All right. Let's just take one particular
6 location so we have it on the record clear. Let's take
7 the location of 5 feet.

8 A. (Dr. Bartlett) Fair enough.

9 Q. All right. Read me what you believe this
10 plot shows in terms of the range or value of TSF for the
11 various CPT's.

12 A. (Dr. Bartlett) Again, about 15 TSF, and
13 they're just slightly less than 30.

14 Q. Okay. You go down, say, to -- you come to a
15 point of 7 feet.

16 A. (Dr. Bartlett) I see that.

17 Q. Okay. What's the variability there?

18 A. (Dr. Bartlett) It's a little bit less
19 there. It's probably just slightly greater than 15 TSF,
20 and maybe on the order of 25 TSF to the higher range.

21 Q. And going to the location of 10 feet, what
22 do you see there?

23 A. (Dr. Bartlett) The lower bound is picked up
24 again. It's probably now higher than 15 TSF, maybe
25 approximately 20 PSF. That's the lower bound. The

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1 upper bound is 25 TSF.
2 Q. All right. One more question as far as
3 understanding the plot. When you say CPT-1 through 5 --
4 A. (Dr. Bartlett) Correct.
5 Q. -- you are talking about specific locations
6 of cone penetrometer tests?
7 A. (Dr. Bartlett) That's correct.
8 Q. And if we wished to figure out where
9 this were, could we go to one of the earlier exhibits
10 and try to --
11 A. (Dr. Bartlett) Yes. They should correspond
12 to the plan view that shows the CPT location.
13 Q. Why don't you look with me at Exhibit 52.
14 And I think you want to look at the last figure on that
15 page, Figure 2.6-19.
16 A. (Dr. Bartlett) Okay, found it. Last page.
17 Q. Exhibit 52 has three pages, and the last one
18 is labeled Figure 2.6-19.
19 A. (Dr. Bartlett) We're referring to Figure
20 2.6-19 of the --
21 Q. Correct.
22 A. (Dr. Bartlett) Okay.
23 Q. Is this a plot that will give you the
24 location of the various cone penetration tests?
25 A. (Dr. Bartlett) Yes.

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1 Q. And the one that is listed -- the ones that
2 are listed here, CPT-1 through 5 --
3 A. (Dr. Bartlett) Correct.
4 Q. -- would be the ones that are in this
5 Exhibit, the Figure 2.6-19, where?
6 A. (Dr. Bartlett) CPT-1 is down in the lower
7 right-hand corner of the -- it would be the southeast
8 quadrant of the pad.
9 Q. So it would be the southeast edge of the
10 pad?
11 A. (Dr. Bartlett) Yeah.
12 Q. Assuming that north is looking up, which I
13 believe is the case.
14 A. (Dr. Bartlett) That's true. There is a
15 north symbol here, and it is up.
16 Q. And CPT-5 would be not quite in the
17 northeast edge but one layer below, if you will, along
18 the lines that are marked 2 to 2'?
19 A. (Dr. Bartlett) Correct. It's in the
20 northeast quadrant on the far east side about in the
21 middle.
22 Q. All right. So you could correlate these
23 various plots that you have made in Exhibit 59 to
24 locations in Figure 2.6-19?
25 A. (Dr. Bartlett) Yeah, one could correlate.

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1 Q. Okay. In case someone wanted to do it,
2 that's the way they would do it?
3 A. (Dr. Bartlett) That's the way they would do
4 it.
5 MS. CHANCELLOR: Could we go off the record
6 for a minute?
7 MR. TRAVIESO-DIAZ: Yes.
8 (Discussion off the record.)
9 Q. (By Mr. Travieso-Diaz) So my question, now
10 that we know what you did, would you tell me what
11 interpretation you made of this first figure, this
12 figure -- let me clarify for the record. The last of
13 the pages in Exhibit 59, which is the one that has the
14 plots for CPT-1 through 5.
15 A. (Dr. Bartlett) The reason I did this was to
16 first understand the potential variability across the
17 full pad emplacement area of the CPT data, particularly
18 in layer 2.
19 There were no really composite plots
20 prepared in the SAR, and I had to kind of try to get a
21 feel for that, so I just did that myself.
22 The reason why I did this is, we talked
23 yesterday that undrained shear strength is and has been
24 correlated with the tip resistance from the cone
25 penetrometer. So somewhat in a relative sense, we can

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1 say that an increase in tip resistance by a factor of 2
2 should correspond to a factor of 2 increase in the
3 undrained shear strength.
4 Q. Before you go on, let me see if I understand
5 your testimony. Are you saying that there is a linear
6 relationship between tip strength, if you will, or tip
7 resistance and strength of the sample of the soil?
8 A. (Dr. Bartlett) Yes.
9 Q. And it's linear, as far as you know?
10 A. (Dr. Bartlett) Yes.
11 Q. Do you have any -- can you cite to any
12 reference or any source for that belief?
13 A. (Dr. Bartlett) Yes. The EPRI manual that
14 we discussed this morning does discuss those
15 correlations.
16 Q. And it's a linear relation?
17 A. (Dr. Bartlett) Yes.
18 MR. TRAVIESO-DIAZ: Why don't we break now.
19 (Deposition was adjourned at 6:42 p.m.)
20 * * *
21
22
23
24
25

Deposition of: Dr. Steven F. Bartlett & Dr. Farhang Ostadan
Taken: November 16, 2000

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C E R T I F I C A T E

State of Utah)
ss.
County of Utah)

I, Vicky McDaniel, a Certified Merit
Reporter and Notary Public in and for the State of Utah,
do hereby certify:

That the deposition of Dr. Steven F.
Bartlett and Dr. Farhang Ostadan, the witnesses in the
foregoing deposition named, was taken on Thursday,
November 16, 2000, and that said witnesses were by me,
before examination, duly sworn to testify the truth, the
whole truth, and nothing but the truth in said cause;

That the testimony of said witnesses was
reported by me in stenotype and thereafter transcribed
into typewriting and that a full, true, and correct
transcription of said testimony so taken and transcribed
is set forth in the preceding pages;

That the same constitutes a true and correct
transcription of said testimony so taken and transcribed
and that the said witnesses deposed and said as in the
foregoing annexed deposition.

I further certify that I am not of kin or
otherwise associated with any of the parties of said
cause of action and that I am not interested in the
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WITNESS MY HAND and OFFICIAL SEAL at Salt Lake
City, Utah, this 28th day of November, 2000.

Vicky McDaniel, RMR
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Case: In the Matter of Private Fuel Storage
Docket No.: 72-22-ISFSI
Reporter: Vicky McDaniel
Date taken: November 16, 2000

WITNESS CERTIFICATE

I, Farhang Ostadan, HEREBY DECLARE:

That I am the witness referred to in the
foregoing testimony; that I have read the transcript and
know the contents thereof; that with these corrections I
have noted, this transcript truly and accurately
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PAGE-LINE CHANGE/CORRECTION REASON

No corrections were made.

Farhang Ostadan

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Docket No.: 72-22-ISFSI
Reporter: Vicky McDaniel
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No corrections were made.

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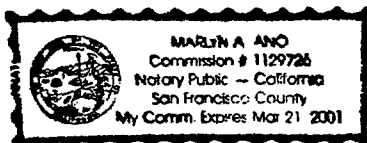
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100 - 16	change linearity to nonlinearity	correction
102 - 2	change and to as a	transcription error
102 - 3	change strength to strain	transcription error
102 - 3	change linear to nonlinear	transcription error
102 - 7	change strength to strain	transcription error
107 - 1	change 30 to upper 30	transcription error
107 - 2	change test to test	type
118 - 5	change 371 to 3.7.1	transcription error
118 - 5	change 372 to 3.7.2	transcription error
118 - 8	change competence to competent	transcription error
128 - 23	change out to NRC	transcription error
128 - 24	change 271 to 3.7.1	transcription error
129 - 5	change margin to modulus	transcription error
129 - 17	change set to soil	transcription error

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Farhang Ostadan
 Farhang Ostadan

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Marilyn A. Ando

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 Docket No.: 72-22-ISFSI
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Page 226-13	change KSE to ABCE	transcription error
page 262-4	change zero to and	transcription error
page 282-12	change simplify to simply	transcription error
page 283-18	change gadget to graduate	transcription error
page 288-3	change a stiffer to stiffer	transcription error
page 288-3	change wetter to weathered	transcription error
page 290-17	change retrofitted to retrofitted	transcription error
page 324-5	change an appropriate to inappropriate	transcription error
page 341-22	change cause to pulse	transcription error
page 349-3	change P to calculations	transcription error
page 349-5	change has stuff that to point	transcription error
page 356-11	change really to displacement	transcription error
page 357-6	change color to color	transcription error
page 359-16	change concentration to consideration	transcription error

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 Docket No.: 72-22-ISFSI
 Reporter: Vicky McDaniel
 Date taken: November 16, 2000

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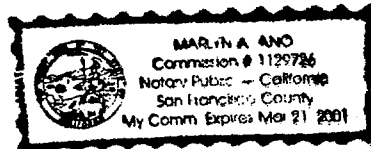
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PAGE-LINE	CHANGE/CORRECTION	REASON
Page 360-15	change cooperation to consideration	transcription error
Page 361-25	change dash part to dash parts	transcription error
Page 362-1	change dash part to dash parts	transcription error
Page 362-7	change was to a	transcription error
Page 366-7	change this to the least	transcription error
Page 371-2	change case to case	transcription error
Page 461-23	change incline to inclined	transcription error

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Deposition of: Dr. Steven F. Bartlett & Dr. Farhang Ostadan
Taken: November 16, 2000

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Taken: November 16, 2000

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Taken: November 16, 2000

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CitiCourt
(801) 532-3441

19,20 - zones

CONDENSED TRANSCRIPT

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
)

) Deposition of:

) DR. STEVEN F. BARTLETT and

) DR. FARHANG OSTADAN
)

) Vol. II
)

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

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

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



CitiCourt
THE REPORTING GROUP

50 South Main, Suite 920
Salt Lake City, Utah 84144

801.532.3441

TOLL FREE 877.532.3441

FAX 801.532.3414

SHEET 1

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

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

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Notary Public in and for the State of Utah

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A P P E A R A N C E S

For the Intervenor: Denise Chancellor, Esq.
ASSISTANT ATTORNEY GENERAL
Office of the Attorney General
160 East 300 South, 5th Floor
Salt Lake City, UT 84114-0873

For the Applicant: Mattias F. Travieso-Diaz, Esq.
SHAW PITTMAN
2300 N. Street, NW
Washington, D.C. 20037-1128

Also Present: Barry J. Solomon, Thomas Y. Chang,
Paul Trudeau

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P R O C E E D I N G S

DR. STEVEN F. BARTLETT

and

DR. FARHANG OSTADAN,

having previously been duly sworn to tell the truth,
were examined and testified as follows:

EXAMINATION (Continued)

BY MR. TRAVIESO-DIAZ:

MR. TRAVIESO-DIAZ: Good morning, gentlemen.

DR. BARTLETT: Good morning.

Q. I will address the next few questions to
Dr. Ostadan. Dr. Ostadan, what is your position and
employer?

A. (Dr. Ostadan) Bechtel.

Q. And what's your position?

A. (Dr. Ostadan) I'm a chief engineer at
Bechtel.

Q. And chief engineer in any particular area?

A. (Dr. Ostadan) Geotechnical engineering
department.

Q. Are you familiar with the PFS project?

A. (Dr. Ostadan) Yes. I have read the
documents.

Q. What is the source of your familiarity?

A. (Dr. Ostadan) I have read the SAR, some of

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the supporting calculations. Participated in discovery, answering questions and responding to questions, RAI's, and discussion with some of the experts retained by state.

Q. When did you become involved with the PFS project?

A. (Dr. Ostadan) In approximately summer of '99.

Q. And for what purpose were you retained?

A. (Dr. Ostadan) I think the state retained me for my personal expertise and experience as it relates to seismic design and foundation loading.

MR. TRAVIESO-DIAZ: I think this may be a good point for me to state for the record, although I have said it before, and this is no disrespect intended to you, Dr. Ostadan, that I am going to object to all matters relating to seismic design, foundation loads, soil-structure interactions, and related matters because I believe they're outside the scope of Contention L. And in my asking questions of Dr. Ostadan or his answering the questions does not constitute an admission on my part that this matter is relevant.

MS. CHANCELLOR: From the state's perspective, we have a disagreement with PFS as to the scope of Contention L, and we believe that seismic

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designs and foundation loadings are contained within the contention, and your comment is noted.

MR. TRAVIESO-DIAZ: We have agreed to disagree on this.

MS. CHANCELLOR: That's right.

Q. (By Mr. Travieso-Diaz) Do you have before you, or maybe you had it a moment ago, Exhibit 3.

A. (Dr. Ostadan) Yes, I do.

Q. Do you recall, there were a number of questions about Exhibit 3 yesterday. Rather than repeating them in detail, let me ask you, you remember the discussion we had about Basis 3 of Contention L which is in Exhibit 3? Basis 3 goes from page 83 to page 92.

A. (Dr. Ostadan) I can't say I remember everything, but I remember some of it.

Q. My question is rather simple: are you the author of any part of that section of Contention L?

A. (Dr. Ostadan) No, I'm not.

Q. Okay. In discharging your role as an expert witness, you mentioned some of the things that you have been reading. But specifically to the charge of your role as an expert, what documents have you reviewed?

A. (Dr. Ostadan) I think I certainly reviewed Chapter 2 of the SAR. All sections that discuss,

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present the results of calculation with respect to the seismic analysis, stability analysis of the foundation. And as I mentioned, the supporting calculation, number of calculations by Geomatrix consultants. Zero calculation by Stone & Webster. I believe one calculation by a civil engineering consultant. Calculation by Boltec. And there maybe one or two that I don't remember.

Q. When you referred to those calculations, are you aware that some of those calculations have been updated periodically since 1997 when Contention L was presented?

A. (Dr. Ostadan) Yes, I am aware of that.

Q. And you have sought to keep yourself up to date with the latest revisions and so on?

A. (Dr. Ostadan) Yes. I have reviewed the latest revision of the calculations.

Q. All right. As we discussed yesterday, you also reviewed the SER that was issued by NRC staff in October?

A. (Dr. Ostadan) Well, this was issued very recently, and I was busy preparing for this deposition. I glanced through it. I didn't really study it in depth.

Q. Now, you mentioned that you took part in

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preparing discovery, both questions and answers?

A. (Dr. Ostadan) Yes, I did.

Q. Do you recall what discovery issues you were involved with?

A. (Dr. Ostadan) Well, again, in my area of expertise, again, issues related to seismic design, foundation loading.

A. (Dr. Ostadan) This wasn't meant to test your memory. Let me show you something that is already in the record as Exhibit 10, and I will identify what it is so that I know it's on the record.

For the record, Exhibit 10 is called State of Utah's Objections and Responses to Applicant's Second Set of Discovery Requests with Respect to Groups II and III Contentions. It is dated June 28th, 1999.

Would you review Exhibit 10 and tell me whether you were involved in the preparation of any portion of this exhibit.

Do you have a copy?

MS. CHANCELLOR: I think it would be helpful for Dr. Bartlett to have a copy.

Q. (By Mr. Travieso-Diaz) Dr. Ostadan, while you're reviewing the exhibit, may I direct your attention to the last page of Exhibit 10, which might be of help to you.

1 A. (Dr. Ostadan) Okay.
 2 Q. Is the last page of Exhibit 10 an affidavit
 3 by Dr. Farhang Ostadan?
 4 A. (Dr. Ostadan) Yes, it is.
 5 Q. Is that you?
 6 A. (Dr. Ostadan) That is me.
 7 Q. So you signed that affidavit?
 8 A. (Dr. Ostadan) Yes, I did.
 9 Q. And that affidavit makes reference with
 10 respect to Exhibit 10 to discovery requests limited to
 11 soil dynamics and soil-structure interaction. Do you
 12 see that in the fourth and fifth line of the text of the
 13 affidavit?
 14 A. (Dr. Ostadan) I see it.
 15 Q. Would that be of help to you figuring out
 16 what portions of Exhibit 10 you were involved with?
 17 A. (Dr. Ostadan) Yes. If you'd like me to go
 18 through this document and point out specifically.
 19 Q. Yes. I would like to know which areas you
 20 contributed to so I don't burden you asking you things
 21 you didn't contribute to.
 22 A. (Dr. Ostadan) Let me have some moments
 23 here. This is a fairly thick document.
 24 MR. TRAVIESO-DIAZ: Steve, I'm going to be
 25 asking the same thing, so if you want to take time now

1 to look at it.
 2 A. (Dr. Bartlett) Okay.
 3 (Witnesses review document.)
 4 A. (Dr. Ostadan) Well, I'm going to have a
 5 long answer for you. As I have mentioned, I have
 6 discussed some of the issues discussed in this document
 7 with other witnesses or experts retained by the state,
 8 and my input has been either directly or indirectly
 9 affected.
 10 With respect to page 54, paragraph F, I
 11 recall discussion along those lines, although I do not
 12 claim to be the author of this paragraph, but I have
 13 expressed a view, my opinion on this subject.
 14 Q. May I interrupt for a second?
 15 A. (Dr. Ostadan) Sure.
 16 Q. Who is the author of F, if you recall?
 17 A. (Dr. Ostadan) I do not recall. I would
 18 suspect it's perhaps Dr. Arabasz.
 19 Q. Okay. I'm sorry. Please go on.
 20 MS. CHANCELLOR: Could I clarify one thing?
 21 When you said "authored," I mean, this was authored by
 22 an attorney.
 23 Q. Okay, let me just clarify my last question,
 24 and perhaps that will change the answer or not. The
 25 main technical contributor to providing the substantive

1 information that went to form the item F. Does that
 2 change your answer? I'm sorry. Maybe you were too
 3 intent.
 4 A. (Dr. Ostadan) I'm sorry.
 5 MR. TRAVIESO-DIAZ: Could you repeat the
 6 last question that I asked in clarification to my
 7 previous one?
 8 (The record was read.)
 9 A. (Dr. Ostadan) Again, I do not know who
 10 authored this writing, but I would not say I am the main
 11 contributor.
 12 Q. Okay. I'm sorry. Please go on.
 13 A. (Dr. Ostadan) Sure. Okay. On page 55-I, I
 14 think I am the main contributor. Page 56-J, I certainly
 15 contributed. I don't know how to give the credit as to
 16 who's the main one here. I share the view being
 17 expressed here. All right.
 18 On the same page, 56-K, yes, this is one of
 19 my comments. Page 57-L is my comment. 58-M, my
 20 comment. 58-N is my comment. 58-O is my comment.
 21 59-P, my comment. And P is a fairly long section. 62-R
 22 is my comment.
 23 Q. I'm sorry. Did you overlook Q, or is that
 24 not your comment?
 25 A. (Dr. Ostadan) I'm sorry. Yes, this is my

1 comment too.
 2 Q. Thank you.
 3 A. (Dr. Ostadan) S is my comment. T is my
 4 comment. U is my comment. V is my comment. W, my
 5 comment. X is perhaps a joint comment with
 6 Dr. Bartlett, and it basically talks about the capacity,
 7 so I suspect that he's the main author. Y is my
 8 comment. Z is my comment. Now we are at AA. It's my
 9 comment.
 10 Q. And that's on page 65?
 11 A. (Dr. Ostadan) 65, yes. AB is my comment.
 12 AC is my comment. AD is my comment. AE is my comment.
 13 AF is my comment. AG is my comment. AH is my comment,
 14 AI is my comment.
 15 Q. And those are on page 68?
 16 A. (Dr. Ostadan) That's correct. AJ is my
 17 comment. AK is my comment, AL is my comment.
 18 Q. And now we're on page 69?
 19 A. (Dr. Ostadan) That is correct. AM is my
 20 comment, AN is my comment. AO on page 70, my comment.
 21 AQ is my comment.
 22 Q. I'm sorry. Did you overlook AP?
 23 A. (Dr. Ostadan) I'm sorry. AP is my comment.
 24 I already stated AQ is my comment. AR is my comment.
 25 AS, I don't recall. It might have been a joint comment

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1 with Dr. Bartlett.

2 Q. Would Dr. Bartlett have been the main
3 contributor?

4 A. (Dr. Bartlett) As I recall, we both
5 discussed this, so I guess --

6 Q. 50-50?

7 A. (Dr. Bartlett) We jointly authored this.

8 Q. All right.

9 A. (Dr. Bartlett) I can't remember who brought
10 it up first.

11 A. (Dr. Ostadan) I can see on page 71, I don't
12 think I contributed to this. Page 72, I don't recognize
13 anything I have done. Same thing on 73. I don't
14 recognize my contribution. 74, I don't recognize my
15 contribution. Same applies to 75. 76, I don't
16 recognize I have done anything. Same for page 77. Same
17 for 78. And then we get to the affidavit section.

18 Q. You started your listing with item F, as I
19 recall, and item F was on page 51. Does that mean that
20 you didn't contribute to anything that preceded item F,
21 from the early part of the document that we didn't talk
22 about?

23 A. (Dr. Ostadan) I don't recognize any portion
24 that I have contributed. I might have participated in
25 some discussion and indirectly contributed, but I don't

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1 recognize any specific piece I have written.

2 Q. Now, to clarify the record as to one minor
3 point. Item F that you referred to, which, if I recall,
4 starts on page 55 -- no, 54, right?

5 A. (Dr. Ostadan) Yes.

6 Q. Is that item F part of a series of answers
7 to an interrogatory or question that starts on page 51?
8 Will you take a look?

9 A. (Dr. Ostadan) No. 8?

10 Q. Yes. Is that it?

11 A. (Dr. Ostadan) Well, it refers to No. 1
12 through 7.

13 Q. Let me read it for the record. The sentence
14 that I'm referring to is in the middle of page 51, and
15 it is labeled Interrogatory No. 8 on Utah L column.
16 "Identify and fully explain any other deficiencies, not
17 set forth in response to Interrogatory Nos. 1-7 above,
18 claimed by the State in the geological, geotechnical or
19 seismic analysis of the PFS site conditions, and the
20 bases therefore." Is it your understanding that the
21 input you provided starting on 54-F is part of the
22 answer to the interrogatory?

23 A. (Dr. Ostadan) I think it could be, because
24 it refers to 1 through 7, and there's a fairly general
25 discussion of a lot of issues here. So I can't be

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1 certain, frankly. It could be.

2 Q. Let me ask you the following. You said --
3 this document is dated June 28th, 1999. Is that
4 correct?

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

6 Q. And your affidavit on the last page is dated
7 June 15, '99?

8 A. (Dr. Ostadan) Yes.

9 Q. And you've testified that you have sought to
10 keep yourself up to date with respect to calculations
11 and other documents prepared by applicant from time to
12 time?

13 A. (Dr. Ostadan) Yes, I have.

14 Q. Is there any of the items that you have
15 referred to in your previous answer, starting with F on
16 page 54, that doesn't need to be modified in any way as
17 a result of what may have transpired between June '99
18 and today?

19 A. (Dr. Ostadan) Yes. I can visit these items
20 one by one. I don't know how much level of detail you
21 would like me to give you. It could be a very long
22 answer.

23 Q. Well, I'll tell you what. What I was
24 seeking is if, for example, you refer in any of these
25 items to a calculation that doesn't exist anymore or

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1 whatever, it would be helpful to know that perhaps what
2 was said then, it doesn't apply today.

3 Well, rather than doing it that way, why
4 don't we wait until we hit each of them, and then we'll
5 figure out whether in fact it needs to be modified.

6 A. (Dr. Ostadan) Very well. As you wish.

7 Q. Dr. Bartlett, could you do the same thing
8 for me? I take it that you contributed to the answers
9 provided with respect to Exhibit 10?

10 A. (Dr. Bartlett) Yes, I did.

11 Q. Could you tell us for the record what
12 portions you were the author on? I'm using the author
13 in the sense that I described earlier.

14 A. (Dr. Bartlett) Provided the technical
15 content for the answer.

16 Q. Exactly.

17 A. (Dr. Bartlett) I had some input to the
18 response to Interrogatory 3 on page 28.

19 Q. Excuse me. Which portion of Interrogatory
20 3?

21 A. (Dr. Bartlett) The response to
22 Interrogatory 3.

23 Q. I'm sorry. I didn't ask the question
24 properly. I see that the response to Interrogatory 3 --

25 A. (Dr. Bartlett) Oh, excuse me.

1 Q. -- has a number of subparts.
 2 A. (Dr. Bartlett) "A" subpart.
 3 Q. "A," okay. But I take it there was somebody
 4 else that provided the main technical content for the
 5 answer?
 6 A. (Dr. Bartlett) This was a discussion
 7 amongst the team at the time. Yeah, there were several
 8 people contributing to this response.
 9 Now I'm on page 40. I am the author --
 10 well, not the author. I contributed to the main
 11 technical content of the response to Interrogatory
 12 No. 5, the general response A, part B, C, D, E, F, G, E,
 13 I, J, K. Response to Interrogatory 6, part A, B, C.
 14 Response to Interrogatory No. 7, part A, part B.
 15 Response to Interrogatory No. 8, part A, part B, part C,
 16 D.
 17 I think from there I think it's joint.
 18 These are mainly Dr. Ostadan.
 19 Q. Will you look on page 54 at item E. I
 20 didn't see you mention that.
 21 A. (Dr. Bartlett) I believe we both discussed
 22 this part.
 23 A. (Dr. Ostadan) I believe I have parts in
 24 this discussion with E, yes.
 25 Q. Was either of you the main technical author

1 of E, or was there somebody else?
 2 A. (Dr. Bartlett) This is probably mostly
 3 Dr. Ostadan's, as I read it, based on his experience
 4 with North Ridge.
 5 A. (Dr. Ostadan) Yes.
 6 Q. Now, Dr. Ostadan, is there any other
 7 interrogatories --
 8 A. (Dr. Bartlett) I had some I guess inputs to
 9 the response to document requests. I'm not sure if you
 10 would be interested in those or not.
 11 Q. Let's skip those for the moment.
 12 Dr. Ostadan, have you provided input to the
 13 response to any other interrogatories that you recall?
 14 A. (Dr. Ostadan) Yes, I might have.
 15 Q. Well, to make the discussion go easier, I
 16 have two documents here, which are also exhibits that
 17 have been previously introduced, which are Exhibits 12
 18 and 13. No. 12 is the State of Utah's Objections and
 19 Responses to Applicant's Fourth Set of Discovery
 20 Requests to Intervenor's State of Utah and Confederated
 21 Tribes, dated January 31st, 2000. And the second
 22 document is Exhibit 13 called State of Utah's Objections
 23 and Response to Applicant's Fifth Set of Discovery
 24 Requests to Intervenor's State of Utah and Confederated
 25 Tribes. I will hand these documents to you, but before

1 I ask you to look at them, let me ask you a more general
 2 question.
 3 Is it your practice or has it been the
 4 practice of the state in answering these interrogatories
 5 to provide affidavits of the witnesses who provide input
 6 in the preparation of the interrogatories? In other
 7 words, you have provided input to the answers to these
 8 interrogatories, you have provided an affidavit to so
 9 state?
 10 MS. CHANCELLOR: For the record, I'll
 11 object. Dr. Ostadan may not know what the practices for
 12 the state. He can answer to the extent that he knows
 13 from his experience.
 14 MR. TRAVIESO-DIAZ: I'm trying to, for the
 15 record again, to avoid having an extended discussion of
 16 a document he may not have been a contributor to.
 17 MS. CHANCELLOR: If you want, I can
 18 stipulate that when an expert has been involved we have
 19 asked for an affidavit.
 20 MR. TRAVIESO-DIAZ: That's very helpful.
 21 Q. (By Mr. Travieso-Diaz) So what I'm going to
 22 ask you, Dr. Ostadan, is to look at these two documents
 23 together since they were filed simultaneously on the
 24 same date, and ask you whether you find an affidavit for
 25 you with respect to either of them.

1 A. (Dr. Ostadan) I'm looking at Exhibit 12
 2 now.
 3 Q. Do you find any affidavits attached to
 4 Exhibit 12?
 5 A. (Dr. Ostadan) I'm looking through. No, I
 6 do not see anything in my exhibit here.
 7 Q. Would you look at No. 13 now and see if
 8 there's any affidavits.
 9 A. (Dr. Ostadan) Okay, I'm looking at No. 13
 10 now.
 11 Q. Yes, please.
 12 MS. CHANCELLOR: Did Dr. Ostadan state that
 13 there wasn't an affidavit from him on Exhibit 12?
 14 MR. TRAVIESO-DIAZ: He actually stated there
 15 were no affidavits whatsoever.
 16 DR. OSTADAN: I didn't see that in this.
 17 MR. TRAVIESO-DIAZ: Excuse me. There was an
 18 affidavit from you, perhaps, from counsel.
 19 MS. CHANCELLOR: No, from Dr. Ostadan.
 20 MR. TRAVIESO-DIAZ: On 12? My copy doesn't
 21 have it.
 22 MS. CHANCELLOR: My copy has one.
 23 MR. TRAVIESO-DIAZ: Well, that's
 24 interesting.
 25 MS. CHANCELLOR: These are copies of the --

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DR. BARTLETT: Well, let's re-count them.

MR. TRAVIESO-DIAZ: Maybe I've got an incomplete copy. Can we go off the record for a second? (Discussion off the record.)

MR. TRAVIESO-DIAZ: While we were off the record we established that the copy of Exhibit 12 that I handed the witness did not have what appears to be an affidavit by him, which was in the copy in the hand of the state's counsel. So I am going to repeat my question to Dr. Ostadan with respect to Exhibits 12 and 13. He's now using the copy provided by the state, and ask him first whether there's an affidavit from him on either of Exhibit 12 or Exhibit 13, and if there is, to go through the appropriate exhibit and tell me which portions he contributed to.

A. (Dr. Ostadan) With respect to Exhibit 12, yes, I do have affidavit.

MS. CHANCELLOR: Excuse me. Could I have just a copy so I can look at -- it doesn't matter if it doesn't have the affidavits. Am I taking your copy?

MR. TRAVIESO-DIAZ: I should have a copy here. Yeah, let me look. Yeah, I have other copies here.

A. (Dr. Ostadan) With respect to 13, I do not see any affidavits by me. I'm going over Exhibit

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No. 12, see which part has been done by me. On page 3 I provided my name and address.

I think on page 28, the strain rate of soil, bottom of the page, I recall some discussion with Dr. Bartlett. And I don't think I wrote this. He might have.

On page 30, factor of safety against sliding, again, I do recall discussion with Dr. Bartlett. I think he probably authored this.

On page 32, factor of safety against sliding of the pads, I do recall a discussion with Dr. Bartlett again. I don't remember who ended up writing this.

Q. Excuse me. Before we go on, there is another caption or paragraph on page 32 called "Factor of safety against bearing capacity."

A. (Dr. Ostadan) Yes, I did not. I'm only pointing out that the part that I either have directly or indirectly contributed to.

Q. Okay. I'm sorry.

A. (Dr. Ostadan) I don't recall any other portion.

Q. All right. Dr. Bartlett, let's go to Exhibit 12, as long as we're talking about it. Will you confirm or modify the sections that were mentioned that you contributed to?

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A. (Dr. Bartlett) Yeah, let's just go through them.

Q. All right.

A. (Dr. Bartlett) I see my affidavit. Going to page 26, requests for admission, response to admission 1, request No. 1. Response to request No. 2. Response to request No. 3, 4, 5, 6, 7, 8. Interrogatory No. 2. I'm not reading this right. Excuse me. Response to Interrogatory No. 1 on page 28, strain rate of soil, undrained shear strength. Factor of safety against bearing capacity and sliding I think we did discuss together. This is my writing, or at least main technical contributor to this. Settlement, soil cement.

On page 34 under the heading "Response to Interrogatory No. 2," I recognize some of my input to this, because I do see discussions of seismic analyses, depth to bedrock, collapsible soils mentioned there.

Q. Were you the main contributor to the response that appears to start on page 34 and goes on for --

A. (Dr. Bartlett) No. This then again appears to discuss data acquisition for the Bay Geophysical and Geomatrix interpretation. That does not appear. I would not be confident doing that. No, I don't recognize anything from here on out.

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Q. All right. And this question now is addressed to both of you. Would you go through Exhibit 13 and determine whether there's any portion that you contributed to.

(Witnesses review documents.)

A. (Dr. Ostadan) With respect to Exhibit 13, I don't believe I have any input.

Q. Thank you. How about you, Dr. Bartlett?

A. (Dr. Bartlett) Just a moment.

Q. Sure.

(Witness reviews documents.)

A. (Dr. Bartlett) Okay. I had some contribution to Response to Admission Request No. 2.

Q. Pardon me. So that the record is clear: where are you reading from?

A. (Dr. Bartlett) Page 6.

Q. Were you the main contributor to that response?

A. (Dr. Bartlett) No. I think there was some discussions about -- let's see -- I just recall a phone call on this, because the issue brought in the buildings and structures. And I can't remember really, frankly, who authored it. I do remember a phone call.

Q. But it was somebody else who authored that?

A. (Dr. Bartlett) I believe so. I just

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1 remember discussions about it.

2 Let's see. Response to Admission Request
3 No. 3, that appears to be my main contribution there.
4 It's mine.

5 Response to Admission Request No. 6, 7, 8,
6 9, 10, 11, 12, 13, 14, 15, 37.

7 Q. Now, this is on page 22?

8 A. (Dr. Bartlett) This is on 22, correct. 38,
9 I'm just unsure because there may have been talk --
10 there may have been discussion between myself and
11 Dr. Allison on this.

12 Q. Would you or would Dr. Allison have been the
13 main contributor to the answer, admittedly short?

14 A. (Dr. Bartlett) We're on 38, right?

15 Q. Correct, page 22.

16 A. (Dr. Bartlett) I guess in regards -- I see
17 a "deny to competency for seismic modeling." I would
18 not have done that portion. Admitted is "competency for
19 shallow static bearing capacity and consolidation
20 settlement." That would have been my input to that.

21 40 is mine, 41, 42, 43, 44. And that
22 appears to be it.

23 Q. All right, thank you very much. Now, again,
24 this question is addressed to both of you. Do you
25 recall whether either of you provided input in any other

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1 Q. When you say brief, is there any significant
2 portion of your history that is not included here?

3 A. (Dr. Ostadan) I believe that a lot of --
4 not all of the projects I have worked on is reflected
5 here. Some of my other professional activities are not
6 listed and may not be important. This is intended to
7 reflect my background and experience in the nuclear
8 industry.

9 Q. Okay. Are you saying that the projects that
10 are not included here are outside the nuclear industry?

11 A. (Dr. Ostadan) No. There could be other
12 nuclear projects; however, I simply didn't list all of
13 them.

14 Q. Could you tell us of those cases, if any of
15 they are relevant, we should be concerned about, which
16 kind of projects you chose not to include?

17 A. (Dr. Ostadan) It's not a matter of
18 choosing, it's a matter of really being brief. I've
19 been proficient in this capacity for almost 20 years
20 now, and some of the things I have worked on are simply
21 not listed here. But I could think back and try to
22 remember some if you wish.

23 Q. I only want to try and establish if you feel
24 like the matters we discuss in Exhibit 60 are what you
25 consider to be the most significant elements of your

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1 state discovery responses with respect to Contention L
2 apart from this that we have gone through?

3 A. (Dr. Bartlett) The only other thing I can
4 recall that may have been, and I don't know whether it's
5 captured specifically, was discussions about the
6 2,000-year return period.

7 A. (Dr. Ostadan) And my answer is, I simply
8 don't remember. It's been a long process and a lot of
9 documents.

10 A. (Dr. Bartlett) I was involved in similar
11 discussions, but where it's found in this series of
12 documents, I don't know if it's even part of this.

13 MR. TRAVIESO-DIAZ: Let me mark as Exhibit
14 60 a document.

15 (Exhibit-60 marked.)

16 Q. (By Mr. Travieso-Diaz) For the record,
17 Exhibit 60 is a document that's captioned on the first
18 page the name Farhang Ostadan. It consists of four
19 pages, and it bears a date on the bottom of each page
20 which reads 5/99.

21 Dr. Ostadan, do you recognize this document?

22 A. (Dr. Ostadan) Yes, I do recognize this.

23 Q. Could you identify it for the record?

24 A. (Dr. Ostadan) This is a brief summary of my
25 resume.

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1 professional experience or not.

2 A. (Dr. Ostadan) I think perhaps I would like
3 to cite a couple of things that might be of relevance.
4 In addition to my professional work reflected here, I
5 was co-author of a computer program called SASSI,
6 S-A-S-S-I, that is now industry practice worldwide for
7 soil-structure interaction analysis.

8 Q. If I could interrupt you for a second. Is
9 that a program that is referred to on page 2 of your
10 resume, page '79 to '83? I'm looking at Experience, top
11 of the page.

12 A. (Dr. Ostadan) Yes, that is correct.

13 Q. Thank you.

14 A. (Dr. Ostadan) I also am now the technical
15 sponsor of this program in collaboration with the
16 University of California at Berkeley. I'm a visiting
17 lecturer at the University of California at Berkeley. I
18 do teach a gadget course on soil dynamics and
19 soil-structure interaction. I'm a member of the Board
20 of Journal of Geotechnical Engineering, American Society
21 of Civil Engineers.

22 Q. With those additions, is this resume which
23 bears a date of 5/99 up to date and complete, or is
24 there other things that have transpired since you
25 prepared it?

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1 A. (Dr. Ostadan) I can't think of anything
2 significant.

3 Q. All right. You have on page 1 under
4 "Summary" a paragraph that describes your experience in
5 various areas. Could you tell us which of the areas
6 that are listed on the summary paragraph on page 1 of
7 your resume you regard as being relevant to the issues
8 of Contention L as you understand it?

9 A. (Dr. Ostadan) I would say dynamic analysis
10 and seismic safety evaluation, up above, and underground
11 structures and surface materials, subsurface materials.

12 Q. So is the first -- those in the first
13 sentence after "15 years"?

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

15 Q. It has a caption that says "15 years."
16 Would you describes for the record what you mean by
17 dynamic analysis?

18 A. (Dr. Ostadan) Dynamic analysis involves
19 those set of calculations that are performed in order to
20 generate seismic loading both for the structure and the
21 foundation as well as the soil supporting the
22 foundation.

23 Q. And seismic safety evaluations?

24 A. (Dr. Ostadan) This is the next stage after
25 you obtain seismic responses. These are a series of

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1 mostly simple calculations to develop a margin of safety
2 against postulated failure scenarios.

3 Q. When you say "margin of safety," could you
4 explain what margin of safety you're talking about? A
5 margin of safety of what?

6 A. (Dr. Ostadan) That relates to really what
7 failure mechanism we are talking about. If it's, for
8 example, stability analysis of a foundation, margin of
9 safety is typically expressed in terms of factor of
10 safety against sliding and overturning.

11 Q. Actually, maybe I didn't pose the question
12 clearly. When I said "margin of safety of what," I
13 mean, you're talking about margin of safety in the
14 design of the foundations or the structures as compared
15 to the loads that were perceived?

16 A. (Dr. Ostadan) My emphasis would be on the
17 foundation and supporting soil, yes.

18 Q. All right. Of the projects that you list,
19 and I understand the list may not be complete, but the
20 projects that you list under "Experience" on page 1 and
21 going on to page 2 of your resume, which do you believe
22 are most relevant to the issues that you are addressing
23 in Contention L?

24 A. (Dr. Ostadan) Okay. I'm going to start
25 from the lower paragraph, the last paragraph of page 1,

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1 because they are specific here.

2 With respect to Diablo Canyon Nuclear Power
3 Plant, generation of seismic loads, proximity of this
4 unit -- nuclear unit to a major fault, issues related to
5 characterization of ground motion, and how and in which
6 form it should be used in the analysis.

7 With EPRI, again, issues with respect to
8 ground response analysis, dynamic soil properties,
9 soil-structure interaction, seismic soil pressure.

10 With respect to SMES, super magnetic energy,
11 there was a -- more of a problem of dynamic soil
12 pressure.

13 This General Electric ABWR, SEWR, and AP600,
14 these are standard design that are intended to be built
15 for a wide range of subsurface conditions. So it was a
16 very broad study that was performed and involved a lot
17 of various types of ground response analysis of
18 foundation loading for various potential sites that
19 could be out there.

20 For Tennessee Valley, these plants were
21 built, and we were pre-evaluating the plan under some
22 different seismic loading conditions, so it was seismic
23 response of the structure and the foundation.

24 I will not go over the non nuclear ones.
25 There are some here.

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1 With respect to Savannah River project, ITP,
2 RTF, K. K is a reactor, actually. There were a lot of
3 issues that had to do with seismic stability of
4 foundation and supporting soil and involved
5 soil-structure interaction.

6 A couple of transportation project listed
7 here. I will not go over them.

8 Q. I take it that the ones that you have
9 mentioned you selected to bring up because they are
10 nuclear projects?

11 A. (Dr. Ostadan) They are more relevant to the
12 review I have done, yes.

13 Q. And I take it you think they are more
14 relevant because they involve the application or the use
15 of nuclear-related regulations?

16 A. (Dr. Ostadan) Exactly.

17 Q. Now, with respect to the first project that
18 you mentioned, Diablo Canyon, how does the work that you
19 did at Diablo Canyon relate to the issues that you
20 address in Contention L?

21 A. (Dr. Ostadan) One important resemblance
22 within these two projects is the fact this unit was
23 found after it was built to be close to a major fault,
24 Hosgri Fault, H-o-s-g-r-i, capable of, if I'm not
25 mistaken, magnitude of seven, seven and a half

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1 earthquake. So in that regard it was similar.

2 The site condition was quite different. It
3 was a much -- a stiffer site, in fact, wetter rock. But
4 issues relating to characterization of ground motion,
5 amplitude, phasing, whether or not the waves could
6 strike the foundation at an angle or arrive vertically,
7 resonance or lack of surface waves, adequate
8 characterization of dynamic soil properties for the
9 purpose of soil-structure interaction analysis.

10 Finally, performing soil-structure
11 interaction analysis in order to develop seismic loads.

12 Q. And with respect to the EPRI work that you
13 did?

14 A. (Dr. Ostadan) Yes. That EPRI study was a
15 really well known study in our field. It was a research
16 work that was work that was funded by U.S. NRC, EPRI and
17 Tai Power. The objective of that study was to build a
18 scale model of a nuclear structure, in this case it was
19 a containment building, in a highly seismic area of
20 Taiwan and record the motion in the ground in the
21 structures as well as other responses, such as soil
22 pressure, pore water pressure, etc., and then invite
23 number of companies and teams from academia to
24 participate in the prediction of the response of this
25 test. And the idea there was to assess the adequacy of

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1 the kind of programs that we use, the modeling
2 techniques we adopt, the methods and the tools we use to
3 characterize dynamic soil properties, and see how
4 accurate they are now that we have a recorded motion
5 from the structure.

6 I was member of a team that was invited to
7 participate. And the study was a full-blown SSI study,
8 and we used the computer program SASSI, among other
9 programs that we had. And it was a full-blown SSI
10 analysis, as I indicated, involving ground response
11 analysis modeling of the structure, soil-structure
12 interaction, and prediction of response.

13 Q. And what role did you play in that EPRI
14 study?

15 A. (Dr. Ostadan) I was responsible for the
16 ground response analysis and soil-structure interaction.
17 And for the record, the results of the study are in
18 voluminous EPRI reports I think in the mid 80's, 90's.

19 Q. Have you done any work, seismic work or any
20 other work, in the Skull Valley area of Utah --

21 A. (Dr. Ostadan) No, I haven't.

22 Q. -- prior to working for PFS?

23 A. (Dr. Ostadan) I have not.

24 Q. Have you done any work involving nuclear
25 facilities in Hanford, Washington?

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1 A. (Dr. Ostadan) Yes. I have participated in
2 some projects there, nuclear caliber projects.

3 MR. TRAVIESO-DIAZ: Let me mark this. I
4 believe it's 61.

5 (Exhibit-61 marked.)

6 MR. TRAVIESO-DIAZ: What I have marked as
7 Exhibit 61 is a study or a document entitled "Validation
8 of the Geomatrix Hanford Seismic Report for Use on the
9 TWRS Privatization Project." It is dated March 17,
10 1999. It consists of approximately 115 pages.

11 Q. (By Mr. Travieso-Diaz) First of all, do you
12 recognize this document?

13 A. (Dr. Ostadan) Yes, I do.

14 Q. What is this document?

15 A. (Dr. Ostadan) Well, in brief, this relates
16 to a project that the Department of Energy initiated to
17 build -- design, build, and operate a retrofication
18 facility in Richland, in Hanford, Washington, Hanford
19 site. The contractor at the time was British Nuclear
20 Fuel, and Bechtel was subcontracted to BNFL. There was
21 a joint team of engineers involving various activities
22 there.

23 The specific document we are looking at
24 here, Exhibit --

25 Q. Sixty-one.

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1 A. (Dr. Ostadan) -- 61, addresses a previous
2 study that was performed by Geomatrix for the site as a
3 whole, that they developed ground motion for different
4 return periods and different locations of the site. And
5 we used that study in order to develop a design basis
6 motion for this retrofication facility called TWRS,
7 which, by the way, the name has changed ever since.
8 This project came to stop for a number of contractual
9 issues. It is on hold. I understand the DOE is issuing
10 or has issued RFP for continuation of the design and
11 perhaps construction. We have no activity at this time.

12 Q. It appears that among the list of authors on
13 page 1 of Exhibit 61 there is a Farhang Ostadan. Is
14 that you?

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

16 Q. So you were one of the authors of this
17 document?

18 A. (Dr. Ostadan) I contributed. I will not
19 say I was the main author or main contributor, as you
20 can tell here. The reason is, this is basically a
21 seismological study that Geomatrix did, and a
22 seismologist from Bechtel, Joe Litehiser, was the main
23 author, as reflected here.

24 My contribution here was to look at the
25 amplification factor that Geomatrix considered in their

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1 analysis in order to include the effect of soil on
2 ground motion.

3 MR. TRAVIESO-DIAZ: I'm sorry. Could you
4 read back the answer?

5 (The record was read: "My contribution here was to
6 look at the amplification factor that Geomatrix
7 considered in their analysis in order to include the
8 effect of soil on ground motion.")

9 Q. What was the purpose of the work that led to
10 the preparation of this report? What was your team
11 asked to do?

12 A. (Dr. Ostadan) The question to our team was,
13 well, should we use Geomatrix motion for this facility.

14 Q. And in a word, what was the answer that the
15 people gave?

16 A. (Dr. Ostadan) I think we agreed to use
17 Geomatrix' motion with some slight modification.

18 Q. And in the preparation of the report, what
19 role did you play?

20 A. (Dr. Ostadan) As I said, the part that
21 relates to issues to soil properties and amplification
22 due to soil is the part I participated in.

23 Q. Why don't we turn to the Executive Summary,
24 which I believe is on page Roman Numeral vii. Do you
25 see that?

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1 A. (Dr. Ostadan) Yes.

2 Q. The first paragraph of the executive summary
3 says -- I'm going to read only the first couple of
4 sentences in the interest of time -- "The purpose of
5 this report is to provide an independent validation of
6 the seismic" --

7 A. (Dr. Ostadan) I'm sorry. I'm not on that
8 page. All right, please go ahead. I'm sorry, yes.

9 Q. I'll start again.

10 A. (Dr. Ostadan) Go ahead.

11 Q. The first paragraph of Executive Summary
12 reads, "The purpose of this report is to provide an
13 independent validation of the seismic hazard analysis
14 completed for the Hanford Site by Geomatrix Consultants.
15 The 2,000-year return period ground motions predicted by
16 Geomatrix for the 200 East Area are an integral part of
17 the seismic design basis for the TWRS-P Project." Is
18 that what you understand the team was asked to do?

19 A. (Dr. Ostadan) I think it is, yes.

20 Q. Now, on the next paragraph, I'm going to
21 skip the first two or three sentences. I'm going to go
22 to the last sentence in the paragraph that says, "We
23 conclude that the Geomatrix report addresses and
24 incorporates all the questions raised in the earlier
25 reviews, that its conclusions match well the latest

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1 independent estimates of the Hanford Site earthquake
2 hazard, and that the seismic source model developed by
3 Geomatrix is state-of-the-art and is consistent with
4 current data." Do you see that?

5 A. (Dr. Ostadan) I see that.

6 Q. Was that the consensus, conclusion of the
7 team?

8 A. (Dr. Ostadan) With the recognition of the
9 fact this -- essentially all seismological topics beyond
10 my expertise, but it's my understanding that was the
11 final conclusion, yes.

12 Q. And you had no reason to disagree with this
13 conclusion in this paragraph?

14 A. (Dr. Ostadan) No. It's not my field.

15 Q. The next to the last paragraph on the page,
16 it starts with "during," and again I will read it.
17 "During the course of our validation effort we have had
18 the benefit of several technical discussions with many
19 of the scientists who worked on the latest (and earlier)
20 version of the Geomatrix report with DOE personnel and
21 consultants." This paragraph suggests in this sentence
22 that members of your team had discussions with members
23 of the Geomatrix team. Is that correct?

24 A. (Dr. Ostadan) I think so, yes.

25 Q. Did you take part in those discussions?

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1 A. (Dr. Ostadan) Some of it, yes.

2 Q. Do you recall which members of the Geomatrix
3 team you had discussions with?

4 A. (Dr. Ostadan) Mr. Bob Youngs.

5 Q. Based on those discussions, did you have the
6 occasion to form an opinion as to the personal
7 competency of Dr. Youngs and/or other members of the
8 Geomatrix team?

9 A. (Dr. Ostadan) I do have great deal of
10 respect for Mr. Bob Youngs and other team members I know
11 at Geomatrix, yes.

12 Q. Thank you much. Let's just look at the last
13 paragraph of the executive summary. It's very short.
14 It reads, "We conclude that the Geomatrix methodology
15 and the results of the Geomatrix report are appropriate
16 for the application to the design of the TWRS-P Facility
17 at the Hanford site." Is that correct?

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

19 Q. And insofar as you contributed to that
20 report, this reflects your view?

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

22 MR. TRAVIESO-DIAZ: This might be a good
23 time to take a break.

24 (Recess from 10:14 to 10:26 a.m.)

25 MR. TRAVIESO-DIAZ: Back on the record.

1 Q. (By Mr. Travieso-Diaz) I'm going to switch
2 gears and ask a couple of questions of Dr. Bartlett.

3 Dr. Bartlett, will you turn your attention
4 to Exhibit 10. That is the list of the State of Utah's
5 Response to the Second Set of Discovery Requests. Look
6 to page 51 to response -- to item A.

7 A. (Dr. Bartlett) Uh-huh.

8 Q. Which is entitled "Undrained Shear Strength
9 May Have Been Overestimated Due to Consolidation During
10 Triaxial Testing." You have that?

11 A. (Dr. Bartlett) Yes.

12 Q. I believe you testified that this was one
13 that you were the main author for?

14 A. (Dr. Bartlett) That's correct.

15 Q. All right. Now, as I read this response, it
16 appears to say that the applicant may have overestimated
17 the undrained shear strength of the soils because they
18 used one set of ASTM standards instead of the others,
19 and the result of using that set of standards is that
20 you ended up with a more or greater amount of undrained
21 shear strength than you should have had. Is that
22 essentially what you're saying?

23 A. (Dr. Bartlett) Let me just reread it.

24 Q. Maybe you can explain it better than I can.

25 A. (Dr. Bartlett) I'll characterize the issue,

1 are. So I was just checking what the depth of
2 overburden was versus what the sample was tested. But
3 the proper design would be to consolidate the sample to
4 the stresses underneath the foundation.

5 Q. I'm going to introduce a document because I
6 think it may be good for the record to show what we're
7 talking about. This is going to be now Exhibit 62.
8 (Exhibit-62 marked.)

9 Let me just identify for the record what
10 this document is. I have marked as Exhibit 62 a Stone &
11 Webster calculation with a number of G(B)05. The name
12 is Document Bases for Geotechnical Parameters Provided
13 in Geotechnical Design Criteria. The pages are not
14 numbered, but it is a document that is probably at least
15 a half an inch thick. And we are dealing here with what
16 appears to be Revision 2.

17 A. (Dr. Bartlett) Correct.

18 Q. (By Mr. Travieso-Diaz) I'm going to ask you
19 only one question. Would you turn, if you can find it,
20 because it's in the middle of the document and the pages
21 are not numbered, but I am going to ask you to try to
22 find page 36 on top right-hand corner. Page 36 has
23 something that's called Figure 11 that looks like this.

24 A. (Dr. Bartlett) Correct.

25 Q. Okay. Find it?

1 maybe, and it may no longer be one.

2 Q. All right.

3 A. (Dr. Bartlett) What I was doing at this
4 point was looking at the testing program and the depths
5 from which the samples were taken versus the depths of
6 which in the device they were consolidated to. And I
7 noticed that the depth, the pressure which was applied
8 in the apparatus was higher than which the depth from
9 which the sample was taken. And because this is a
10 partially saturated soil, then it would consolidate and
11 obviously the strengths would increase. That was for
12 just the overburden stresses.

13 The applicant has now come back and said,
14 well, it's fine to do this type of testing and loading
15 as long as we keep that loading in the range at which we
16 anticipate the loadings of the foundations, which
17 they've done in subsequent calculations. So I'm not
18 sure right now if this particular interrogatory is
19 really that important to discuss.

20 Q. So you take it that because of the fact that
21 the design pressure when the building is sitting on top
22 of the soil will be --

23 A. (Dr. Bartlett) Yes, that will effectively
24 consolidate the soils, so one should then do the test
25 program according to what those anticipated loadings

1 A. (Dr. Bartlett) Yes, I've found it.

2 Q. I have only one question. Is this figure a
3 graphical representation of what we have discussed?

4 A. (Dr. Bartlett) Not necessarily. It
5 includes test data, and the point is, as I was just
6 making, is that if one was to devise a test program to
7 get the undrained shear strength using the consolidated
8 undrained test that the proper confining stress -- or
9 the proper stress to apply to consolidate it prior to
10 shearing it undrained would be the foundation loads
11 underneath the building.

12 Q. Okay. I don't want to belabor the point,
13 but just for labeling purposes, there are a number of
14 data points marked with sigmas.

15 A. (Dr. Bartlett) Yes, I see that.

16 Q. And there is a sigma of 0 at 10 feet?

17 A. (Dr. Bartlett) Right.

18 Q. And a sigma of 0 at 16 feet?

19 A. (Dr. Bartlett) Right.

20 Q. And then at the end is a sigma sub V?

21 A. (Dr. Bartlett) At the end?

22 Q. At the end of the curve on the top
23 right-hand side.

24 A. (Dr. Bartlett) Yes, I see that.

25 Q. The discussion that we had referred, if I

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1 understand it, that your view -- that the sigma sub V
2 zero at 10 feet is lower than the sigma sub V zero at 16
3 feet?

4 A. (Dr. Bartlett) The sigma sub V at 10
5 feet -- yeah, that's trivial. Yes, the overburden
6 stresses at 10 feet will be less than at 16 feet.

7 Q. Obviously. And your contention or your
8 concern was that what data that you were using was the
9 sigmas -- or getting what the sigmas sub V zero at 16
10 feet instead of 10?

11 A. (Dr. Bartlett) Something to that effect,
12 yes.

13 Q. And whereas the actual sigma V with at same
14 pressure on the right is higher than either of the two?

15 A. (Dr. Bartlett) Yes. They've put those in
16 and represented those by arrows on the chart.

17 Q. Okay, that's all I have. Okay, let's just
18 move on to -- I believe it's item B on top of page 53,
19 which I think you also identified as your contribution.

20 A. (Dr. Bartlett) Yes.

21 Q. Rather than my trying to paraphrase what you
22 say, would you explain what the concern here is?

23 A. (Dr. Bartlett) We discussed this somewhat
24 yesterday. In my experience with the Bonneville clays,
25 because they're lake bed deposits, they are deposited in

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1 fairly thin layers, if you will, the sequence is of
2 fairly thin layers. And because of that layering that's
3 there, the fabric of the soil has an inherent anisotropy
4 to it. In this case, this is dealing with shear
5 strength anisotropy, and the simple idea is the shear
6 strength is dependent upon which direction you shear.
7 And I think this B here that we're looking at on page 53
8 is addressing that in the initial calculations that we
9 reviewed there was really no consideration for
10 anisotropy in the testing program.

11 Q. Is this still a concern of yours?

12 A. (Dr. Bartlett) What the applicant has done
13 since this is they've gone to the direct shear device,
14 which could give you part of the anisotropy envelope, if
15 you want to call it that. One concern with possibly the
16 direct shear test is, in cemented soils we may be --
17 with the direct shear test the failure plane is
18 predetermined by the testing device. It's a shear box,
19 and we fail it essentially along the gap between the
20 upper and lower gap of the shear box. So we're
21 predetermining the failure in the sample.

22 In cemented soils there can be a fair amount
23 of even differences even within the sample, and so one
24 might perchance get a high estimate or a low estimate of
25 the direct shear device because you're allowing the

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1 sample, you're forcing the sample to fall in a
2 predetermined manner. And the direct simple shear
3 device was an attempt that's been devised to overcome
4 that stress concentration, and just pointing out that
5 perhaps the direct simple shear would give a better
6 estimate on these maybe slightly cemented soils that
7 were seeing. They have not addressed potential of
8 triaxial extension along the buried surface, and I have
9 not seen any testing done in triaxial extension.

10 Q. But you would not use this type of test to
11 test the extension, for extension, or --

12 A. (Dr. Bartlett) No, when you do the triaxial
13 extension it's a different apparatus.

14 Q. Okay. That's what I thought you meant.

15 A. (Dr. Bartlett) The same device that's used
16 for triaxial compression.

17 Q. Let me ask you a couple questions about the
18 direct simple shear test.

19 A. (Dr. Bartlett) Sure.

20 Q. Do you know whether the NRC includes that as
21 among the types of tests it either requires or
22 recommends to be used during testing for nuclear
23 facilities?

24 A. (Dr. Bartlett) That level of detail I don't
25 know. I'd have to look at the Reg Guide.

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1 Q. Let's do that.

2 A. (Dr. Bartlett) Sure.

3 MR. TRAVIESO-DIAZ: I'm going to mark now
4 Exhibit 63.

5 (Exhibit-63 marked.)

6 Q. Exhibit 63, for the record, is a copy of NRC
7 Regulatory Guide 1.138 dated April 1978, and entitled
8 "Laboratory Investigation of Soils for Engineering
9 Analysis and Design of Nuclear Power Plants." Are you
10 familiar with this document?

11 A. (Dr. Bartlett) Yes, I've seen it before.

12 Q. Let me ask you to turn to two areas in this
13 document. First take a look at page 1.138.5, and this
14 document, the pages have two columns. Look at the top
15 of the right-hand column on top of page 5. Do you see
16 that? Are you there?

17 A. (Dr. Bartlett) Yeah.

18 Q. There appears to be a listing of laboratory
19 tests to measure shear modulus, at least in that page
20 and that column. Do you find the direct -- the direct
21 simple shear test among them?

22 A. (Dr. Bartlett) These are tests to measure
23 shear modulus, not shear strength.

24 Q. And let's see. Let us look at then -- at
25 something that may be a little bit more general. Let's

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1 look at a table that appears in Appendix B on page
 2 138-11. Actually it goes on for quite some distance.
 3 Starts on 11 and goes on through 13.
 4 A. (Dr. Bartlett) Fair enough.
 5 Q. Now, what is the test that you referred to a
 6 moment ago?
 7 A. (Dr. Bartlett) The direct simple shear
 8 test.
 9 Q. I understand; but for what parameter?
 10 A. (Dr. Bartlett) It's for shear strength.
 11 Q. All right.
 12 A. (Dr. Bartlett) Well, it's for undrained
 13 shear strength.
 14 Q. All right. Let's see if we can find that.
 15 That would be -- I guess the parameters are listed on
 16 this table not on the left-hand column but on the fourth
 17 column starting from the left. Is that right? Where it
 18 says "properties or parameters determined"?
 19 A. (Dr. Bartlett) Yeah, I see that column.
 20 Q. All right. Let's take a look at the second,
 21 if you will, page of this table, which is 1.138-12, and
 22 the type of soils, shear strength and deformability.
 23 Would that be where we should be looking?
 24 A. (Dr. Bartlett) Yes, under that column.
 25 Q. Take a look at the tests that are listed

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1 there, and I believe it goes through beginning of page
 2 13.
 3 A. (Dr. Bartlett) Uh-huh.
 4 Q. Do you see direct simple shear tests as one
 5 of them?
 6 A. (Dr. Bartlett) No, not specifically. I see
 7 direct shear, but I do not see direct simple shear
 8 listed.
 9 Q. All right, let me ask another question. Who
 10 does this type of test commercially?
 11 A. (Dr. Ostadan) May I add to the response?
 12 Q. Sure.
 13 A. (Dr. Ostadan) Just before we change the
 14 subject. I would like to read from Exhibit 63, the
 15 cover page, the column on the right.
 16 Q. Right.
 17 A. (Dr. Ostadan) Second paragraph.
 18 Q. Yes.
 19 A. (Dr. Ostadan) Unfortunately the stamp has
 20 gone over some of the words here, but I'll do my best.
 21 "The course of" -- I don't know what the next word is.
 22 Q. I believe it says "site." Some copies are
 23 probably better than others.
 24 A. (Dr. Ostadan) "The course of site and
 25 laboratory investigations will depend on actual site

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1 conditions, the nature of the problem encountered or
 2 suspected at the site, and desired requirement for
 3 foundations and earthworks."
 4 A. (Dr. Bartlett) May I also point out that
 5 this document is dated April 1978. We're now in the
 6 year 2000. The geotechnical practice has progressed
 7 since this document's been written.
 8 Q. And do you know whether this document has
 9 been updated or reissued?
 10 A. (Dr. Bartlett) Not to my awareness, but
 11 it's dated April 1978.
 12 Q. All right. But as far as NRC guidance is
 13 concerned, are you aware of anything that supersedes
 14 1.138?
 15 A. (Dr. Bartlett) I do not.
 16 Q. Let me go back to the question that I had a
 17 moment ago.
 18 A. (Dr. Bartlett) Sure.
 19 Q. Do you know whether -- who commercially does
 20 this type of test that you're suggesting, the simple
 21 shear test?
 22 A. (Dr. Bartlett) I believe Woodward-Clyde's
 23 laboratory in New Jersey does it.
 24 Q. Okay. Who else?
 25 A. (Dr. Bartlett) Well, that's mostly my

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1 experience with Woodward-Clyde. Here locally in the
 2 valley you're saying, or nationally?
 3 Q. Whoever you know. I'm trying to understand
 4 how widespread is the availability of this type of test.
 5 A. (Dr. Bartlett) That I can't answer. I just
 6 have experience with a few labs.
 7 Q. How about you, Dr. Ostadan? Do you know?
 8 A. (Dr. Ostadan) Oh, in the Bay area we use
 9 the laboratory facilities at the University of
 10 California at Berkeley. I believe Woodward-Clyde has
 11 some laboratory facilities in the East Bay. I
 12 specifically don't know if they have direct shear tests
 13 or not. Hardin Lawson Associates, they have laboratory
 14 tests in that area.
 15 Q. Do you know whether either Woodward-Clyde in
 16 the Bay Area or Hardin Lawson have facilities and
 17 conduct direct simple shear tests?
 18 A. (Dr. Ostadan) I cannot be certain.
 19 A. (Dr. Bartlett) I also believe, at least for
 20 some of the testing along the I-15 corridor, it's not a
 21 commercial lab, but MIT.
 22 Q. This is only to the extent you know. Is
 23 this type of device more commonly found in academic
 24 institutions like MIT or University of California,
 25 Berkeley?

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1 A. (Dr. Bartlett) I can't state that. I don't
2 know the number of commercial labs versus university
3 labs. But it's recognized as a test and it's in the
4 geotechnical literature. It's discussed in the EPRI
5 manual.

6 Q. Let's go to paragraph C on the same page of
7 Exhibit 10. Again, that's one that you told us that you
8 were main contributor to; is that correct? It's Exhibit
9 10, page 53.

10 A. (Dr. Bartlett) Okay.

11 Q. If you will first again explain to me what
12 the concern raised in that particular item was.

13 A. (Dr. Bartlett) This is item C, correct?

14 Q. Correct, item C on page 53.

15 A. (Dr. Bartlett) As I was reviewing I guess
16 calculations relating to something using the subgrade
17 reaction, it seems like I saw a value used for
18 cohesionless soils in that I felt at least the shallow
19 surficial soils were more cohesive and one should use a
20 modulus of subgrade reaction that was more appropriate
21 for cohesive soils.

22 I cannot say whether this has been changed,
23 the subject calculations. It may have been. I'm not
24 sure -- I can't state, because this is somewhat of a
25 historic calculation that may have been revised, and I

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1 didn't really review, readdress this issue. It's not a
2 major concern of mine. It's just a fine point.

3 Q. Just so that we get the record clear on
4 this: do you recall when Mr. Trudeau and Dr. Chang
5 testified a couple days ago that they made reference I
6 think more than once to the fact that this calculation
7 has been superseded?

8 A. (Dr. Bartlett) Sure, and it may. The
9 design has been superseded by the intent to use soil
10 cement, too. So I think this is a historic issue.

11 Q. All right, then. It's not a current
12 concern?

13 A. (Dr. Bartlett) No.

14 Q. All right. Let's go to paragraph D.
15 Paragraph D starts on the same page. It addresses "No
16 Consideration in Foundation Design of Potential Ground
17 Rupture of Faulting." Again, would you briefly explain
18 to us what your concern here is?

19 A. (Dr. Bartlett) Well, in the Geomatrix
20 report when I reviewed this looking for potential for
21 faulting underneath the facility, which I thought from a
22 geotechnical perspective would be prudent to look for,
23 there is indications of shear zones and small
24 displacements of the soils that could be indicative of
25 faulting.

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1 Now let me read what I said.

2 Q. That always helps.

3 A. (Dr. Bartlett) As I recall, I think
4 Geomatrix has done a subsequent report talking about the
5 probability of displacements and gave a number assigned
6 that I can't remember, it's a very small number. Given
7 that that number is a good number -- and again, I'm not
8 going to comment on the validity of that number other
9 than, as I recall, it's a fairly small number and it was
10 a probabilistic displacement number, as I recall. Those
11 are relatively small, I think, for the foundation
12 design.

13 Q. Since this is not a memory exercise --

14 A. (Dr. Bartlett) Let's look at it.

15 Q. Yes.

16 MR. TRAVIESO-DIAZ: Mark it Exhibit 64.
17 (Exhibit-64 marked.)

18 Q. (By Mr. Travieso-Diaz) Exhibit 64, even
19 though the pages are out of order, includes the cover
20 page of the final report prepared by Geomatrix entitled
21 "Fault Evaluation Study and Seismic Hazard Assessment,"
22 February '99. It is a very voluminous report.

23 A. (Dr. Bartlett) Yes, I recall it from
24 yesterday.

25 Q. And the second page of the exhibit is

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1 Section 7.4 called "Summary of Results."

2 A. (Dr. Bartlett) Right.

3 Q. And it appears to indicate that the
4 displace -- the small number displacement that you
5 referred to a moment ago was less than .1 centimeter.
6 Is that the way you read it?

7 A. (Dr. Bartlett) Yes. This is a
8 probabilistic number. And so it's not the displacement
9 during an actual event, but it essentially says that
10 probably the mean annual frequency of the number is .1
11 centimeters. So it's a probabilistic displacement,
12 sure.

13 Q. This is the number that you were referring
14 to?

15 A. (Dr. Bartlett) That's the small number I
16 was referring to.

17 Q. No, do you know what the tolerance for
18 settlement is in the canister transfer building?

19 A. (Dr. Bartlett) The tolerances for
20 settlement?

21 Q. Yes.

22 A. (Dr. Bartlett) Are you talking differential
23 settlement? What type of settlement?

24 Q. Well, the type of settlement that you would
25 experience as a result of exposure to hazard during an

1 earthquake that is mentioned here.
 2 A. (Dr. Bartlett) I don't, but I'm sure it's
 3 well above these tolerances.
 4 Q. But let me again, since this is not a test
 5 of memory, go to Exhibit 62 for a second.
 6 A. (Dr. Bartlett) Sure. I think.
 7 Q. I think this document has an answer on page
 8 13.
 9 MS. CHANCELLOR: Exhibit 62?
 10 MR. TRAVIESO-DIAZ: Yes.
 11 Q. We're on Exhibit 62, which again is
 12 Calculation G(B)05. Number 13 on the top.
 13 A. (Dr. Bartlett) Okay.
 14 Q. And you take a look at the very end, this is
 15 a handwritten calculation, or portion of --
 16 A. (Dr. Bartlett) I see it, okay. I see what
 17 I'm looking for.
 18 Q. And the last -- I think the answer is the
 19 last number in the page, the very last line. And the
 20 number is, as I read it, 1.73 inches?
 21 A. (Dr. Bartlett) Correct.
 22 Q. And that's greater than .1 centimeter?
 23 A. (Dr. Bartlett) Yeah, sure.
 24 Q. I think I'm going to move now to one that
 25 both of you identified as having contributed to, which

1 is Item E, and Item E is on page 54. Is that right?
 2 A. (Dr. Bartlett) Yes. I think this is more
 3 coming from Dr. Ostadan's experience, not mine.
 4 Q. All right. Dr. Ostadan, would you again
 5 summarize for the record what your concern was that you
 6 sought to express in Item E?
 7 A. (Dr. Ostadan) Yeah. I think this has to do
 8 with previous work that Geomatrix did to develop the
 9 deterministic ground motion. And the comment or the
 10 question is whether the basin effect has been included
 11 in the calculation of deterministic ground motion.
 12 However, subsequent calculations and position that the
 13 applicant has taken, you have moved from deterministic
 14 to probabilistic ground motion. And whether or not this
 15 comment still applies in the probabilistic ground
 16 motion, I must say I have not reviewed the Geomatrix
 17 report, I cannot assess that at this time.
 18 Q. Fine. Just so that we understand for the
 19 record: this concern referred to a calculation that was
 20 performed based on the deterministic ground motion
 21 earthquake.
 22 A. (Dr. Ostadan) That's correct.
 23 Q. And that calculation is no longer applicable
 24 because we have moved from a deterministic to some sort
 25 of probabilistic ground motion earthquake, right?

1 MS. CHANCELLOR: Could I just put on the
 2 record, the State considers that the deterministic
 3 earthquake is still the standard. Until PFS's exemption
 4 required before the Atomic Safety and Licensing Board,
 5 the regulation requires a deterministic. I'd just like
 6 to note that on the record.
 7 MR. TRAVIESO-DIAZ: And I would like to note
 8 that my intent is not to debate that here but only to
 9 figure out whether Dr. Ostadan has reviewed the same
 10 concern based on the probabilistic ground motion to see
 11 if it's still a concern, assuming that that applies.
 12 MS. CHANCELLOR: I have no problems with
 13 Dr. Ostadan answering any questions with respect to
 14 updated and current calculations.
 15 MR. TRAVIESO-DIAZ: And that's all that I'm
 16 going to do. I believe he testified that he hasn't
 17 looked at it so, he doesn't know.
 18 A. (Dr. Ostadan) That's correct.
 19 Q. (By Mr. Travieso-Diaz) Now, would the
 20 answer be the same with respect to paragraph F, which I
 21 also believe refers to a deterministic ground motion
 22 earthquake? Paragraph F on page 54.
 23 A. (Dr. Ostadan) We are talking about now
 24 somewhat of a historic calculation. At the time that
 25 the deterministic ground motion was reviewed, the

1 concern was whether the attenuation relationship used
 2 were adjusted to reflect the site conditions for PFS
 3 facility.
 4 If I have to comment whether this concern
 5 has been addressed or not, I will say it's been
 6 aggravated ever since, because applicant has conducted
 7 seismic cone data and identified a very soft layer in
 8 the upper ten feet. And I do not think that even in the
 9 current ground motion calculation, probabilistic
 10 calculation, the recent geotechnical data has been used.
 11 Q. Have you reviewed the, as you call it, the
 12 current calculation to in fact assess the start of your
 13 concern?
 14 A. (Dr. Ostadan) I have looked at the few
 15 pages of Appendix F, and I have discussed that with
 16 Dr. Bartlett. I do not have the report itself. And
 17 made certain that the shear wave velocity, the mean
 18 shear wave velocity that is now recognized to be 540
 19 feet per second has not been used in Geomatrix's
 20 calculation.
 21 Q. All right. I might have the document that
 22 you referred to or may not. What Geomatrix calculation
 23 are you talking about?
 24 A. (Dr. Ostadan) Since I do not have the
 25 report, may I defer to Dr. Bartlett?

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A. (Dr. Bartlett) I believe the issue is in Appendix F where it discusses the development of the probabilistic ground motions. And those are discussed and developed in the shear wave velocity profiles from which the -- we're calling them calculations -- but the analyses done by Geomatrix isn't discussed in Appendix F, or the fault evaluation and probabilistic -- or the hazard evaluation study. When we look both in the text of that Appendix F and also the figures from which we could conclude that the ground motion studies were done, both of those apparently had shear wave velocities around 750 feet per second. So our concern was that it didn't appear that the shallow layer that we've been talking about with the mean velocity of 540 feet per second had been included in the discussion analyses in Appendix F.

A. (Dr. Ostadan) I would like to add to that answer. Since we are discussing about whether this concern has been addressed or exists in the recent calculation, I think as was stated by Dr. Bartlett, we are certain that the upper soft layer was not represented in the ground motion analysis. I also would like to state that the properties of the deeper layers, 750 feet per second and increasing with depth were obtained from geophysical refraction tests that were

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conducted by the applicant at the time, predating the seismic cone data, obviously.

And as far as I understand, and I'm not a geophysicist, but if in this analysis you measure some layers such as the upper ten feet soft layer, it could potentially impact the measurement -- not the measurement -- the properties developed for the deeper layers. So another way of saying this is that if the refraction data were to be analyzed again or conducted again and the upper ten feet is recognized, it's very likely that the velocities for deeper layers will change.

Q. Since both of you referred to Appendix F and I happen to have a copy of Appendix F here, let's mark it as an exhibit so rather than talking generally where your concern is expressed in the body, you can pinpoint it for the record.

MR. TRAVIESO-DIAZ: Let's make this Exhibit, what, 65?

(Exhibit-65 marked.)

MR. TRAVIESO-DIAZ: And while we're looking at that, can we go off the record for about two minutes?

(Discussion off the record.)

Q. (By Mr. Travieso-Diaz) Now, we were talking about Appendix F to the Geomatrix report, which is now

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Exhibit 65. And I asked you to perhaps give us references as to where in the analysis do you find the problems that you just referred to. Have you been able to do that?

A. (Dr. Bartlett) Yes, we have.

Q. All right. And will you tell us where that is?

A. (Dr. Bartlett) It is on page F-8.

Q. All right.

A. (Dr. Bartlett) Okay. The last paragraph beginning "As indicated above."

Q. Correct.

A. (Dr. Bartlett) You see there that "the average velocity," and this would be shear wave velocity, I believe they're referring to, "for the Holocene and Pleistocene sediments are estimated to be," they're speaking of both, 750 feet per second, shear wave velocity; 2,000 feet per second, P-wave velocity, primary wave velocity.

Q. And your concern is that for the upper layer these numbers may be too low?

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

A. (Dr. Ostadan) No, too high.

A. (Dr. Bartlett) Excuse me.

Q. I'm sorry. Too high.

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A. (Dr. Bartlett) Too high.

A. (Dr. Ostadan) And the second concern is the new measured data could impact the numbers cited here?

A. (Dr. Bartlett) Let's also refer to Figure F-4 just to show that the apparent shear wave velocity profile used in the analysis, or at least the mean -- should probably say the mean shear wave velocity profile used in the analysis. I see a Skull Valley sediment with a solid line, a California deep soil with a dashed line. And to the best that we can tell from the scale of this drawing, it appears that in the upper 50 feet of the profile, going from 50 feet to the surface, that there's a shear wave velocity here of 750 feet per second. And we believe this to be incorrect now, at least in light of the new -- not the new, but the seismic cone penetrometer data that's been developed by the applicant.

Q. I didn't mean to cut you off; but to further define your concern, what is your understanding as to what the cone penetrometer data reflects or shows as to the shear wave velocity in the upper, what, layer 2?

A. (Dr. Bartlett) I believe we discussed this yesterday, but the mean value is approximately 540 feet per second with a lower bound somewhere around 400 feet per second and an upper bound maybe around 700 feet per

1 second --

2 Q. All right.

3 A. (Dr. Bartlett) -- in the upper 10 feet, at
4 least in this layer 2 that we've been talking about,
5 this clay layer near the surface.

6 Q. And I take it -- do you have a concern with
7 the values of shear wave velocity that are plotted on
8 Figure F-4 with respect to layers below I guess 50 feet?

9 A. (Dr. Ostadan) Yes, I do.

10 Q. And what is the concern?

11 A. (Dr. Ostadan) The concern was the
12 development of these properties were based on refraction
13 data at the time that the upper soft layers were not
14 recognized to exist at the site. Now, with the new
15 information from seismic cone data, I believe the
16 refraction data needs to be reanalyzed and the
17 properties for the deeper layers needs to be
18 recalculated.

19 Q. Just explain for the record how the velocity
20 on the layers say 50 feet or below would be affected by
21 a variation in the velocity in the upper layer.

22 A. (Dr. Ostadan) Okay. This is -- I am
23 speaking from experience. I'm not a geophysicist and I
24 don't claim to have expertise there. They trigger a
25 source and they measure vibration of the ground at the

1 surface, and then they collect a lot of raw data
2 repeating this test. And then they assume certain
3 layering at the site and they take the peak's time to
4 travel a refraction. And they work from layers above to
5 below. If they miss on a layer at the top, the
6 properties that were subsequently calculated for layers
7 below would be impacted.

8 Q. Would be impacted or might be impacted?

9 A. (Dr. Ostadan) Would be impacted.

10 Q. For a fact?

11 A. (Dr. Ostadan) Yes.

12 Q. If you assume, as this curve appears to
13 assume, that there is a uniform velocity on the top 50
14 feet or so -- I believe that's what Figure 11 seems to
15 show.

16 A. (Dr. Bartlett) Approximately 50 feet.

17 Q. Assuming for the moment that this figure is
18 correct, would a shift in that curve, say, from 750 to
19 600, 500 change their response below?

20 A. (Dr. Ostadan) "Their response below," would
21 you clarify?

22 Q. The velocity below. I'm sorry.

23 A. (Dr. Ostadan) Would you repeat the
24 question?

25 Q. Yes. You express a concern that there may

1 have been an underestimation of the -- or overestimation
2 of the shear wave velocity in the, say, layer 2, the
3 first couple layers of soil. Is that it?

4 A. (Dr. Ostadan) I did not characterize it as
5 over or under. I stated that the layers, soft layers
6 were not recognized in the refraction test that was
7 performed.

8 Q. What I'm trying to get to is two things.
9 First, assuming that it was in fact as it is shown in
10 the curve, uniform, the same shear wave velocity for the
11 top 50 feet as opposed to perhaps being different from
12 one layer to the other, would that result, assuming that
13 this curve is correct, perhaps not as to what the number
14 is but that the fact that it's uniform, would that
15 affect the value of shear wave velocities at levels
16 below, say 100 feet or below?

17 A. (Dr. Ostadan) You recognize this is a
18 hypothetical question. You're assuming it's uniform.

19 Q. Yes.

20 A. (Dr. Ostadan) We know it is not uniform
21 from seismic cone data. Therefore, I cannot really
22 postulate that. As I said, I am not a geophysicist, but
23 I do know the process sitting through these meetings and
24 other projects that if you did not pick the upper layers
25 properly, the layers below will be impacted.

1 Q. Let me ask you a variation of that question.
2 Assume that the average velocity for the top 50 feet is
3 as depicted in Figure F-4, average as opposed to, you
4 know, point-by-point variation. How would that affect
5 the validity of the shear wave velocity measurements of
6 layers below 50 feet, if you know?

7 A. (Dr. Ostadan) I would suspect it would
8 impact the velocities.

9 Q. Even if the average is as stated on Figure
10 F-11? And what would be the basis for your suspicion?

11 A. (Dr. Ostadan) Simply based on the
12 techniques and the methods the geophysicists use to come
13 up with these properties, and they work out from layer
14 to layer.

15 Q. I tell you, I think we should move to
16 paragraph G. Paragraph G is on page now 55. Do you see
17 that paragraph?

18 A. (Dr. Ostadan) Yes, I see.

19 Q. Can you again explain for us what your
20 concern is in paragraph G?

21 A. (Dr. Ostadan) This is I believe again an
22 old calculation to do with deterministic ground motion.
23 The state suggests the P-wave velocity of 4,000 feet per
24 second is applicable to the site. And the reason for
25 the erroneous measurement of 2,500 feet per second

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1 should be described.

2 It's been a long time. I think there was a
3 mismatch in the package, as I recall. There was a
4 measurement of 2,500 feet per second that was recognized
5 to be an appropriate property, and they chose to use in
6 this case I believe Geomatrix' 4,000 feet per second.
7 However, the geophysicist did not provide any
8 information why the property he or she picked was 2,500
9 feet per second rather than expected value of 4,000 feet
10 per second. And what would be the impact of this
11 erroneous assessment in the other layers, that was the
12 comment.

13 Q. Is this still a valid comment?

14 A. (Dr. Ostadan) Again, I have not reviewed
15 appendix -- Geomatrix report that's reflected here. I
16 cannot answer that.

17 Q. Do you recall when Mr. Trudeau and Dr. Chang
18 testified on Wednesday that they testified that this
19 particular Calculation (PO5)-1 had been superseded by
20 what's now called (PO18)-1?

21 A. (Dr. Ostadan) I recall that.

22 Q. Have you reviewed (PO18)-1 for purposes to
23 determine whether this is still true?

24 A. (Dr. Ostadan) Can you give me the title to
25 (PO18)-1? I don't remember numbers.

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1 Q. I can do better than that. Let me just give
2 you (PO18)-1.

3 MR. TRAVIESO-DIAZ: Let's mark this as 66.
4 (Exhibit-66 marked.)

5 Q. I have marked as Exhibit 66 a Stone &
6 Webster calculation entitled "Soil and Foundation
7 Parameters for Dynamic Soil-Structure Interaction
8 Analyses," Calculation Number G(PO18)-1. The date
9 appears to be August 26, 1999. And it says on the right
10 that it supersedes calculation G(PO5)-01, Rev. 1. Do
11 you see that? On the front page.

12 A. (Dr. Ostadan) Yes, I see it.

13 Q. Okay. Would you turn your -- look at -- I
14 believe it's page 9 of 26. And I believe also that
15 there is a table on the top of page 9.

16 A. (Dr. Ostadan) Two tables.

17 Q. You're right. And then there is on the
18 bottom of the page a section 4.0. Let's look at 4.0
19 first. And the section 4.0 indicates that the dynamic
20 properties for the idealized layers as developed in
21 support of this analysis are presented in Table 1. And
22 then now I'll ask you to look at Table 1, which is on
23 page 14 of 26. Do you have that?

24 A. (Dr. Ostadan) I have that. Yes, I'm there.

25 Q. By looking at this Table 1, and let's look

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1 at the middle column, which is entitled "Best Estimate."

2 A. (Dr. Ostadan) Yes.

3 Q. Will you take a look at the best estimate
4 entries for the shear wave velocities and the pressure
5 velocities, which I believe are in the fifth and sixth
6 columns.

7 A. (Dr. Ostadan) Yes.

8 Q. And look at the numbers that are reported
9 for the various layers which correspond to various
10 depths.

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

12 Q. All right. Now, isn't it true that the
13 shear wave velocity as reported now in this new
14 calculation is 500 to 663 for the first -- well, let me
15 not characterize myself what this shows.

16 Would you look at the shear wave velocities
17 in the middle column for best estimates on this table,
18 and tell me whether these are better estimates than the
19 ones that you were referring to with respect to (PO5)-1,
20 and meaning better in the sense of being closer to
21 measured values?

22 A. (Dr. Ostadan) Yes, I think these
23 properties, as I recall, reflect latest soil data,
24 including seismic cone data.

25 Q. Would the fact that these are the numbers

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1 now used by Geomatrix in its calculation resolve the
2 concern that you had on paragraph G with respect to the
3 use of inconsistent figures?

4 A. (Dr. Ostadan) I think there are two topics
5 here mixed up.

6 Q. All right. Please clear me up.

7 A. (Dr. Ostadan) As far as the development of
8 soil and foundation parameters are concerned, which is
9 the mission of Calculation G(PO5)-1 and Exhibit 66, I do
10 believe the Exhibit 6, as I stated, reflected the latest
11 geotechnical data.

12 However, the premise of the comment G was
13 that at the time Geomatrix performed a similar
14 calculation using the deterministic motion, they
15 recognized that the velocity of 2,500 feet per second
16 was erroneous, and I believe that probably came from
17 refraction data. And they chose to use 4,000 feet per
18 second.

19 Therefore, part of the concern has been
20 addressed, the part that relates to development of soil
21 and foundation parameters in support of dynamic soil
22 analysis. But part of the comment that it states that
23 the impact of the cause and the velocities of the layers
24 below should be explored has not been answered.

25 Q. So what you are referring to as being a

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1 separate concern, even though it's part of the same
2 paragraph, is that -- what is stated on the last clause,
3 if you will, on this paragraph which reads, the impact
4 of the cause on -- I'm sorry. The cause for what? The
5 cause of what?

6 A. (Dr. Ostadan) I think -- I'm recalling from
7 memory here on this. You handed me this calculation,
8 the old calculation. I think Geomatrix states that the
9 P-wave velocity of 2,500 feet per second in their
10 opinion is erroneous, and they chose to use 4,000 feet
11 per second. And part of the concern expressed here, if
12 that is the case that 4,000 feet per second is
13 appropriate, what would be the impact of this erroneous
14 measurement or analysis on the other velocities of other
15 layers.

16 Q. All right. Let me ask you to turn back to
17 page 5 of the text of that exhibit.

18 A. (Dr. Ostadan) Which one?

19 Q. The one you have in front of you, Exhibit
20 66.

21 A. (Dr. Ostadan) Correct.

22 Q. I believe on page 5, middle of the page to
23 the bottom of the page, there is a section called "Site
24 Data."

25 A. (Dr. Ostadan) Yes.

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1 Q. And I believe that that paragraph contains
2 an explanation of how the values that are reported in
3 Table 1 were contained.

4 A. (Dr. Ostadan) Yes, I read that.

5 Q. Okay. Does it help you understand how the
6 numbers on the table were obtained, and does it
7 alleviate the concern you just expressed in any way?

8 A. (Dr. Ostadan) I don't think that issue is
9 really as important, because first of all, this
10 calculation is really a historic calculation now on the
11 account of change of ground motion and the philosophy
12 here. I don't think I have a major concern with this.

13 Q. Why don't we move to H. I guess we're up to
14 H on page 55. And H is entitled "Unknown Influence of
15 the Sharp Contrast in Dynamic Soil Properties on
16 Foundation Parameters and Soil Structure Interaction
17 Analysis." Again, so that I don't misinterpret what
18 your concern was, will you explain?

19 A. (Dr. Ostadan) Okay. At the time this
20 calculation was performed, they used a very quick
21 approach to estimate the stiffness and damping, and the
22 effects of frequency dependency was not considered. I
23 think in the revised calculation it has been considered.
24 But I do not have a concern on this anymore.

25 Q. Let's then look at "I" on page 55. Again,

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1 it's entitled "No Variation of Soil Parameters Has Been
2 Considered in Performing Site Response Analysis." This
3 goes up to page 56. And again, I think it refers to the
4 same calculation that we have been discussing before,
5 the 1997 calculation.

6 A. (Dr. Ostadan) Yes, sir.

7 Q. In light of the new calculation, (PO18), is
8 this still a current concern?

9 A. (Dr. Ostadan) You need to realize the chain
10 of calculations that are using the information that are
11 provided by Geomatrix calculation -- first of all, this
12 is again an old calculation. At the time they did not
13 recognize any variation of the properties. Now, the
14 revised calculation does recognize the variation of soil
15 properties. However, the way the new Geomatrix
16 calculation is written out, they have chosen to vary the
17 properties in the upper 30 feet or so by increasing and
18 reducing shear modulus by a factor of one and a half.
19 And I made a comment yesterday that no statistical
20 analysis was shown to justify whether this variation is
21 sufficient, or they should have used NRC SRP 371 to
22 change the shear modulus by a factor of 2. However, for
23 layers below 30 feet or so, Geomatrix calculation states
24 that the properties are less known, and they choose to
25 change the properties by a factor of two, which is, in

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1 my opinion, sufficient.

2 And I mentioned this chain of calculation
3 needs to be considered because then Stone & Webster
4 performed a similar calculation using the shake results
5 provided by Geomatrix, the strain compatible soil
6 properties, in order to develop soil spring and damping
7 for canister transfer building. In doing so, Stone &
8 Webster chose to vary the shear modulus by a factor of
9 one and a half for all layers, shallow and deep.

10 So the concern remains, how come Geomatrix,
11 for reasons to be provided, limited the variation to one
12 and a half in the upper 30 feet but recognized that more
13 variation is needed for deeper layers, but Stone &
14 Webster using Geomatrix data did not recognize this. I
15 have not seen any discussion of data to suggest that
16 would be appropriate.

17 Q. To paraphrase what you just said and to make
18 sure I understand it, with respect to the Geomatrix
19 calculation, your concern is that it has not been
20 established a basis for using a variability factor, if
21 you will, of 1.5 for the upper layers?

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

23 Q. And you don't have other concerns with the
24 Geomatrix calculation; is that right?

25 A. (Dr. Ostadan) I do not have any other

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1 concerns.

2 Q. With respect to the Stone & Webster
3 calculation that uses the Geomatrix calculation or may
4 use it, your concern is that they had used 1.5 across
5 the board for all layers. Is that it?

6 A. (Dr. Ostadan) Yes. I make a correction.
7 They have used it.

8 Q. They have?

9 A. (Dr. Ostadan) Yes.

10 Q. So to the extent that the Geomatrix approach
11 for using 1.5 in the upper layer is faulty, the Stone &
12 Webster will be faulty as well; and to the extent that
13 it is correct for the upper layers, the Stone &
14 Webster's 1.5 would be correct?

15 A. (Dr. Ostadan) I think that's true.

16 Q. On the other hand, Stone & Webster will have
17 to prove why they used 1.5 for the other layers, whereas
18 Geomatrix used 2?

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

20 Q. I think I understand. Now, what determines,
21 based on your knowledge of industry practice and their
22 standards, whether you can use a 1.5 factor of
23 adjustment or not? What basis do you make that
24 determination?

25 A. (Dr. Ostadan) Statistical analysis of the

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1 data. One needs to collect enough data to be able to
2 capture the variance to be able to establish the upper
3 bound, lower bound, mean, so that a call can be made
4 whether a limited variation should be considered or a
5 larger variation should be considered.

6 Q. Now, let's consider for a second the upper
7 layers of soil at the PFS site and the shear wave
8 velocities that have been reported using the various
9 tests that have been run. You remember we had some
10 discussion of that the other day when Mr. Trudeau was
11 testifying?

12 A. (Dr. Ostadan) Yes.

13 Q. Do you recall whether there is a wide
14 variation on shear wave velocities in the upper layers?

15 A. (Dr. Ostadan) I think it is fair to state
16 that I do not expect a wide variation of shear wave
17 velocity based on seismic cone data. However, all I am
18 asking is that statistical analysis needs to be
19 presented to justify that.

20 Q. So you think that a confirming statistical
21 analysis should be performed?

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

23 Q. But your recollection of the data is that
24 the velocities are fairly uniform for that?

25 A. (Dr. Ostadan) I expect them to be. That's

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1 correct.

2 Q. And in fact, just -- again, this is not a
3 test of memory. Do you recall, we introduced in the
4 deposition of Mr. Trudeau Exhibit 38, and Exhibit 38,
5 I'm only going to show it to you to refresh your memory.
6 Includes as the last page Figure 2.628 of the SAR.

7 A. (Dr. Ostadan) Yes.

8 Q. And if I remember the discussion,
9 Mr. Trudeau testified that it appeared that the shear
10 wave velocities were reasonably uniform across. And
11 that's what my understanding was of this graph.

12 A. (Dr. Ostadan) That's my understanding, yes.

13 Q. Thank you. All right. And again, your
14 concern as to the upper layers would be that even though
15 this may be the case, you'd like to see statistical
16 verification?

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

18 Q. And as to the lower layer, you'd like to
19 know how come Stone & Webster used a factor of 1.5?

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

21 Q. Thank you. By the way, when you say Stone &
22 Webster, I think I know, but I don't want to put words
23 in your mouth. What calculation did Stone & Webster
24 use?

25 A. (Dr. Ostadan) I don't remember the number

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1 even to touch it, but this is a calculation that
2 calculates the soil spring and damping.

3 Q. Soil spring and damping for -- okay. If we
4 come across that calculation, we'll come back to it.

5 A. (Dr. Ostadan) Sure.

6 Q. We were now talking about -- I lost my train
7 of thought here. I think we just finished talking about
8 "I" on page 55. And let's just move to J on page 56.

9 Now, this -- again, I'll let you explain
10 what your concern is with respect to J.

11 A. (Dr. Ostadan) Okay. What I would like for
12 the record to state, it is a very, very important
13 decision in the course of the study of seismic design
14 for any facility that once a design basis motion has
15 been developed, and the engineers will take that motion
16 and will have to apply it into their analysis at which
17 location in the soil profile this motion should be
18 introduced -- in technical terms, the control point, the
19 location of the control point. SRP 371 specifically
20 states, if you have soil profile that has a thin soft
21 layer, the design motion should be specified as outcrop
22 at the top of the competent material. In other words,
23 they want applicants not to put the design motion on the
24 top of a thin soft layer.

25 That issue is still very much of the

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1 concern, and I must say has been even aggravated by the
2 new seismic cone data.

3 Q. Let me ask first just to -- perhaps we can
4 agree on the applicable standard. Are you familiar with
5 Reg Guide 1.165?

6 A. (Dr. Ostadan) I believe I am. Is this the
7 one that talks about damping?

8 Q. Again, we're not going to test your memory
9 here. I'm not going to introduce it because it's
10 already on the record as Exhibit 2. I'll give you a
11 copy. Reg Guide 1.165 entitled "Identification and
12 Characterization of Seismic Sources and Determination of
13 Safe Shutdown Earthquake Ground Motion," dated March
14 1977. I believe that testimony by all the witnesses
15 earlier on has indicated that this is the currently
16 controlling regulation from the NRC standpoint on the
17 issue that we were discussing a moment ago.

18 MS. CHANCELLOR: Objection. It's not a
19 regulation.

20 MR. TRAVIESO-DIAZ: Okay, guidelines from
21 the NRC. I stand corrected.

22 A. (Dr. Ostadan) May I comment on that? I
23 think that counsel has stated that their position on the
24 probabilistic ground motion will be formulated. This
25 guidance specifically talks about the probabilistic

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1 Q. (By Mr. Travieso-Diaz) My question to you
2 is, first clarify for me, when it says in the second
3 part of this paragraph that the ground motion estimates
4 should be made for road conditions in the free field, is
5 the free field that they referred to the same as
6 competent materials you're testifying? I'm trying to
7 understand what the distinction is, if any, between the
8 two concepts.

9 A. (Dr. Ostadan) Well, I do know it is done
10 both ways. Free field simply means ground free of
11 presence of any structures or building.

12 Q. Would that mean on the surface?

13 A. (Dr. Ostadan) Yes. So -- and that's how
14 the practice is. You develop ground motion for the
15 ground first. And it's done for the rock and it's also
16 done for competent soils, yes.

17 Q. Now let me ask you a different question. Is
18 it your concern, one, that the top 30 feet of soil at
19 the PFS site are not competent material as you define
20 it?

21 A. (Dr. Ostadan) Yes.

22 Q. So your concern is that you feel that the
23 top 30 feet of soil at PFS is not competent material;
24 therefore, you should not place your earthquake source
25 there?

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1 method to be used for the development of ground motion.

2 Q. Well, let me ask you the following question.
3 Looking just within the text of this regulation, and I'm
4 going to refer you specifically to page 1.1657, 1.65-7.
5 And as many NRC documents tend to be, this is has two
6 columns. I'd ask you to look at the left column,
7 paragraph No. 3, and let me ask you to read that
8 paragraph first.

9 A. (Dr. Ostadan) Do you want me to read it?

10 Q. No, no. Read it to yourself. I can read
11 it, but I just want you to study it.

12 A. (Dr. Ostadan) Yes, I read that.

13 MS. CHANCELLOR: For the record, I'm going
14 to object that this document addresses probabilistic
15 ground motions and addresses sites in the eastern United
16 States, that this isn't relevant to the PFS site. He
17 may answer if he can.

18 MR. TRAVIESO-DIAZ: Well, my question was --
19 in fact, as to the second part of your objection, I
20 invite you to look at the middle of the paragraph.

21 MS. CHANCELLOR: I see it now.

22 MR. TRAVIESO-DIAZ: Right.

23 Okay, and your objection to the first part
24 is noted.

25 MS. CHANCELLOR: Okay.

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1 A. (Dr. Ostadan) Not on top of that layer,
2 that is correct. I'd like to make a clarification.

3 Q. Please.

4 A. (Dr. Ostadan) There are two ways to apply
5 or use the analysis, in my opinion, to be proper. One
6 is, the seismologist that developed the design basis
7 motion recognize the soil profile and all the layers and
8 the latest information in their calculation. This
9 obviously was not the case. The upper layers with the
10 low velocities were not reflected in the Geomatrix
11 seismic hazard analysis. Short of doing that, recognize
12 that the ground motions were developed for a soil
13 profile that has a velocity of 750 feet per second in
14 the upper layers, and therefore use a ground motion that
15 has been developed but put it in the soil column where
16 the shear wave velocity of 750 feet per second shows up
17 to be consistent with the development of the ground
18 motion.

19 Q. So your view is that the earthquake location
20 should be at the place where you computed your shear
21 wave velocity?

22 A. (Dr. Ostadan) Consistent with that
23 assumption that you used in the development side, that's
24 correct.

25 Q. Now, if it was determined by reference to

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1 industry standards or some other source that in fact the
2 top 30 layers -- the top 30 feet of soil at PFS were
3 competent material, as you defined it, would that
4 resolve your problem?

5 A. (Dr. Ostadan) I certainly would like to see
6 that documentation. I think to help you out, if I may,
7 there is a documentation by NRC that defines thin, soft
8 layers. And if I'm not mistaken, thin is defined to be
9 anything less than 100 feet, and soft is defined to
10 be -- and I have to be approximate here -- anything less
11 than either six or seven hundred feet per second.

12 Q. And can you give me for the record that NRC
13 standard?

14 A. (Dr. Ostadan) That's a NUREG publication.
15 I don't recall the name.

16 Q. All right. Does that publication contain a
17 definition of what competent soil is?

18 A. (Dr. Ostadan) It defines what thin soft
19 layer is as stated in the Standard Review Plan 3.7.1.

20 Q. But it does not contain, and this is only if
21 you remember because I don't have the document in front
22 of me to give you, it does not specifically define what
23 a competent layer is?

24 A. (Dr. Ostadan) I think it implies what a
25 competent layer is by defining the properties of the

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1 soft layer.

2 Q. Do you know whether there are other industry
3 publications that provide a definition of what a
4 competent soil layer is?

5 A. (Dr. Ostadan) I don't recall any. I think
6 the most relevant guide and standard would be NRC here.

7 Q. Well, the only reason I'm asking that is, in
8 the absence, and we don't know if there's an absence,
9 but assuming that there is an absence of definition by
10 the NRC of what a competent layer is -- let me ask the
11 question again.

12 Assuming, and again it's not established,
13 that there is no NRC specific guidance as to what a
14 competent layer of material is, would the practice in
15 your profession be to refer to other industry sources
16 that may contain a definition?

17 MS. CHANCELLOR: I'm going to object because
18 he testified that soft thin layer was basically
19 synonymous with competent layer, and the NUREG defines
20 soft thin layer. And he gave you his best recollection
21 of what soft thin layer, the definition of that. And so
22 now you're asking him to speculate that that may not
23 exist and that what would you do if this didn't exist,
24 and I think he's told you that it's in the NUREG.

25 MR. TRAVIESO-DIAZ: Only for clarification.

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1 If I understand the witness, and please correct me if
2 I'm wrong, he said that you can imply what a competent
3 layer is from the definition of soft layer --

4 Q. -- but they are not the same thing, are
5 they?

6 A. (Dr. Ostadan) Well, in the context of
7 discussion we have as to where you place the design
8 motion, the NUREG document talks about or clarifies what
9 the soft layer is, and that would also clarify what thin
10 soft layer is not.

11 Q. And how do you go from there to what a
12 competent material is? That's my question.

13 A. (Dr. Ostadan) My assessment of that
14 information is, if you have a layer that has velocities
15 in excess of what is recognized to be a soft layer, you
16 can treat it -- for the purpose of locating design
17 motion, you can treat it as competent.

18 Q. Let me ask you the question differently. In
19 determining whether you have competent material, what
20 you look at is the velocity in that material?

21 A. (Dr. Ostadan) That is correct.

22 Q. And you're inferring that if you have a thin
23 layer, a thin layer may not have a velocity high enough
24 to be classified as a competent material?

25 A. (Dr. Ostadan) That is correct.

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1 Q. All right. I think that that clears what
2 you're talking about.

3 Why don't we move on to I think paragraph K,
4 which I believe starts on page 56. And again, rather
5 than attempting to describe the concern, I would ask you
6 to please summarize it.

7 A. (Dr. Ostadan) There are a number of points
8 made under K. "The seed time used to generate each
9 component of the design time history has not been
10 described." Seismic design time history for private
11 storage facility, etc.

12 All right. So at the time, again, this is a
13 historic calculation, and the comment states that what
14 recorded time history date is started with a seed time
15 history. I think to that effect this has been resolved.
16 The new Geomatrix calculation states which seed time
17 history they have used.

18 Q. And which is that?

19 A. (Dr. Bartlett) I remember seeing it. It
20 has been stated.

21 A. (Dr. Ostadan) Right. It is a record from
22 Italy, I believe.

23 A. (Dr. Bartlett) It's an external site, rock
24 site. We've seen the time history.

25 Q. Excellent memory.

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1 A. (Dr. Ostadan) I think he lived through that
2 motion, I believe.

3 A. (Dr. Bartlett) I have been in that
4 earthquake.

5 Q. Then you have good reason for being
6 intimately familiar with this. But anyway, let's just
7 put this on the record so we know what we're talking
8 about. Let's call this Exhibit 67.

9 (Exhibit-67 marked.)

10 Exhibit 67, and for the record, let me
11 identify, this exhibit consists of excerpts. It's not a
12 complete document.

13 A. (Dr. Ostadan) Yes.

14 Q. I believe it's the first ten pages of Stone
15 & Webster Calculation G(P018)-3 entitled "Development of
16 Time Histories for 2,000-Year Return Period Design
17 Spectra."

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

19 Q. All right. Now, and this is only for
20 purposes of clarifying the record, would you take a look
21 at page 4 of 34 in Exhibit 67. I believe it identifies
22 the earthquake that was used as the seed -- to provide a
23 seed history, as you mentioned it. And I believe it
24 says in the last paragraph of the page that it was the
25 November 23, 1980 M 6.9 Irpinia, Italy earthquake. And

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1 that's what we're talking about.

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

3 Q. So the first portion of your concern was
4 only historical, because now we have an identification
5 of which was the seed history.

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

7 Q. Do you have any concerns as to that
8 selection itself, whether that was a proper selection
9 for PFS?

10 A. (Dr. Bartlett) It seems to be a reasonable
11 record. As I understand it, it comes from a normal
12 faulting type of event which we have in the Basin and
13 Range. I believe it was also used at Yucca Mountains.

14 A. (Dr. Ostadan) I would like to add to that.
15 It is, in my opinion, appropriate but not adequate.

16 Q. Now you need to clarify what you mean by
17 that. So it's necessary but not sufficient?

18 A. (Dr. Ostadan) Then again, we have to
19 recognize what this calculation does to the entire
20 design package. Geomatrix was asked to develop time
21 histories to be compatible with the design response
22 spectrum. And in the second round of calculations that
23 they performed, I think they did a substantially much
24 better job than the previous round. And they developed
25 one set of time histories with three components, two

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1 horizontal and one in vertical. And these time
2 histories, in my opinion, are acceptable. They meet all
3 the requirements in terms of energy and frequency
4 characteristics.

5 However, they're not sufficient, and the
6 reason is we need to now look at the entire design
7 package. And there are two elements that come in. One
8 is, the analysis of the casks on the pad that was
9 conducted by Boltec is a nonlinear analysis. They have
10 modeled the friction and the sliding behavior of the
11 cask on a pad by nonlinear elements. It is a common
12 practice in our field that whenever you do a nonlinear
13 calculation you use at least three sets of time
14 histories rather than one, because it is recognized that
15 the nonlinear analysis is sensitive to the phasing of a
16 time history, and in order to cover variation of the
17 phasing in the design, a minimum of three time histories
18 and sometimes four are used.

19 The other concern I have is that Geomatrix
20 has appropriately recognized that we are near a major
21 fault, the applicant is near a major fault here, and
22 therefore the velocity cause, or quote-unquote, fling,
23 should be included in the time history. They have done
24 so. They have included that. However, no parametric
25 study has been done in this design package to reveal

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1 what is the impact of these pulses on the design.

2 Therefore, the concern remains whether the pulse in
3 terms of shape and period has been adequately
4 characterized.

5 And I would like to cite an example, for
6 example, in the Bay area, San Francisco Bay area. The
7 same issues have been raised for construction of a
8 bridge there, the San Francisco Bridge -- Bay Bridge, in
9 which it's been recognized that these pulses could be
10 symmetric, asymmetric, one-sided, two-sided. And as a
11 result of that, several time histories were generated to
12 make sure variation of these pulses are included in the
13 design.

14 Q. Before we address the two concerns you just
15 mentioned, I want to ask you about one more item that is
16 mentioned in paragraph K, and that is in the last
17 paragraph, just to make sure that we don't overlook it.
18 It says, "Acceleration-compatible time histories are
19 shown to match the design response spectra at only
20 5 percent damping." Is that a historical concern, or is
21 it still correct?

22 A. (Dr. Ostadan) It's a historical concern.

23 Q. So it is no longer true?

24 A. (Dr. Ostadan) It's no longer true.

25 Q. Now, let's go back to the two you did

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1 address. If I understand the first, you don't have a
2 problem with the time histories that Geomatrix
3 developed, but you do have a problem with the ones that
4 Holtec used. Is that correct?

5 A. (Dr. Ostadan) I think my concern is the
6 ones that were developed are fine but are not
7 sufficient. More needs to be developed.

8 Q. You mean they have to develop more than one
9 time history?

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

11 Q. So that all their designers, like Holtec,
12 could have them available to use?

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

14 Q. And your understanding is that in the design
15 Holtec did not use three time histories?

16 A. (Dr. Ostadan) My understanding, they used
17 the one set that Geomatrix developed.

18 Q. I understand it now. Now, the second
19 concern is that even though Geomatrix has addressed
20 fling in its calculations, they did not try to determine
21 parametrically the potential variations or the potential
22 differing effects assuming various levels of fling. Is
23 that the concern?

24 A. (Dr. Ostadan) Yes. I would restate that,
25 as I stated earlier, that if the design calculation can

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1 identify that the design parameters are not sensitive to
2 the fling, perhaps there's no need to have additional
3 time histories for the P. But if this effort has not
4 been done, and it has not been done, therefore I think
5 that has stuff that needs to be covered.

6 Q. And I was remiss in asking you earlier to
7 identify for the people who read this transcript what
8 "fling" means so that we can have a better idea of what
9 we're talking about. In common parlance that means
10 something else, I'm sure.

11 A. (Dr. Ostadan) As you know, we learn from
12 every earthquake, a fling is a phenomenon that was known
13 for a number of years but was not appreciated until we
14 had these two recent earthquakes in Kobe and North
15 Ridge. But what is the best way to characterize fling
16 is to look at the velocity time history of a record of a
17 site which is near a major fault. And what you will
18 observe is a huge pulse that contains a lot of energy in
19 a short period of time. For example, in the case of
20 North Ridge, the shaking was in the order of ten to
21 fifteen seconds. If I'm not mistaken, 85 percent of
22 energy was delivered in -- some of it in one to one and
23 a half seconds. This is what make earthquake more of a
24 blast.

25 And of course as a result of that, there was

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1 major damage in the Los Angeles area and Kobe, and the
2 subsequent research and studies identified that the
3 fling was a major contributor to that damage.

4 Q. To put it perhaps in layman's terms, an
5 earthquake that features fling is one in which there is
6 an energy pulse delivered over a very short period of
7 time?

8 A. (Dr. Ostadan) I think that is one way of
9 characterizing it, yes.

10 Q. And that energy pulse can be characterized
11 in terms of the velocity?

12 A. (Dr. Ostadan) That would be the best way to
13 observe it. You will not see it in a response spectrum.
14 You will see it in time history -- in velocity time
15 history.

16 Q. And what you're suggesting is that what has
17 not been done at PFS is in addition to use of recorded
18 type -- recorded value or pattern of fling where they
19 should have also done parametric studies to determine
20 the extent to which variation in the size of the
21 velocity would have an impact on the response?

22 A. (Dr. Ostadan) As I stated, there are two
23 ways to address my concern and my opinion. One is to go
24 back and look at the dynamic analysis of the cask and
25 the pads and the canister transfer building and show

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1 whether those seismic responses are sensitive to the
2 pulse or not. And these pulses usually take place at
3 longer periods. If that can be established, I don't see
4 there's a need to generate additional time histories
5 with other pulses.

6 If applicant chose not to do that, then my
7 concern is we should have enough time histories with
8 variation in the pulses to ensure, in case the design
9 parameters are sensitive, they are covered.

10 Q. So you're saying that a designer has a
11 choice between two procedures; either you establish
12 parametrically that you are not sensitive to fling -- to
13 variations in the fling, and therefore you can use
14 whatever best fit you can find, or if you don't do that
15 or if your parametrics show that you are sensitive, then
16 you have to use a range of those values?

17 A. (Dr. Ostadan) That is correct. I think the
18 record will be clear what you mean here.

19 (Recess taken from 12 noon to 12:10 p.m.)

20 Q. Dr. Ostadan, before we broke, took a break,
21 we were talking about paragraph L, I believe, on page
22 57. And I neglected to ask you a question about the
23 parametric study that you were -- suggested that would
24 be used. And typically in a parametric study, you take
25 what you consider to be a significant parameter and you

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1 vary it manually to how see how it affects the output of
2 the result. Is that what you do?

3 A. (Dr. Ostadan) Variation within reason, yes.

4 Q. Now, in the parametric study that you're
5 suggesting, what parameter would you suggest be varied
6 and how?

7 A. (Dr. Ostadan) You need to be specific. We
8 talked about two issues. One had to do with the
9 nonlinear analysis of Holtec. The other has to do with
10 characterization of the pulse in the time history. Both
11 of them.

12 Q. Well, you can talk about both of them.

13 A. (Dr. Ostadan) All right. For a nonlinear
14 analysis, as I have stated, it is generally known that
15 the response is sensitive to the phasing of the time
16 history. And the only way that it can be, to my
17 knowledge, can be properly recognized is to have more
18 than one time history so that various phases are
19 conducted in the design.

20 With respect to the pulse, if the applicant
21 chooses to have simply a number of time histories, it
22 would be to look at other recorded time histories with
23 the pulse and do the same calculation that Geomatrix did
24 so that we have several time histories with various
25 pulse confirmations.

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1 Q. But I'm not understanding now where the
2 parametric study would come in in the second scenario.
3 I understand your testimony to be that for the first
4 concern --

5 A. (Dr. Ostadan) Okay.

6 Q. -- there is no way around using different
7 time histories. Is that it?

8 A. (Dr. Ostadan) I don't know of any, no.

9 Q. Okay. For the second concern as to
10 whether --

11 A. (Dr. Ostadan) Where the parametrics study
12 comes in or how the variation -- it's very simple.
13 There are a lot of recorded motion, the so-called seed
14 time history that's stated here that are recorded that
15 do have the fling in them. And you look at it you see
16 the fling are different. You know, they have different
17 energy, they have different periods, they're symmetric
18 and asymmetric. So it's a matter of simply going after
19 different recorded motion and introduce additional
20 recorded motion into the similar calculation.

21 Q. So the parametric study here would be not to
22 take the one time history that you are using and varying
23 the magnitude?

24 A. (Dr. Ostadan) No, I would not do that.

25 Q. It would be a parametric study in which you

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1 tried to use three different earthquakes, if you will,
2 with different fling and see what effect, if any, you
3 have by using one or the other?

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

5 Q. Now I think that that's pretty clear. Thank
6 you.

7 I believe that there was an item being K
8 that we didn't talk about. Take a look at page 57.

9 A. (Dr. Ostadan) Yes.

10 Q. And these may be historic, but I just want
11 to make sure I have a confirmation. On top of page 57,
12 the second full paragraph says, "Acceleration-compatible
13 time histories are shown to match the design response
14 spectra at only 5 percent damping." Is that still a
15 valid concern?

16 A. (Dr. Ostadan) No, it's not a concern.

17 MS. CHANCELLOR: He already testified to
18 that.

19 MR. TRAVIESO-DIAZ: He did? Well, to prove
20 how much I understand what people tell me. I apologize.

21 Q. (By Mr. Travieso-Diaz) Well, now let's move
22 to paragraph L. I believe -- well, again, will you
23 summarize for me what your concern with L is.

24 A. (Dr. Ostadan) I think this first paragraph
25 is historical. The seed time history has been defined

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1 now.

2 Q. How about the second paragraph?

3 A. (Dr. Ostadan) Yes. I think this is
4 historical. At the time the designer used -- for each
5 package they used their own time histories. There are a
6 number of them. It is now consistent but not
7 sufficient.

8 Q. I understand. That was your concern with
9 respect to the previous one.

10 A. (Dr. Ostadan) Right.

11 Q. Looking at M on top of page 58.

12 A. (Dr. Ostadan) Yes. That -- for the one set
13 of time history that has been developed by Geomatrix,
14 this is no longer a concern.

15 Q. How about -- move to N on the bottom of page
16 58.

17 A. (Dr. Ostadan) This, again, for the one set
18 of time history that will apply, Geomatrix is no longer
19 a concern.

20 Q. Would the concern that you expressed on M
21 and N remain a concern if only one time history was
22 used? I'm referring you back to your discussion
23 earlier.

24 A. (Dr. Ostadan) Well, at the time I was very
25 concerned, because at that time also everybody used one

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1 time history. But they didn't do the check and balances
2 as requested here. They need a revised calculation,
3 they go to the check and balances required.

4 Q. Now, on N, and this is only because I'm not
5 sure the terminology will be able to stand up to it,
6 either, they talk about checking for drift.

7 A. (Dr. Ostadan) Yes.

8 Q. Will you just explain for the record again
9 what drift means in connection with this concern?

10 A. (Dr. Ostadan) I think drift essentially has
11 to do really to make sure the time history of earthquake
12 is properly and adequately characterized. And what
13 drift is, you would calculate the displacement time
14 history, because designers often use acceleration time
15 histories. You want to make sure you look at the
16 displacement time history and you don't see any peculiar
17 behavior, especially in the drift, which is the build-up
18 of displacement over time. That was a concern at the
19 time.

20 Q. And there has been addressed now?

21 A. (Dr. Ostadan) For the one time history
22 Geomatrix has developed, it has been addressed.

23 Q. Let's look at O, which starts on page 58.
24 We talked about this I believe before, but let's make
25 sure that there is nothing there that we haven't

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1 addressed. Paragraph O refers to fling.

2 A. (Dr. Ostadan) I think, as I stated before,
3 the only concern that remains is that to show that the
4 design is either not sensitive to the fling and
5 therefore no more fling characterization is needed, or
6 have enough fling in the various time histories to color
7 variation in the fling.

8 Q. So this paragraph O will be, if you will,
9 incorporated into what we discussed on K?

10 A. (Dr. Ostadan) I think so. We can blend
11 that.

12 Q. All right. Let's go to P. That's on page
13 59.

14 A. (Dr. Ostadan) Okay.

15 Q. (By Mr. Travieso-Diaz) "Soil Structure
16 interaction Issues in Modeling Cask Seismic Response."
17 This goes for a number of pages, 59 through 61.

18 A. (Dr. Ostadan) Okay.

19 Q. Let me ask you, so that the record is clear:
20 you are talking about a very specific document, which is
21 a report that is cited on the first paragraph, Holtec
22 report?

23 A. (Dr. Ostadan) Yes. That is true, yes.

24 Q. So that again we know we're talking about
25 something that is valid, is this report the current

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1 Holtec calculation that you're concerned with, or is
2 there a newer version of it?

3 A. (Dr. Ostadan) Well, of course the comment
4 was made at the time I reviewed that. This is in '97.
5 But I did review the latest version of it, too. And I
6 think the only difference within these two versions are,
7 they chose to use the time history that was developed by
8 Geomatrix consistently with other things. I don't
9 believe there was any difference in the modeling of the
10 cask or the nonlinear elements. That part remained the
11 same.

12 Q. And this is a report that deals with what?
13 It is a report with --

14 A. (Dr. Ostadan) Well, it is an important
15 calculation for the pad. This is really -- is the
16 calculation that generates the seismic loads that would
17 be acting on the pads.

18 Q. Is this part of the same package that Holtec
19 developed for the pad?

20 A. (Dr. Ostadan) Yes.

21 Q. Now, will you briefly summarize -- I know
22 this is long but just to get a sense, what the concerns
23 are -- the current concerns that you have with respect
24 to that calculation?

25 A. (Dr. Ostadan) Okay. Let's start with (1),

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1 input motion. I think we discussed that in length on
2 one of the previous items here, on K or J. It
3 effectively has to do with presence of thin soft soil
4 layer at the site. Holtec in their dynamic analysis of
5 the cask and the pad placed design motion at the top of
6 the soft soil layer in the profile.

7 I'm going to page 60 now, first paragraph.
8 I think it's stated in the SAR that this site is located
9 near a major -- a major fault, and in fact the fault is
10 dipping under the site a distance of four to six miles.
11 I don't remember exactly. It is known when a site is
12 near a major fault, the seismic wave arriving to the
13 foundation of structure are not necessarily vertically
14 propagating waves. The analysis performed by Holtec
15 assumes that the waves are vertically propagating.
16 There has been no concentration whatsoever to the
17 possibility that the waves may come at an angle. And
18 the concern there is, a wave coming in an angle tend to
19 introduce additional rocking and torsion above and
20 beyond what is captured by assumption of vertically
21 propagated waves.

22 Q. Can I interrupt for a second?

23 A. (Dr. Bartlett) Sure.

24 Q. Because I have a question of what you just
25 said. Have you studied the earthquake analysis

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1 performed by Geomatrix to characterize the earthquake
2 that would be usefully designed?

3 A. (Dr. Ostadan) I think, if I'm understanding
4 you correctly, you're referring whether Geomatrix has
5 specified what type of wave should be considered.

6 Q. That's exactly my question.

7 A. (Dr. Ostadan) Right. To the extent I know,
8 and again, I have not reviewed the Geomatrix seismic
9 hazard in detail, I don't expect that they would have
10 specified the wave would be of one type or the other.
11 It is appropriate to assume the waves are vertically
12 propagated, and I think applicant has done that,
13 although it's not sufficient because of the proximity of
14 the site to a major fault. I think parametric studies
15 should be performed with concentration to the fact that
16 the wave may arrive in an angle.

17 Q. And so that I understand the concern better:
18 is that characterization or that parametric study one
19 that would be done by Geomatrix as the generator of the
20 earthquake information or by the designer using that
21 information to figure out what difference it makes at
22 what angle the earthquake arrives?

23 A. (Dr. Ostadan) I think the answer is both.
24 Geomatrix can provide input as to what would be a
25 reasonable angle of incidence, and then the designer can

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1 assess the analysis.

2 Q. And you don't know whether Geomatrix has
3 provided that input?

4 A. (Dr. Ostadan) I do not know that.

5 Q. All right. But you know that the designer,
6 in this case, Holtec, did not use --

7 A. (Dr. Ostadan) I do know that for a fact,
8 yes.

9 Q. Okay. I understand you now. Please go on.

10 A. (Dr. Ostadan) Okay. The second paragraph
11 on page 60, "The Holtec calculation is based on
12 nonlinear formulation of the system." I think we
13 discussed that. Nonlinear is sensitive to the phasing
14 of the input motion, and therefore, multiple time
15 histories should be used.

16 Q. Now we're to item 2.

17 A. (Dr. Ostadan) Item 2, okay. This remains
18 to be a concern even in the latest calculation Holtec
19 submitted: how do you calculate soil spring and damping
20 for a foundation, and whether you recognize the site is
21 a layered site here, and whether you recognize the
22 spring and damping are function of frequency of
23 vibration.

24 I think in the calculation performed for the
25 spring and dash parts for the pad as well as the spring

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1 and dash parts for the canister transfer building, it's
2 been recognized that these properties, the stiffness and
3 damping, are all a function of frequencies. As a matter
4 of fact, it's shown to be a strong function of
5 frequencies for these sites. However, in the
6 calculation by Holtec, that aspect disappears. They
7 have simply calculated A as spring and A damping without
8 consideration to the frequency dependency of these
9 parameters.

10 Q. All right.

11 A. (Dr. Ostadan) Let me move to the second
12 paragraph, bottom of page 60. I think the fact that I
13 state here -- I'm going to page 61 now, top -- at the
14 time they did not consider the variation. Now they
15 consider the variation, so that's not an issue.

16 Okay. Well, moving down to the first part
17 of page 61, that is still a concern. The pad -- in
18 calculating the spring and damping, Holtec apparently
19 did not consider frequency dependency. They also assume
20 this pad is rigid. And again, if you look at the chain
21 of calculation for design, the results generated by
22 Holtec was given to ICEC, International Civil
23 Engineering Consultants, for subsequent stress analysis
24 of the pads. And I reviewed that calculation. And I
25 noted that when they applied the loading coming from

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

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

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

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

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

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

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

9 Q. Would you like to take off on there?

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

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

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

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

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

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

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

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

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

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1 Every design has a philosophy, and this design has its
2 own philosophy. And I think the main feature when it
3 comes to the cask and the pads is the philosophy here
4 that the casks would have to slide on the pads. And
5 then they have to slide in a controlled manner so that
6 they will not fall down and they will not impact each
7 other. It's a very bold philosophy to say this, in my
8 opinion, and unprecedented, to be close to such a major
9 fault with such a high level of ground motion to rely on
10 a philosophy without any redundancy in the design.

11 Q. What do you mean by philosophy? Do you mean
12 design assumptions as to the fact that the pads are
13 going to act in the manner that you described?

14 A. (Dr. Ostadan) That is what is expected of
15 the design.

16 Q. And your concern is that that, you're making
17 that assumption without testing it somehow is not
18 sufficient? Testing, by testing I mean trying to
19 determine whether this is a good assumption to use.

20 A. (Dr. Ostadan) Every design in engineering
21 has a redundancy. There is a possibility for anything
22 to fail. There has to be a backup measure to help with
23 design. Here the casks have to slide, and they have to
24 slide in a controlled manner. And there is no other
25 redundancy in the design. And the point raised here,

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1 for example, what about cold bonding over time? What if
2 one or two or eight casks do not slide?

3 Q. What redundancy would you expect to see
4 introduced into the design to account for this
5 possibility?

6 A. (Dr. Ostadan) Well, I really talked about
7 what would be other philosophies here, you know. I
8 think the designer has chosen not to anchor the casks to
9 the pads. They have relied on the casks to slide. That
10 will be something to look at. At a minimum, I would say
11 if they do not slide, what will be the seismic loads
12 coming to the pads.

13 Q. Again, I was remiss in not asking you to
14 define for the record cold bonding so that either of us
15 reading the transcript can understand what you're
16 talking about. Can you go back and tell us that?

17 A. (Dr. Ostadan) When two bodies are in
18 contact, in this case the cask and the pad, and the
19 casks are in the order of, if I'm not mistaken, 350, 360
20 kips, over time at the point of contact some local
21 deformation and redistribution of stresses may take
22 place that, in terms of engineering characteristic,
23 would create a bonding. And that also in turn negates
24 the assumption of being ready to slide when the
25 earthquake comes.

1 Q. Now, will you clarify what the consequence
2 would be if the cask because of cold bonding does not
3 slide if you have an earthquake?

4 A. (Dr. Ostadan) In my opinion, the seismic
5 loads will be larger.

6 A. (Dr. Bartlett) To the foundation and soil
7 system. And that's what we were -- when we investigated
8 this issue was our concern is that if perchance they did
9 not slide, the assumption that they -- the assumption
10 was that they did slide and the forces were reduced
11 because they did slide. If they did not slide, would
12 the soils underneath the pads be able to take that
13 additional force that would be imparted to them due to
14 the fact that they did not slide.

15 Q. So your concern is, again, to see if I
16 understand you properly, that in the event that there is
17 no sliding, some of the forces or stresses that will be
18 absorbed by the sliding motion won't be absorbed and
19 instead will be transported to the soil?

20 A. (Dr. Bartlett) Transported to the soil
21 system.

22 Q. And would these be vertical forces?

23 A. (Dr. Bartlett) These would be horizontal.

24 Q. Horizontal forces.

25 A. (Dr. Bartlett) Primarily.

1 Q. How would the horizontal forces be
2 transmitted to the soil?

3 A. (Dr. Ostadan) I can clarify that. I think
4 the forces would be impacted in all directions.

5 A. (Dr. Bartlett) In all the directions, okay.

6 A. (Dr. Ostadan) Yes. The seismic load and
7 horizontal direction on the pad would increase. Of
8 course, the load has to go somewhere. Therefore, it
9 comes to the pad first. It would aggravate the
10 stability condition of the pad first, and then it would
11 go to the soil underneath. And then the question is if
12 there's enough capacity to absorb that load. It also
13 threatens the overturning stability of the pad because
14 your loads have gone up.

15 Q. Would the fact that there is a plan to use
16 soil cement on the foundations of the pads assist in the
17 concern with having further or greater loads transmitted
18 down to the soil?

19 A. (Dr. Ostadan) I don't see any relation with
20 the soil cement and the fact that the casks may not
21 slide on the pad. So the loads on the pad will -- if
22 the casks do not slide, the load would go off. But as
23 to what happens with the soil, I defer that to
24 Dr. Bartlett.

25 Q. Actually, that was my question. What

1 happens to the soil assuming that you have a layer of
2 soil cement within the pad?

3 A. (Dr. Bartlett) I think we're talking in
4 this case now, sliding on top of this layer 2. That
5 would be maybe then -- we went through a long
6 discussion. We're not confident yet that this soil
7 cement mat will behave as an integral unit as we've
8 discussed; but also one additional force is, even if it
9 did, it would be transferred then to the soil.

10 Q. So that the entire discussion we have been
11 having is clarified -- I didn't quite follow what you
12 just said. I mean -- no, no, wait. I did understand
13 it, but I didn't quite get the grasp of this report.
14 The sliding concern that you are relating to is not one
15 in which the top layer of soil, if you will, slides, but
16 it's the layer beneath -- some feet beneath the surface?

17 A. (Dr. Bartlett) Well, again, we'd look at
18 the chain from the pad downward. We have to look at the
19 different interfaces. The first interface would be the
20 bottom of the pad, top of the soil cement. One would
21 have to check that. We've raised issues about that
22 behaving as an integral unit and resisting some of that.
23 But then even if that did, one would have to look
24 further down and look at the interface between the
25 bottom of the soil cement mat and top of layer 2. And

1 that's -- you'd just have to check those loads and how
2 they're transferred, and whether you have adequate
3 factors of safety through the full system if the cask
4 did not slide.

5 Q. I see what you're saying now. Let me ask
6 you another clarification that I overlooked to ask
7 before. And this relates for a moment back to the
8 concern that you were talking about rigidity before.
9 When you're talking about the CEC calculation showing
10 that the system isn't rigid, the mat is not rigid, are
11 you talking about rigid in which direction, vertical or
12 horizontal?

13 A. (Dr. Ostadan) You're talking about the pad.
14 Essentially my comment was on the vertical. The
15 horizontal, the pad itself I expect to be rigid.

16 Q. That gets me some sort of relief, because I
17 found it hard to understand. Okay.

18 I'm sorry. You were still talking about
19 paragraph 3 on page 61.

20 A. (Dr. Ostadan) Cold bonding, we discussed
21 that.

22 Then we go to the next paragraph. I think
23 perhaps some of your experts are familiar with friction
24 pendulum system. And this is another mechanism that
25 relies on a sliding to cut back on seismic loads.

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1 Q. May I ask you what friction pendulum system
2 is?

3 A. (Dr. Ostadan) Well, it's oscillations. And
4 if you are willing to accept displacement and
5 dislocation, it gives you a mechanism to reduce the
6 seismic loads on the foundation. And that's what's
7 happening here if the casks are sliding on the pad.

8 But the question remains at what level of
9 earthquake these sliding triggers. Of course at very
10 low levels it will not trigger, it will be together.

11 And then you can carry on this discussion.
12 Of course, Holtec calculation was done using the design
13 basis motion and relying on the assumption that it
14 would -- the casks would slide to cut back on the
15 seismic loads. But they never look at the condition
16 that some smaller earthquake, there may not be enough
17 driving force to make the cask slide. And that
18 condition may deliver larger seismic loads to the pad
19 because the casks are not sliding.

20 Q. (By Mr. Travieso-Diaz) But if the
21 earthquake is smaller, the load will be correspondingly
22 smaller?

23 A. (Dr. Ostadan) That is correct. The load
24 will be smaller in general term, but the fact that the
25 casks are not sliding under that earthquake doesn't mean

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1 that the loads that come to the pad are going to be
2 smaller. That needs to be said.

3 Okay, let me move to the next paragraph, if
4 I may.

5 Q. We're now looking at the last paragraph on
6 page 61?

7 A. (Dr. Ostadan) That's correct. I think this
8 is a discussion that I already talked about, the general
9 philosophy, and I stated this is really a bold feature
10 of this design. What I mean by "bold," it makes
11 reviewers very uncomfortable, like me. And I like to
12 see really adequate studies, parametric studies done to
13 ensure the sliding in a controlled manner takes place in
14 the event of major earthquake.

15 On page 62-Q --

16 Q. Before you start talking about Q, this is a
17 different subject. Let me ask you one question on P,
18 which is the items of Holtec that you have been
19 referring to before.

20 A. (Dr. Ostadan) Yes.

21 Q. Is it fair to say that the various concerns
22 that you have expressed you are raising as concerns of
23 things that need to be addressed to determine whether in
24 fact the problem exists? Is that a good way of putting
25 it, or not?

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1 A. (Dr. Bartlett) Well, what we're charged to
2 do mainly under Contention L, as we see it, is to look
3 at the soil system and how it will respond to these
4 dynamic forces that are being imparted to it. And in
5 doing so I guess we have to follow the chain of forces
6 and where they're coming from. We cannot -- when
7 evaluating whether the soil has a sufficient capacity to
8 resist the seismic motions in those loads, we have to
9 understand the nature of the loads and where they're
10 coming from. And that's I guess why we're pursuing even
11 looking at these issues, you know, of sliding at the top
12 of the pads, because it impacts the loads ultimately
13 imparted to the soils.

14 Q. Well, my question was intended to illicit
15 from you the clarification as to whether these concerns
16 that you expressed are at the current moment based on
17 the study you have done, concerns that you feel need to
18 be addressed as opposed to being --

19 A. (Dr. Bartlett) Historical?

20 Q. No. As opposed to being problems that you
21 know exist.

22 A. (Dr. Ostadan) The answer is both. I think
23 if you go back, look at the mat being rigid, as I
24 indicated, applicant's another set of calculation
25 clearly shows not rigid. So it is a problem.

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1 Q. So that is a problem?

2 A. (Dr. Ostadan) Right. Then we talk about
3 cold bonding. I would characterize it as a genuine
4 concern, a serious issue. We talk about incline waves
5 is a genuine concern. There may be a problem or not. I
6 think the applicant needs to show that.

7 Q. Now, you were starting to talk about the
8 items on page 62.

9 A. (Dr. Ostadan) Yes.

10 Q. Before you do that, because I believe
11 that -- and tell me if this is right or not -- items
12 that start with paragraph O -- sorry, Q on page 62 and
13 go down to W on page 63, they all relate to the same
14 calculation

15 A. (Dr. Ostadan) Yes, that's true.

16 Q. And the calculation is storage pad analysis
17 and design?

18 A. (Dr. Ostadan) That's right.

19 Q. By CEC?

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

21 Q. And this is the calculation of, as the title
22 implies, for the design and analysis of the storage
23 pads?

24 A. (Dr. Ostadan) Yes, that is.

25 Q. And the calculation that you cite is dated

1 June of 1997?
 2 A. (Dr. Ostadan) Yes.
 3 Q. Is there a more recent version of that
 4 calculation?
 5 A. (Dr. Ostadan) I believe there is, yes.
 6 Q. And have you looked at the new
 7 calculation --
 8 A. (Dr. Ostadan) Yes, I have.
 9 Q. -- against these various concerns to
 10 determine if there is any one that has been cured by the
 11 geotechnical calculation?
 12 A. (Dr. Ostadan) Let me go over every one,
 13 then.
 14 Q. That's what I would like you to do.
 15 MS. CHANCELLOR: Do you need a break for
 16 lunch?
 17 DR. OSTADAN: Maybe we'll finish that and --
 18 MR. TRAVIESO-DIAZ: That was my plan.
 19 A. (Dr. Ostadan) I think the first one, what
 20 dynamic loading has been considered for foundation
 21 stability and design of the pad. I think that has been
 22 clarified. I think the latter part of Q says, "It is
 23 not clear why a friction value larger than .8 (due to
 24 potential cold bonding) was not considered." We already
 25 discussed that, why the condition of cold bonding has

1 not been considered.
 2 And moving to R, "Variation of Soil
 3 Properties Not Considered." I think this has been
 4 considered now.
 5 Moving to S, I must say I have not looked at
 6 this specific item to see whether the revised
 7 calculation addresses that or not. I cannot express
 8 opinion now. I think same applies to T. I haven't --
 9 or I don't recall whether it's been addressed or not.
 10 We're to U now, and I think there is a twist
 11 now in the latest revision of this calculation. This is
 12 also an important issue. I think Stone & Webster has
 13 taken up this design feature to look at the stability of
 14 the pads. And I think specifically we discussed a
 15 number of details, issues when applicant's experts were
 16 deposed with respect to what seismic parameters should
 17 have been considered in estimating the foundation
 18 loading for stability analysis. I think, in my opinion,
 19 a wrong parameter was used. PGA is not appropriate. If
 20 one goes back to Civil Engineering Consultant
 21 calculation and look at the results they present, it's
 22 clear that this foundation is flexible. And as I
 23 recall, the site frequency is anywhere from 5 to 8
 24 hertz, depending on the soil case -- lower bound, mean,
 25 and upper bound, to be a natural frequency of the

1 foundation in a vertical direction.
 2 And if one goes to the design response
 3 spectrum with those frequencies, you would have to use
 4 values close to or in excess of 1G rather than PGA in
 5 the stability evaluation. So that remains to be a
 6 genuine concern.
 7 We -- again, the scenario and the concept
 8 for the pad has changed. Now, the applicant is
 9 discussing or has presented a conceptual design using
 10 soil cement. They have not submitted a final design.
 11 When and if they do that, we'll have to revisit this
 12 comment, whether separation takes place between the soil
 13 cement and the pad or not. It depends on their final
 14 design.
 15 Q. So whether this remains a concern will
 16 depend on the characteristics of the design of the soil
 17 cement?
 18 A. (Dr. Ostadan) That's correct.
 19 Q. All right.
 20 A. (Dr. Ostadan) This, again, has changed in
 21 the chain of events. I'm looking at W. Again, the soil
 22 cement is here. It was not there at the time. And I
 23 think once applicant's final design for soil cement is
 24 submitted, this item will be revisited.
 25 Q. I'm sorry. I forgot to bring up paragraph X

1 on the next page. Does paragraph X also refer to the
 2 same design document?
 3 A. (Dr. Ostadan) Which page are you on?
 4 Q. I'm sorry. On page 64, X.
 5 A. (Dr. Ostadan) You're ahead of me.
 6 Q. I'm sorry. At least we went through W.
 7 A. (Dr. Bartlett) That's my comment.
 8 MR. TRAVIESO-DIAZ: In that case, why don't
 9 we break for lunch now.
 10 MS. CHANCELLOR: Did you finish with W,
 11 Dr. Ostadan?
 12 DR. OSTADAN: I am finished.
 13 MR. TRAVIESO-DIAZ: I was trying to go
 14 through what we need to talk about and reduce it
 15 somewhat. Okay.
 16 (Lunch Recess from 12:54 to 2:06 p.m.)
 17 Q. (By Mr. Travieso-Diaz) Before we broke for
 18 lunch, Dr. Ostadan, we went over a series of concerns
 19 that went from Item Q on page 62 of Exhibit 10 and went
 20 all the way through Item W on page 63. And we went
 21 through those, and you told me which were still valid
 22 concerns or current concerns. And based on your
 23 answers, I would like to ask you to talk a little bit
 24 more about Item U, which I believe is the first one that
 25 you mentioned that was definitely your concern. Tell me

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1 a little more about Item U. Why is it that you are
2 concerned?

3 A. (Dr. Ostadan) When stability analysis is
4 performed, one has to calculate the demand and capacity,
5 and the demand consists of a number of components, one
6 of the components being seismic loads: how do you
7 calculate the seismic loads, and what parameters do you
8 use.

9 The stability analysis of the pad, I think
10 in this case, applicant has chosen to use one point in
11 the design response spectrum curve without checking
12 whether that point on that curve is applicable here or
13 not. And when I look at the Civil Engineering
14 Consultant cited here, I noted that the natural
15 frequency of this foundation is such that that point
16 chosen by applicant is not correct and that other points
17 on the curve should have been used.

18 This is with respect to the pad. However, I
19 must say, when it came to the canister transfer
20 building, and it is not part of U here, perhaps the same
21 team recognized the fact that the ground motion
22 amplifies in the foundation and in the structure, and
23 they appropriately chose to use the amplified
24 accelerations for stability analysis. That concept was
25 not carried on when it came to the pad.

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1 Q. Let me ask you two questions, first one
2 general. So I take it with respect to this concern, you
3 don't see that something's looking too good as a real
4 problem?

5 A. (Dr. Ostadan) I see that as a real problem.

6 Q. And the problem is that you believe that
7 with respect to the design of the pad emplacement area
8 to the pad, they did use a wrong volume?

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

10 Q. Okay. Now, you said that they should have
11 used a different point in the curve. What point should
12 they have used?

13 A. (Dr. Ostadan) Well, I cannot be very
14 precise. One has to obtain the natural frequency of the
15 cask/pad system, and that would tell you which point on
16 the response spectrum curve should have been used. Just
17 a quick review of Civil Engineering Consultant, I think
18 in the course of what they were asked to do, they have
19 some plots that indicate what is the natural frequency
20 of the foundation for the three soil cases they
21 studied -- the lower bound, best estimate, and upper
22 bound. If I recall correctly, that showed that the
23 frequencies are within 5 to 8 Hz.

24 Q. And your concern is that they didn't used
25 that information to --

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1 A. (Dr. Ostadan) Yes. If you then accept that
2 you're not sure of frequencies within 5 to 8 Hz. and you
3 go to the design response spectrum, you would not read
4 in the vertical direction .533 G. You would read a much
5 higher number.

6 Q. So what you're saying is that the value they
7 used in the design spectrum does not match the actual
8 natural frequency of the structure?

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

10 Q. All right. Is there any damping factor that
11 could affect the value that you need to use?

12 A. (Dr. Ostadan) Yes. There is radiation
13 damping in the soil that if it's quantified and
14 established what value it is, it can be also considered
15 in selecting the appropriate acceleration value.

16 Q. This also has not been done?

17 A. (Dr. Ostadan) No, they have not.

18 Q. Let's move now to Item V. And I believe you
19 talked about -- a little about this before, but could
20 you elaborate?

21 A. (Dr. Ostadan) I think what we discussed
22 earlier was the applicant has submitted a conceptual
23 design for soil cement around the pad, and that they
24 have indicated they are working on the final design of
25 the -- or they will be working on the final design.

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1 Therefore, this point needs to be revisited when the
2 final design is submitted.

3 Q. So this point is sort of on hold awaiting
4 the final design?

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

6 Q. Let's go to W.

7 A. (Dr. Ostadan) The same comment applies.
8 When the final design for soil cement is submitted, this
9 comment will be revisited.

10 Q. This Item W talks about passive pressure.
11 Would you explain what that term means as you use it
12 here?

13 A. (Dr. Ostadan) This pressure is a component
14 of a resistance that is available to resist lateral
15 loads, in this case, seismic loads, when and if it's
16 needed. And I think that in that historic calculation
17 here it was used and the comment was raised, but I think
18 this comment really doesn't apply to that original
19 concept because soil cement is being considered now.
20 And after the final design is submitted, we'll have to
21 revisit how is the passive pressure calculated.

22 Q. Let me be sure I understand. The passive
23 pressure is a property of the soil, if you will?

24 A. (Dr. Ostadan) If the soil -- well, it's a
25 behavior of the soil.

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1 Q. Behavior. And it's a behavior that tends to
2 oppose or resist the forces that would act on it during
3 an earthquake?

4 A. (Dr. Ostadan) Act on the structure during
5 an earthquake, that's correct.

6 Q. And that force -- that property is
7 available. And you say here sometimes it's taken credit
8 for, but often it's not?

9 A. (Dr. Ostadan) Yes. If you're referring to
10 the specific comment, and I assume you're not thinking
11 of soil cement now, when there was soil around the
12 foundation. Because the soil at shallow depth does not
13 have any overburden, it's not confined, the design tend
14 to not rely on the passive pressure in the shallow
15 embedment area, because one cannot be certain that in
16 the shallow area it is available.

17 Q. The reason I'm asking is, there's a sentence
18 here that reads, "The basis for using the full passive
19 pressure for entire depth of embedment should be clearly
20 stated," and that implies to me that they took credit
21 for that passive pressure.

22 A. (Dr. Ostadan) At the time they did, yes.

23 Q. And your belief is they shouldn't have taken
24 credit for the passive pressure?

25 A. (Dr. Ostadan) I think they should have

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1 considered that at shallow depths the confinement
2 necessary to develop passive does not exist.

3 Q. Are you saying that there should have
4 been -- that there probably was no passive pressure at
5 all, or there was a number that was less than full?

6 A. (Dr. Ostadan) I think it's a common
7 practice to ignore it unless a designer can demonstrate
8 that it exists.

9 Q. And there would have been some, but you have
10 to demonstrate what that some is?

11 A. (Dr. Ostadan) Yes, it should be considered.

12 Q. Do you know as a matter of practice when
13 this passive pressure is taken credit for, what its use?
14 If you know. I mean, I don't know. I'm just curious.

15 A. (Dr. Bartlett) I was going to speak to the
16 case that we have bridges and bridge foundations, and
17 one of the issues is deep pile foundation also has a
18 pile cap, and it has, you know, thickness is roughly
19 three feet or so also. And a design issue is how much
20 of that passive pressure again can I mobilize, and how
21 much is it going to play in the resistance of the
22 seismic forces in a deep foundation system. And to
23 resolve that issue, UDOT has done some testing where
24 they have -- essentially they use compacted fill on the
25 passive side and did lateral loading and testing to try

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1 to measure and take count, or try to quantify the amount
2 of passive pressure that was developed.

3 Now, those tests may not be particularly
4 useful for this case because it's a different type of
5 structure, different type of foundations. But there are
6 somewhat tests that you can do on prototype structures
7 with prototype soils, or in this case maybe even in the
8 future soil cement to establish what those values might
9 be, how are they mobilized and what deformations, and so
10 on and so forth. So there are ways of determining how
11 much of this passive pressure you can take credit for.

12 Q. Do you recall what UDOT came up with?

13 A. (Dr. Bartlett) I don't. I think the
14 studies in fact are actually ongoing. I think most of
15 the testing was completed I believe early summer. I do
16 not recall that I've seen any published literature on it
17 yet.

18 Q. Let's move to item --

19 A. (Dr. Ostadan) May I add to that answer? I
20 came up with sort of another reason why the upper 3 to 5
21 feet is typically not considered in calculation of
22 passive pressure. The other reason is the seismic
23 loading is an oscillatory loading and the foundation
24 moves back and forth. Soil does not have tensile
25 strength, and so therefore a gap develops. That's in

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1 the foundation and the soil, where this back-and-forth
2 movement takes place. The separation is typically
3 limited to the upper depth of the soil. That's another
4 reason that passive one is needed, and that is during
5 the seismic loading. It would not be available in the
6 full depth.

7 Q. Some would be available?

8 A. (Dr. Ostadan) Some would be, certainly,
9 yeah.

10 Q. Let's move to X.

11 A. (Dr. Bartlett) I had one.

12 Q. Okay.

13 A. (Dr. Bartlett) Also in relation to gapping,
14 I do believe, and I'm just going from memory, that maybe
15 the study that has been done does look at that gapping
16 issue, too. I know it does for the piles. Whether it
17 does for the pile cap, I'm not sure. But I guess there
18 are beginning to be studies to kind of develop ideas
19 about how one deals with the issues.

20 Q. Thank you much. I think I know now about
21 passive loading.

22 Let's move to item X, which I believe both
23 of you talked about knowing about this. Does anyone
24 want to take a lead in explaining Item X?

25 A. (Dr. Bartlett) I think this is mostly mine.

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Q. Could you explain to us what X is?

A. (Dr. Bartlett) When we reviewed the calculations initially, it appeared to us that for the stability analysis or seismic stability sliding analysis of the pads that we could see shear strengths determined from two tests that were done. And we were concerned about, first, were those representative of this entire pad area, and also whether designers have considered if there was any potential variation in that value. It was hard to understand what this value meant. When we calculate factors of safety we like to know whether it's kind of a lower bound value that was being used, a medium or mean or upper bound. And we just really could not ascertain that.

Q. Now, there is a new calculation as we discussed earlier.

A. (Dr. Bartlett) Correct.

Q. Does the new calculation address this concern?

A. (Dr. Bartlett) Additional data have been gathered. We still have concerns about their adequacy. And yesterday when we started discussing the cone penetrometer data, that was the beginnings of discussing potential variation across this site. I don't know if you want to go into that or if we just want to defer

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that to after --

Q. In the interest of getting Dr. Ostadan out of town early --

A. (Dr. Bartlett) Yeah, let's defer that, because I think we're going to go back to that.

Q. Definitely.

A. (Dr. Bartlett) Okay. So we can readdress the shear strength value for design when we start that discussion.

We had some initial concerns. Let's see if it's in here, too. Yes, there's a statement here that the Naval Facility Design Manual 7.2 provides an adhesion value of 950 to 1300 PSF. What the issue here was is when we reviewed the calculation, the applicant was using the full what we call cohesion of the clay. Some designers, instead of using full cohesion or cohesive strength of the clay, recommend that you should be using what's called an adhesion factor. In this case, it would have been between the concrete and the clay at that time. So we were concerned about using full cohesive strength and suggested that perhaps that adhesion would be more appropriate since we had concrete resting on top of clay.

That may be somewhat resolved with the addition of soil cement. We would still like to know

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what, if any, issues of sliding with that bonding is between the concrete pad and soil cement interface. We assume that the lower interface, where the soil cement interfases with the clay, that that would probably be a fairly rough interface and that it might be appropriate then to use full cohesion. But we just don't really know much about that interface at this time until you submit a design.

Q. Would it be fair to say -- and I don't want to put words in your mouth, but would it be fair to say that the concerns that you have on Item X are -- whether they remain concerns or not depends on the review of the design of the soil cement foundation?

A. (Dr. Bartlett) Correct.

Q. Go to item Y. And this is back to you, Dr. Ostadan, I believe.

A. (Dr. Ostadan) Yes, thank you. This is -- actually, we've seen this comment before. At the time, every team has its own time history. So none of this comment's repeated here. I think the Stone & Webster develop their own time history, and this comment no longer applies. It's historic.

Q. And how about Item Z, checks for drift? This sounds very much like item N that we discussed before.

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A. (Dr. Ostadan) That's correct. I think this is also taken carry of, because everybody's using Geomatrix's calculation.

Q. Okay. Now we go into double figures. Let's go to Item AA, which is on page 65 of Exhibit 10. Could you give us a brief summary of what this concern is?

A. (Dr. Ostadan) Okay. Again, this is -- previous calculation wasn't clear whether the time histories used in order to develop strain-compatible soil properties for canister transfer building were the same time histories that in fact were used for analysis of the building. So I think the first part of this paragraph is no longer a concern.

Q. And by first half, you mean the sentence that starts "it is not clear" and goes through "dynamic analysis of the building"?

A. (Dr. Ostadan) That is correct. I think in the second part, in light of the discussion we had with respect to ground motion and control point, if those are taken care of, I don't see a point pursuing this, the remainder of the paragraph here.

Q. Let's move to Item AB, then. AB is on the bottom of page 65.

A. (Dr. Ostadan) Yeah. This remains to be a concern still. I indicated that earlier. Stone &

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Webster in the calculation for development of soil impedance functions for canister transfer building chose to use a variation of one and a half for shear modulus, whereas Geomatrix for calculation of soil impedance for pads stated that properties of the soil are less known at deeper layers and chose to use a variation by a factor of two. And I think the latest calculation still have the same inconsistency.

Q. I'm trying to relate this discussion back to the one we had a little while ago. I'm trying to find out what item that was for. Can you help me locate?

A. (Dr. Ostadan) I will try.

Q. Item "I," maybe, on page 55.

A. (Dr. Ostadan) I think so.

Q. Do me a favor so we can short circuit this discussion. Will you compare Item "I" with Item AB to see if there is anything on AB that is not part of "I" that we need to discuss beyond what we already discussed with respect to "I." Do you understand my question?

A. (Dr. Ostadan) Yes, I understand.

I don't think so.

A. (Dr. Bartlett) One moment. Do you think it would be appropriate -- I think it talks here about major soil properties, and we have seen the applicant go in and do resonant column testing for it appears one

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particular layer in the system to develop these Gmax curves. But I'm not sure we've seen how those have really been applied at all in the analyses.

A. (Dr. Ostadan) Yeah, I guess at the point you're thinking of --

A. (Dr. Bartlett) We can cover that later.

A. (Dr. Ostadan) It may come up later. It's up you.

Q. But in any event, the concern will be that there is information available from the resonant column testing that you don't know whether --

A. (Dr. Bartlett) -- they have been applied or not.

Q. Okay.

A. (Dr. Bartlett) That's the only thing. It talks a little bit about -- there has been some work done to develop some of those soil properties for the apparently upper soil column. We're still wondering if they've been applied and how they have been applied in the analysis, the response analysis.

Q. Can we move to Item AC on page 66?

A. (Dr. Ostadan) Yes.

Q. Please.

A. (Dr. Ostadan) This calculation that developed the soil spring and damping for canister

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transfer building assumed the foundation mat to be rigid. It was a fairly large mat of 265 by 165, and the assumption was never verified and is still not verified, even though Stone & Webster performed a follow-up stress analysis of the Canister Transfer Building, finite element analysis of the building, where one could readily verify from the results if the mat behaved as a rigid mat or not.

Q. Again, I'm having the same freshman college concern or lack of understanding as we talk about it here. Tell me more on this mat. You said it is --

A. (Dr. Ostadan) I'm talking about vertical direction.

Q. Okay.

A. (Dr. Ostadan) And it was assumed to be rigid for the purpose of developing soil strength and mapping, or so-called soil impedance functions.

Q. And the rigidity in the vertical direction would have -- would it be affected in any way by how thick this mat was?

A. (Dr. Ostadan) Yeah. It has a function of how thick the mat is and how much load is coming to it.

Q. How thick is the mat?

A. (Dr. Ostadan) I don't remember. It's either five or seven. Somewhere around there.

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Q. So your concern that this mat, even though it's 5 feet thick, might still be flexible under the loads that it's going to see?

A. (Dr. Ostadan) Yes. And I -- what I'm also saying, that the information is available in the applicant's package to verify that. It has not been done.

Q. But let me just try to compare -- remember when we talked about the mat for the pad emplacement area, you felt there was a concern there.

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

Q. Because the analysis that CC had done showed that that mat was flexible in the vertical direction.

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

Q. As to this mat on the canister transfer building, there is no similar information that turns a potential concern to a problem, is it?

A. (Dr. Ostadan) I have not seen any results presented in the documents otherwise.

Q. So in fact the concern is that there is no information that would elucidate the issue as to whether you have a rigid or a flexible mat for the canister transfer building. Is that a good way of putting it?

A. (Dr. Ostadan) I think the information is available but not presented in the documents I've seen.

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1 As I indicated, Stone & Webster performed a finite
2 analysis of the building and of probably all the loads.
3 It's just a matter of looking up on the displacement for
4 the mat.

5 Q. So again, to see if I can figure it out, how
6 would this information be displayed? Separate
7 calculation or --

8 A. (Dr. Ostadan) No. Just go to the finite
9 element analysis of the building and obtain the
10 displacement response of the mat, you know, several
11 number of nodes in the vertical direction, and see if
12 they are uniform or they show local deformation.

13 Q. And not to beat a horse to death, but you
14 have not seen any information that leads you to believe
15 that that effort has taken place?

16 A. (Dr. Ostadan) No, I have not seen any.

17 Q. All right. Let's move to the next one,
18 which I believe we're now up to AD.

19 A. (Dr. Ostadan) Yes.

20 Q. We're on page 66.

21 A. (Dr. Ostadan) I think that's a historic
22 comment. The graphs that were present at the time, they
23 were not explaining what is vertical axis. And this
24 comment no longer applies.

25 Q. Then we can go to AE, which begins on page

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1 66 and moves to the top of page 67.

2 A. (Dr. Ostadan) Okay. I think this comment
3 has to do with the fact that at the time the building
4 members' dimensions were not known, and they simply
5 assumed certain numbers for the purpose of dynamic
6 analysis.

7 Q. Is that the case now?

8 A. (Dr. Ostadan) I have not reviewed the new
9 calculation to be able to comment.

10 MR. TRAVIESO-DIAZ: Let's take one second,
11 please.

12 (Exhibit-68 marked.)

13 Q. (By Mr. Travieso-Diaz) Let's look for a
14 moment at what I have identified as Exhibit 68. It is a
15 Stone & Webster calculation entitled "Seismic Analysis
16 of Canister Transfer Building." It's Revision 1. The
17 calculation number is SC-5, and the date of Revision 1
18 is 8/31/99. Is that correct?

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

20 Q. I believe that if we go to this document and
21 go to page 4, which is at the very beginning, and that
22 page 4 has -- and the bottom half of the page, at least,
23 are assumptions. Do you see that?

24 A. (Dr. Ostadan) Yes.

25 Q. Let's look together at assumption No. 1.

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1 Can you read that to yourself?

2 A. (Dr. Ostadan) Okay. Yes, I've read that.

3 Q. That assumption seems to say to me that now
4 there is a set of concrete drawings.

5 A. (Dr. Ostadan) Yes.

6 Q. And I take it those are design drawings for
7 the building?

8 A. (Dr. Ostadan) I would assume so.

9 Q. And you would expect that those drawings
10 would have the kind of information that was not
11 available when Item AE was created?

12 A. (Dr. Ostadan) I think that's probably the
13 case, yes.

14 Q. And it says at the end that there may be
15 changes, "minor changes made to the building," "to the
16 building configuration in the future. However, it is
17 anticipated that any changes would be minor and will
18 have little effect on results." Is that right?

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

20 Q. And that's common engineering practice?

21 A. (Dr. Ostadan) That is common engineering
22 practice.

23 Q. So if you wanted to find out information
24 about dimensions and so on, you would just have to look
25 at concrete drawings that are listed there?

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1 A. (Dr. Ostadan) Yes. If I want to know the
2 basis for development of the model, that's where I would
3 go, yes.

4 Q. Understanding that you have not reviewed
5 these concrete drawings, I presume --

6 A. (Dr. Ostadan) I did not.

7 Q. But subject to what the content of the
8 concrete drawings may be, their existence would resolve
9 your concern as to what was expressed in Item E?

10 A. (Dr. Ostadan) Item A --

11 Q. E.

12 MS. CHANCELLOR: Point of clarification. Do
13 you know if you produced these drawings to the state?

14 MR. TRAVIESO-DIAZ: I have no idea.

15 MS. CHANCELLOR: Okay, then he can't review
16 them if you haven't produced them.

17 MR. TRAVIESO-DIAZ: I know. And since you
18 brought it, I have not reviewed them. If we haven't
19 given them to you, obviously he hasn't.

20 Q. (By Mr. Travieso-Diaz) And subject to the
21 review for the content, would their existence address
22 your concern?

23 MS. CHANCELLOR: It's a little speculative.

24 MR. TRAVIESO-DIAZ: Why don't we ask the
25 question a different way.

1 MS. CHANCELLOR: That's better.
 2 Q. (By Mr. Travieso-Diaz) Would you
 3 anticipate, based on your extensive engineering
 4 experience, that a set of concrete drawings for a
 5 building like the canister transfer building would
 6 contain the type of information that you noted in Item
 7 AE that was missing, things such as thickness of walls
 8 and the slabs and the beams?
 9 A. (Dr. Ostadan) Yes, I would expect that.
 10 Q. In the normal of course of events, those
 11 drawings will have that information?
 12 A. (Dr. Ostadan) That is true, yes.
 13 Q. Unless the drawings are in some matter
 14 defective, they will have dimensions of beams and walls;
 15 is that correct?
 16 A. (Dr. Ostadan) That's correct.
 17 Q. Now, understanding that you haven't reviewed
 18 these drawings to determine whether they're defective or
 19 not, and I assume they are not, they would have
 20 information that you were calling for in AE. Is that
 21 correct?
 22 A. (Dr. Ostadan) Yeah. There's one part to be
 23 added. They would have the information, and the
 24 information should have been properly transferred into
 25 the building model, the so-called stick model.

1 Q. And the stick model that we're talking about
 2 would be the one that was presented in Exhibit 68?
 3 A. (Dr. Ostadan) Okay. Do you have a
 4 question? I'm sorry.
 5 Q. Yes. The stick model that you referred to
 6 would be the one that is the subject of the document you
 7 have in front of you?
 8 A. (Dr. Ostadan) I think so, yes.
 9 Q. Look let's back again at this assumption 1e.
 10 We're now to the first part. It says, "The structural
 11 model developed in Revision 0," which I take it is the
 12 previous revision, "of this calculation was reviewed for
 13 conformance with ... concrete drawings" such-and-such,
 14 and minor changes to the model were made.
 15 Assuming that that's a true statement, would
 16 it tell you that in fact level one includes a model that
 17 incorporates the information on the concrete drawings?
 18 MS. CHANCELLOR: Before Dr. Ostadan answers
 19 that, I'd request that this is -- if you have a line on
 20 the structural concrete drawings, then I request that if
 21 you haven't already produced a copy, if you could
 22 produce a copy.
 23 A. (Dr. Ostadan) Yes, I would expect that the
 24 model is based on these drawings, and I would expect
 25 that dimensions, beams and slabs, etc., are properly

1 calculated and represented by the stick model.
 2 Q. Let's move, then, to Item AF, "Proper
 3 Location of Control Point for the Rock Motion Used in
 4 the Site Response Analysis."
 5 A. (Dr. Ostadan) I think we discussed that in
 6 length with respect to the pads before.
 7 Q. So it is the same concern as to the proper
 8 location of the control point where we talked about
 9 having competent soil?
 10 A. (Dr. Ostadan) That's correct.
 11 Q. So the discussion that we had with respect
 12 to the pads equally applies?
 13 A. (Dr. Ostadan) Equally applies. It does.
 14 Q. All right. Let's go to Item A sub G on page
 15 67.
 16 A. (Dr. Ostadan) Yes. Well, it certainly was
 17 a concern at the time that there was a cut-off frequency
 18 of 15 Hz. And it was not shown that it is appropriate
 19 to cut off the frequency at 15 Hz.
 20 Q. What's the current status of this concern?
 21 A. (Dr. Ostadan) Okay. I'm looking at Exhibit
 22 68 to see whether --
 23 Q. Can I give you a hint?
 24 A. (Dr. Ostadan) Sure. In the interest of
 25 time.

1 Q. May I?
 2 A. (Dr. Ostadan) Sure.
 3 Q. Can I refer you back to the same page 4 we
 4 were looking at before, and I ask you to look at
 5 Assumption No. 5 on that first page.
 6 A. (Dr. Ostadan) I need to ask for a
 7 clarification to put this concern to rest, whether this
 8 analysis is done for a horizontal direction or vertical,
 9 or both.
 10 Q. You're clearly asking the wrong person.
 11 A. (Dr. Ostadan) So I have not -- I don't know
 12 on this. The results here specifically show -- it's a
 13 statement here that says that. It's not obviously
 14 complete. It doesn't say whether it's horizontal or
 15 vertical. But I don't know if there are results
 16 presented that show the results were 15 Hz. and 19 and a
 17 half Hz. or not. I would think not, just judging from
 18 the nature of this statement here.
 19 Q. Can we defer, since I don't think anybody at
 20 this table is able to answer that right now, but perhaps
 21 after the break we can see if it is something that we
 22 can pose in the form of a question that will help you?
 23 A. (Dr. Ostadan) Sure.
 24 MR. TRAVIESO-DIAZ: Can we take a break
 25 right now?

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(Recess taken from 2:44 to 2:52 p.m.)

Q. (By Mr. Travieso-Diaz) Before we took a short break, I asked a question to Dr. Ostadan and he gave me a reply that seemed to indicate that the answer would depend on whether we are dealing with horizontal or vertical elements. Can I ask him to again repeat the answer that he gave, and if he can't, since we don't have at this moment the information that he needs, tell us what the result will be or the resolution depending on whether we're talking horizontal or vertical.

A. (Dr. Ostadan) I think I -- we'll check the vertical response and make sure the statement made here does indeed include the vertical analysis.

Q. So for you, it will be satisfactory if the vertical response was the subject of the analysis -- if the vertical response was the subject of the analysis that is discussed in Assumption 5?

A. (Dr. Ostadan) Yes. Basically that's true, yes.

Q. All right. Now, tell me about paragraph AH, which is now on page 68. It's entitled "Basis for Ignoring Translation Motion Caused by the Rotation."

A. (Dr. Ostadan) I don't even remember this one. This -- again, the original calculation or the earlier versions of these calculations. I'm afraid I

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can't even remember the context in which this concern was raised.

Q. I have a question that maybe we can get out of the way, in any case. You are making reference here to ASCE Standard 4-98?

A. (Dr. Ostadan) Not in AH.

Q. I'm sorry. I'm looking at the -- strike that question. We'll forget it. I got ahead of myself. Okay.

So you say that you can't address the concern that you have on AH because you don't recall this particular concern in detail now?

A. (Dr. Ostadan) I do not recall right now, yes.

Q. Do you recall what it was about?

A. (Dr. Ostadan) My mind is just blank on this right now. I'd have to revisit the whole version to remember.

Q. Not to pursue and put thoughts into your head, but would that indicate to you that it's not a really big concern on your list?

A. (Dr. Ostadan) It would include that I'm a very busy person.

Q. That's probably true. Good answer. Let's move to item AI.

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A. (Dr. Ostadan) Yes.

Q. "Consideration of Concrete Cracking."

A. (Dr. Ostadan) Yes.

Q. Is this a current concern?

A. (Dr. Ostadan) If you're going to follow up with another question, I would appreciate that. But I will look.

Q. Well, I can tell you that the next question will be -- is totally independent of the former one, so maybe you should --

A. (Dr. Ostadan) I do not see a discussion here. Obviously I don't recall this being addressed or not, but I'm looking at Exhibit 68 to see whether concrete cracking has been considered. On page 4 I'm looking at the assumptions. No. 1, "structural model developed," it does not indicate cracking. No. 2 is a bridge crane. No. 3, "not used." No. 4, again, no discussion of cracking. No. 7, don't see anything about concrete cracking. All right. To the extent I can look now, I don't see this being address.

Q. Okay. Let me ask you the first of the two questions, which is, if concrete cracking was taken into account in your calculations such as this one, and by "this one" I mean Exhibit 68, how would it be taken into account?

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A. (Dr. Ostadan) The way it's been taken into account is that, depending on the stresses developed in the structural members, the stiffness of the structural member will be reduced, and then the subsequent dynamic analysis would be performed using the reduced stiffness properties.

Q. And the stiffness properties would be input values to the model?

A. (Dr. Ostadan) It would be revised input values to the model, yes.

Q. So it is conceivable, I'm not saying this is or is not the case, that the model could have accounted for concrete cracking by using lower values for the parameters even though you may not have listed them in the assumptions. Is that a possibility?

A. (Dr. Ostadan) I'd like to make a clarification. Concrete cracking is not a replacement of condition of concrete not being cracked. Both analyses are needed on the uncracked and cracked conditions.

Q. So you would like to see or expect to see a different computer drawing that would take -- analyze the same structure again but assuming now that the concrete is cracking?

A. (Dr. Ostadan) Correct. That's the

1 practice.

2 Q. And you have not seen that before?

3 A. (Dr. Ostadan) I have not seen that.

4 Q. My second question is, you start your
5 discussion on this item AI by saying that "ASCE 4-98
6 requires consideration" -- "requires consideration to
7 the effect of concrete cracking." Do you see that?

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

9 Q. Now, is this project committed to following
10 4-98?

11 A. (Dr. Ostadan) I do not know. I think this
12 is a document that -- what standards and rules are
13 adopted by design, I expect that to be documented. I
14 have seen references cited to ASCE 4-98 in a number of
15 other calculations, for example, with respect to
16 variation of soil properties that the designer has opted
17 to adopt ASCE 4-98.

18 Q. Is there another ASCE Standard numbered
19 4-86?

20 A. (Dr. Ostadan) That's correct. That's the
21 previous version of 4-98.

22 Q. So 4-86 was the standard that was in effect
23 prior to the promulgation of 4-98?

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

25 Q. Now, do you recall when 4-98 came to be

1 promulgated?

2 A. (Dr. Ostadan) Actually, you know, the draft
3 version was available in '99, and perhaps a true name
4 for this should be ASCE 4-2000, I think it was
5 officially published. But as far as the cracking is
6 concerned, the previous standard I believe also has
7 guidelines for concrete cracking.

8 Q. Could you -- maybe we should look together
9 at page 6 of this document.

10 A. (Dr. Ostadan) Which document?

11 Q. I'm sorry. "This document" being Exhibit
12 68. I believe you have it handy.

13 A. (Dr. Ostadan) Okay.

14 Q. And page 6 is the references?

15 A. (Dr. Ostadan) Yes.

16 Q. Will you look at reference 4?

17 A. (Dr. Ostadan) Yes.

18 Q. Would that be -- I don't know if it is the
19 same, but asking for "Standard for Seismic Analysis of
20 Safety-Related Nuclear Structures," 1986. Is that what
21 it's also called, 4-86?

22 A. (Dr. Ostadan) I believe you're referring to
23 reference No. 3.

24 Q. That's correct.

25 A. (Dr. Ostadan) I think it is, yes.

1 Q. So would that tell you that the designers
2 were following at the time what's said in shorthand is
3 4-86?

4 A. (Dr. Ostadan) It would tell me that, yes.

5 Q. And if you look at the later calculations,
6 which appears to have been done in the first instance,
7 at least -- well, Rev. 1 is from 8/99.

8 A. (Dr. Ostadan) Yes.

9 Q. That calculation may have been issued at a
10 time where 4-98 had not yet been published.

11 MS. CHANCELLOR: Objection. Calls for
12 speculation. He doesn't know when the calculation was
13 done.

14 MR. TRAVIESO-DIAZ: I'm only bringing it up
15 because he says it may have come out, it may have been
16 called 4/2000 because it come out this year.

17 MS. CHANCELLOR: The discovery is June 28,
18 '99, and so it would have to be sometime -- the
19 calculation would have to be at some time before June of
20 '99 for that to be applicable. So I think it calls for
21 speculation.

22 A. (Dr. Ostadan) Well, if you want my
23 technical opinion, if you go to ASCE 4-1986, Reference
24 3, I trust that the concrete cracking issue has been
25 addressed as well. However, I'm not certain. I need to

1 look it up.

2 Q. Is it -- do you recall whether 4-86 and 4-98
3 have different standards as to how and to what extent on
4 whether concrete cracking should be considered?

5 A. (Dr. Ostadan) I think definitely 4-98
6 states that it should be considered. As I said, 4-86 I
7 expect to have it, but I cannot be certain unless I look
8 it up.

9 MR. TRAVIESO-DIAZ: Can we take a very short
10 break? And I promise it's very short.

11 (Brief Recess.)

12 MR. TRAVIESO-DIAZ:

13 Q Just let's go back on the record.

14 Before we took a short break, we were
15 discussing whether and to what extent ASCE Standard 4-86
16 contained any guidance information on how to deal with
17 concrete cracking. And during the break Dr. Ostadan
18 reviewed a copy of the standard ASCE 4-86. And could
19 you tell me based on your review of 4-86 how that
20 standard addresses concrete cracking?

21 MS. CHANCELLOR: I would like to note for
22 the record that Dr. Ostadan took a couple of minutes to
23 review this.

24 A. (Dr. Ostadan) Well, I'm reading from page
25 11 of ASCE 4-86 3.1.3, "Modeling of Stiffness." Under

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1 "Stiffness of Reinforced Concrete Elements," okay. I'm
2 going to read paragraph A. "Best-estimate stiffness
3 properties for elements shall be used, except that
4 reinforced concrete elements may be modeled as uncracked
5 sections, provided that the elements do not crack
6 significantly due to the critical load combination."

7 Q. What does that mean to you?

8 A. (Dr. Ostadan) Let me read paragraph B, and
9 I will respond. "For generation of input motion for
10 subsystems, consideration shall be given to the
11 uncertainties in the stiffness properties of the
12 concrete elements."

13 Q. Now, could you tell me what information you
14 draw or guidance from those two sections?

15 A. (Dr. Ostadan) Okay. Under paragraph A
16 it's saying, the best estimate stiffness properties can
17 be used provided that the elements do not crack
18 significantly due to the critical load combination. So
19 you're allowed -- in my interpretation of this, you can
20 use uncracked properties if you can show cracking does
21 not development.

22 Q. To a significant degree?

23 A. (Dr. Ostadan) To a significant degree.

24 Q. Tell you what I'd like to do. Let's mark
25 this as Exhibit 69, and we will make copies and put it

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1 in the record, the cover page and the page we were
2 reading from.

3 Let me identify for the record. We have
4 marked as Exhibit 69 a document that is comprised of two
5 pages. The first one is the cover page of ASCE Standard
6 ASCE 4-86 dated September 1986. And the second page of
7 the exhibit is page 11 of the standard that contains
8 section 3.1.3 entitled "Modeling of Stiffness."

9 A. (Dr. Ostadan) I'd like to add for the
10 record that it is a common practice in the industry for
11 nuclear-type structures that condition of concrete
12 cracking be recognized in dynamic analysis.

13 Q. We are I believe about to discuss Item AJ,
14 "Consideration of Accidental Torsion," on page 68.
15 Could you tell us about Item AJ?

16 A. (Dr. Ostadan) Yes. At the time I reviewed
17 that older version of this calculation for canister
18 transfer building, I did not see any consideration to
19 accidental torsion in developing seismic loads.

20 Q. Have you reviewed the updated calculation,
21 which I believe is Exhibit 68, to see if this concern is
22 addressed?

23 A. (Dr. Ostadan) I have not reviewed it in
24 detail. I am looking at it, Exhibit 68, and looking at
25 the assumptions. I am looking at page 37 of Exhibit 68

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1 where seismic response of the building in terms of
2 acceleration and seismic loads for the upper-bound soil
3 case are presented, and I do not see here any discussion
4 or any adjustment to these loads on the account of
5 accidental torsion.

6 Q. Again, I was remiss in asking you before to
7 define what you mean by accidental torsion.

8 A. (Dr. Ostadan) Oh, this is again a
9 requirement that is typically observed for nuclear
10 structures, and it is in recognition of the fact that
11 when the buildings are built and equipment are placed on
12 the floors, they don't necessarily will be located
13 exactly where the drawings at the time of development of
14 the model show that they will be located, and therefore
15 the mass may be offset. So this measure is to guard
16 against any adjustment that may be made later on either
17 due to construction or operation that the mass of the
18 building or equipment may be located slightly from where
19 it was. Therefore the shear loads are increased, and
20 that is taken into account in the design of the
21 building.

22 Q. I take it that you really won't know whether
23 you have this sort of a problem until the building is
24 built and the masses are placed on it, the equipment
25 itself. Is that correct?

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1 A. (Dr. Ostadan) That is exactly for the same
2 reason that this guidance has been provided and
3 exercised, because you do not know and you're likely --
4 you're likely never to know.

5 Q. But that was what I was about to ask. Is it
6 perhaps a more appropriate time to make this adjustment
7 once you know the extent to which you may have offset in
8 the location of the masses of the structures and
9 components in the building?

10 A. (Dr. Ostadan) I would say it would be very
11 unusual if applicant proposed an approach or a
12 calibration that this can be measured during the
13 operation or after the construction. Based on my
14 experience, it is addressed and guarded against during
15 the design time.

16 Q. Well, help me understand, because I'm
17 missing something here, which is, if before you actually
18 physically located masses in the building, when you are
19 to the point when this Exhibit 68 was prepared, if you
20 don't know where the masses are to be located, how can
21 you perform a calculation to determine the effect of
22 offsetting their location? How would you determine how
23 much to offset them by?

24 A. (Dr. Ostadan) Well, when the drawings are
25 drawn and the final design done, you are more or less

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1 certain as to what the structural members are and what
2 sizes they are and where the mass is. However, when you
3 build this, it's recognized that there may be
4 deviations. The beam may be thicker or heavier, and it
5 could have been that could have been on a spot A, maybe
6 now a few feet away on a spot B. And these are the
7 necessities that come about after a building is built,
8 for operational reasons. And as I said, to guard
9 against that, in the early part of the design this
10 impact is included in the design.

11 Q. Are you familiar with what I have seen at a
12 number of nuclear plants which is called the preparation
13 of as-built drawings?

14 A. (Dr. Ostadan) Yes.

15 Q. And is it a process whereby after the
16 construction is finished, you go back with the design
17 drawings to compare the location and characteristics of
18 your components against what the design called for?
19 Have you seen that?

20 A. (Dr. Ostadan) Yes.

21 Q. And if you find discrepancies, you try to
22 reconcile them by re-running your calculations?

23 A. (Dr. Ostadan) No, I have not seen
24 discrepancies for the purpose of going back and whether
25 or not to include accidental torsion in the design. As

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1 I said, my experience at least has been that during the
2 design this is taken care of in the early part of the
3 design to guard against this measure.

4 Q. Are you aware of whether applicant in this
5 instance intends to do that in the future?

6 A. (Dr. Ostadan) If the applicant makes the
7 commitment that the model that they have at this time
8 would present the building after it is being built and
9 during the operation and can be verified, I suppose that
10 means the model is adequate.

11 (Exhibit-69 marked.)

12 Q. (By Mr. Travieso-Diaz) The next item on
13 page 68 is AK, "Combination of Coupling Effects." Would
14 you summarize this item for us?

15 A. (Dr. Ostadan) Okay. At the time -- again,
16 it's a historic calculation -- the question was, or the
17 concern was, how the coupling within two horizontal
18 directions were considered in developing the seismic
19 loads as realized in the structure responses.

20 Q. Can you tell by looking at Exhibit 68
21 whether the coupling effects have been taken into
22 account in the calculations?

23 A. (Dr. Ostadan) Okay, I'm looking at Exhibit
24 68 now. Looking at the assumptions again.

25 I cannot see anywhere in this exhibit a

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1 discussion about coupling effects. However, I haven't
2 looked carefully to make sure it's not anywhere here.

3 Q. Where would you expect to see the coupling
4 effects to be taken into account?

5 A. (Dr. Ostadan) In the very same calculation
6 in Exhibit 68.

7 Q. I understand. But within the calculation,
8 where would you see them if they -- where would you
9 detect that these effects have been taken into account
10 in the calculation?

11 A. (Dr. Ostadan) Okay. It would be on page --
12 like page 37 here where the seismic loads are present in
13 the X and Z. And as you can see here, I don't see any
14 discussion on the coupling on this page. It should
15 direct the designer what to do with these numbers.
16 Should we use them directly? Should we add them up?
17 And I don't see anything here.

18 Q. And I take it that, looking at the
19 handwritten attachments to the calculation, would they
20 help you determine where they are incorporated?

21 A. (Dr. Ostadan) I think these are the
22 calculations that how this stick model was developed.
23 So it goes through or back and forth between the
24 drawings and a bunch of hand calculations. I would
25 expect the discussion of coupling to be on a page like

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1 38 where you see the results as where you apply when you
2 have seismic responses.

3 Q. So your testimony is that you would like
4 to -- you will expect to see a specific reference in the
5 text of the calculation to how these coupling effects
6 were accounted for?

7 A. (Dr. Ostadan) That is correct.

8 Q. And you haven't seen that?

9 A. (Dr. Ostadan) I haven't seen it.

10 Q. Let's turn to item AL on page 69, the title
11 being "Percentage of Live Load Used in Calculation of
12 Lumped Mass Values." Can you tell us what the concern
13 was?

14 A. (Dr. Ostadan) Well, at the time it was not
15 clear -- while it was clear that how much of a dead
16 weight was included, it was not clear how much of a live
17 load was included in calculating the mass points.

18 I'm now looking at Exhibit 68 to see whether
19 that information has been provided or not. I'm looking
20 at assumptions on page 4. Okay. This is definitely not
21 here. I will go to the back of the calculation. I
22 think there's a section for mass calculation on page
23 A-1, Attachment A.

24 It states in the first paragraph, "The
25 attributed masses to each mass point location from

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1 walls, roofs and mat are shown on the attached
2 sketches." Again, it does not talk about live load,
3 talks about the mass due to walls, roofs, and mat.

4 Q. By live loads, you would mean things like
5 equipment?

6 A. (Dr. Ostadan) Equipment, yes.

7 Q. And what would be the biggest equipment
8 pieces, if you will, that would be placed in the
9 canister transfer building?

10 A. (Dr. Ostadan) I don't think it's referred
11 to or characterized in terms of biggest equipment.

12 Q. More massive, I meant.

13 A. (Dr. Ostadan) Well, it really depends where
14 the equipment is. If there's small equipment on a small
15 slab, could be important. And I do not see, as I
16 indicated, a discussion about mass, masses.

17 Q. Again, let me just, so if you know, and for
18 the record, do you know what the most massive piece of
19 equipment --

20 A. (Dr. Ostadan) I think the crane is probably
21 your massive equipment. I would expect that to be
22 included.

23 Q. And will you happen to know the relative
24 masses of the crane vis-a-vis, say, the mat or the
25 building?

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1 A. (Dr. Ostadan) I do not know. I must say,
2 there is a percentage of the live load simply due to
3 operation. You may have personnel, traffic or equipment
4 traffic, or a number of other reasons. That is typical
5 to include percentage of a live load and permanent
6 equipment loads in the dynamic model.

7 Q. And you have seen no specific accounting
8 being made that you can detect of live loads in this
9 calculation?

10 A. (Dr. Ostadan) Yes. As I mentioned, I am in
11 Attachment A where the discussion of building masses is
12 presented, and it specifically talks about the mass of
13 the wall, roof and beam. No mention of operating
14 weights or equipment.

15 Q. And this may not be a help at all, but would
16 you turn to page 7 of the exhibit that talks about the
17 model development and read through it to see if it tells
18 you anything about how masses have been accounted for in
19 the model. Take a look at the first paragraph.

20 A. (Dr. Ostadan) Yes. Okay, I think the first
21 paragraph states that, again, the mass of the beam,
22 walls, etc., partition walls are included. And it goes
23 on to say, "an allowance of 5 percent will be" -- "will
24 be made for miscellaneous equipment."

25 Q. Does that imply to you that they are

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1 accounting for live loads by having a 5 percent
2 allowance on the other masses?

3 A. (Dr. Ostadan) I would think that is what
4 they intend to do, yes.

5 Q. And if that was what they intended to do,
6 would that be properly accounting for the live loads?

7 A. (Dr. Ostadan) That, now, I cannot answer,
8 because I do not know enough about the building and its
9 mission at this time.

10 Q. But you -- at least based on that paragraph,
11 you know that they have done some accounting or tried to
12 do some accounting.

13 A. (Dr. Ostadan) As indicated here, yes.

14 Q. Let's look at now AM, "Amount of Peak
15 Broadening Considered."

16 A. (Dr. Ostadan) Yes.

17 Q. Describe this for me, if you would, please.

18 A. (Dr. Ostadan) Okay. At the time it was not
19 clear when the response of the building, in terms of
20 in-structure oscillation responses were generated, how
21 much broadening of the peak were considered. And
22 looking at figures presented in Exhibit 68, I think now
23 it has been indicated. Therefore, this is not a
24 concern.

25 Q. Thank you. Item AN that begins on page 69

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1 and goes to page 70, will you describe this one for me?

2 A. (Dr. Ostadan) Okay. Refers to the previous
3 version of the calculation for canister transfer
4 building. It was information regarding the center of
5 rigidity and center of mass was not available at the
6 time.

7 Q. Have you reviewed Exhibit 68 to determine
8 whether it is available now?

9 A. (Dr. Ostadan) I think we are talking about
10 the first paragraph in AN. I will expect that is taken
11 care of.

12 Q. I'm sorry. The first paragraph of AN?

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

14 Q. It goes from -- on page 69.

15 A. (Dr. Ostadan) Page 69.

16 Q. How about the second paragraph, the one that
17 starts with the words "the center of rigidity"?

18 A. (Dr. Ostadan) Okay. That is a comment that
19 at the time was when the soil spring and dampings were
20 calculated, springs and damping values were attached to
21 the beam stick model of the building. By virtue of the
22 attachment, it implies that the center of the rigidity
23 at the lower level of the building is at the center of
24 the mat. And that was the point of discussion, whether
25 or not the center of rigidity is indeed at the center of

1 the mat.

2 Q. I don't want to assume, but may I offer you
3 another hint?

4 A. (Dr. Ostadan) Sure.

5 Q. Would you turn to page B-1 of Attachment B.
6 It's like two-thirds through the calculation.

7 A. (Dr. Ostadan) Yes, I'm there.

8 Q. Will you look at the first full paragraph.
9 And to be exact, to the middle of the first paragraph.

10 A. (Dr. Ostadan) Yes.

11 Q. To a sentence that says, "To account for
12 eccentric of the center of the rigidity from the mass
13 centroid, the stiffness matrix is calculated using SWEC
14 program RIG3 and RIG4."

15 A. (Dr. Ostadan) Yes.

16 Q. The results are given in the attachment.
17 Does the text that I read to you indicate that some
18 effort has been made in this calculation to account for
19 the eccentricity of the center of the building?

20 A. (Dr. Ostadan) I am not familiar with this
21 program RIG3, RIG4 and the statement is vague. And it
22 could be quite unrelated to what we are talking about.

23 Q. So you cannot tell in fact from this text
24 whether indeed it takes care of or seeks to address the
25 concern you raised?

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

2 Q. Well, that was my hint.

3 A. (Dr. Ostadan) I appreciate it.

4 Q. Now we're in paragraph AO on page 70 of
5 Exhibit 10 entitled "Consideration of Both Translation
6 and Rotational Mass Properties." Could you explain to
7 us what the concern here is?

8 A. (Dr. Ostadan) Well, again it refers to the
9 previous version of the calculation. It was not clear
10 at the time whether translation and rotational mass
11 properties are properly included in the dynamic model of
12 the building. And that the design of the canister
13 building has gone through some changes, one of the
14 elements being shear key is being added to the mat, and
15 that point was discussed the day before yesterday in the
16 context of passive soil pressure.

17 And a number of other issues was raised. I
18 think your expert stated that the design is such that
19 the passive pressure will be developed beyond the face
20 of the shear key and not within the inner side of the
21 shear key. And it was stated that the soil under the
22 mat will be moving with the shear piece, however, not
23 participate in the development of passive pressure. If
24 that is the philosophy for the design, I would expect
25 not only the shear key but also the mass of the soil

1 under the mat within the circle of shear key to be
2 included in the dynamic model.

3 Q. I'm glad that you mentioned the words,
4 because I don't believe that two days ago an explanation
5 was given on the record of what a shear key is. Could
6 you just help us here?

7 A. (Dr. Ostadan) Shear key is the, as I
8 understand it, for canister building is the extension of
9 the mat in the form of a ring. It's one foot high, and
10 I forget how thick it is, around the periphery of the
11 mat.

12 Q. For what purpose is it intended to serve?

13 A. (Dr. Ostadan) It is intended to provide
14 additional passive resistance for -- to help improve
15 sliding stability of the building.

16 Q. And with specific reference to item AO, you
17 are concerned, I take it, that the mass properties of
18 the shear key -- the shear key and the other elements of
19 the mat are not properly accounted for in the model, or
20 at least there is no evidence that they are?

21 A. (Dr. Ostadan) There is certainly no
22 evidence, and as I indicated, if the philosophy is that
23 the passive soil pressure does not develop under the mat
24 and the soil and the mat would act in an integrated
25 manner, the mass of the soil should be included in the

1 model.

2 Q. Can you ascertain by looking at this
3 calculation what the design philosophy in that regard
4 is?

5 A. (Dr. Ostadan) I don't think Exhibit 68 gets
6 into passive calculation or engages in the philosophy of
7 developing passive resistance.

8 Q. Where do you expect that you'll be able to
9 find that information?

10 A. (Dr. Ostadan) The passive calculation for
11 passive pressure is in the Stone & Webster calculation
12 for slope -- for stability analysis of canister transfer
13 building. This is another mismatch of the process and
14 concept between various groups.

15 Q. In which respect?

16 A. (Dr. Ostadan) Well, as I said, at the time
17 the state raised the concern that if passive develops
18 under the mat, the passive wedge would also put vertical
19 load acting on the mat, and the question was whether
20 this effect of vertical load is considered or not.

21 Again, the witness stated that they don't
22 expect such passive pressure develops under the mat
23 because they expect the soil under the mat within the
24 area of the shear key moves with the mat and the passive
25 pressure develops beyond the shear key.

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1 Now, that's fine, but that also means the
2 mass of the soil under the mat within the depths of
3 shear key would participate in the dynamic vibration of
4 the building.

5 Q. Based on your review of the calculation you
6 alluded to, stability analysis of the canister transfer
7 building, do you have an opinion or can you tell what
8 design philosophy was used in -- with respect to what
9 you just mentioned? If you can tell.

10 A. (Dr. Ostadan) Yes. I think the calculation
11 of -- when I reviewed the calculation, the impression I
12 got, the design philosophy was for passive soil pressure
13 to develop beyond the face of the mat and the shear key.
14 And then the state raised a question that, why is the
15 assumption valid, because under the mat you have the
16 effect of overburden of the building, the soil is
17 confined, and it's likely that the passive will develop
18 under the building rather than outside the building.
19 And the expert stated that will not happen because, as I
20 said, the soil and the mat will act as an integrated
21 unit.

22 Q. Let's move on, then, to Item AP, entitled
23 "soil-structure interaction (SSI) Effects on Building
24 Response."

25 A. (Dr. Ostadan) Okay. AP, as a general

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1 concern that is even valid now, is very typical in our
2 practice that when you perform soil-structure
3 interaction analysis, you also show the results or
4 responses from the building to see how significant the
5 effect of interaction is. This was not presented at the
6 time. Frankly, I don't see it is presented now. I do
7 know it's included because they used the soil spring and
8 damping, but I cannot judge how much of this amplified
9 response is due simply to structural vibration, how much
10 of it is due to soil-structure interaction.

11 Q. Can you, for the record, identify where in
12 the calculation you're looking?

13 A. (Dr. Ostadan) Oh, I'm specifically looking
14 at the response spectra plots in Exhibit 68. For
15 example -- let's see, the beginning is back here. Page
16 15, and the series of plots go all the way to 36.

17 Q. And these plots are, so that the record is
18 clear, plots of what?

19 A. (Dr. Ostadan) These are plots of
20 acceleration response of the building at various
21 elevations.

22 Q. Versus?

23 A. (Dr. Ostadan) Well, if you're talking about
24 the vertical and horizontal axis --

25 Q. Yes.

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1 A. (Dr. Ostadan) -- the way these responses
2 are expressed is in terms of acceleration response
3 spectra, and --

4 Q. As a function of frequency?

5 A. (Dr. Ostadan) As a function of frequency,
6 yes.

7 Q. You said, then, that you don't know, you
8 cannot tell from these various acceleration versus
9 frequency plots whether the accelerations that are shown
10 incorporate the -- well, I'm sorry. I'll let you
11 describe it rather than me.

12 A. (Dr. Ostadan) Well, I did not say it. I
13 think the effect of soil-structure interaction is
14 included. The calculation is clear, and it discusses
15 soil springs and damping. But what I am saying is, it
16 is typical in our practice to delineate these various
17 effects, specifically to show how much is the effect of
18 soil-structure interaction on building response.

19 Q. So what you're lacking here is a separate
20 tabulation or a graph or a plot that will tell you how
21 the soil-structure interaction is factored into the
22 plots that you see starting on page 15?

23 A. (Dr. Ostadan) I would like to see how much
24 is the effect of soil-structure interaction, and I think
25 some results can be extracted easily to demonstrate

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1 that.

2 Q. So you would like to see those things
3 separately identified and -- so that you can look at
4 them?

5 A. (Dr. Ostadan) That's correct. Because --
6 that also is important, because you would right away
7 know how much is the effect of soil and how much
8 variation of the soil properties impacts your building
9 response.

10 Q. Let's move to item AQ. It's on page 70 of
11 Exhibit 10, and it refers to "Modeling of Secondary
12 Systems in Dynamic Analysis."

13 A. (Dr. Ostadan) Yes.

14 Q. Could you explain AQ?

15 A. (Dr. Ostadan) Yeah. I think that when you
16 have heavy equipment in the building, it is recognized
17 that there will be equipment-structure interaction. And
18 the acceleration, floor acceleration response spectra,
19 such as those shown in Exhibit 68, would not be
20 sufficient for the qualification of the equipment if
21 these equipments are heavy with respect to the
22 supporting structural members.

23 What I would like to see is that -- and a
24 statement here that perhaps this condition does not
25 exist in this building, or, if it exists, how it has

1 been addressed.

2 Q. You mentioned earlier that as far as you
3 remembered, the most massive piece of equipment in the
4 canister transfer building would be the bridge crane --

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

6 Q. -- that is used for moving the canisters?

7 A. (Dr. Ostadan) Right.

8 Q. Do you know whether a separate analysis has
9 been performed for the bridge crane?

10 A. (Dr. Ostadan) With respect to comment AQ, I
11 don't think Exhibit 68 addresses whether equipment and
12 structure interaction should be considered or not. It
13 simply uses the mass of the crane in the model.

14 MR. TRAVIESO-DIAZ: Let me mark this
15 document as Exhibit No. 70.

16 (Exhibit-70 marked.)

17 Q. I have identified as Exhibit No. 70 Stone &
18 Webster calculation entitled "Crane Decoupling
19 Evaluation -- Canister Transfer Building." The
20 calculation number is SC-8, it's Revision 0, and it's
21 dated 12/14/98.

22 Q. (By Mr. Travieso-Diaz) Are you familiar
23 with Exhibit 70?

24 A. (Dr. Ostadan) No. It's the first time I
25 see this.

1 Q. Can I ask you to look at page 4 of
2 Exhibit 70?

3 A. (Dr. Ostadan) Yes.

4 Q. It's only one paragraph in the text of the
5 page, and the paragraph reads, "Purpose. The purpose of
6 this calculation is to verify that it is not necessary
7 to consider coupling between the Canister Transfer
8 Building (CTB) and the 200 ton bridge crane when
9 performing the seismic analysis of the crane. The
10 seismic analysis of the building (Ref. 1) and the
11 analysis of the crane (Ref. 4) were performed
12 independently, and do not include dynamic coupling
13 between them."

14 A. (Dr. Ostadan) Yes, I saw that.

15 Q. Based on what you read, will you understand
16 the purpose of this calculation to be to determine
17 whether in fact there is a coupling between the crane
18 and the building?

19 A. (Dr. Ostadan) Yes. As I said, I have not
20 seen this document before. I see now it has been
21 addressed.

22 MS. CHANCELLOR: Could I ask, is this the
23 full document? Are there more calculations or anything?

24 MR. TRAVIESO-DIAZ: I believe this is the
25 entirety of the document.

1 MS. CHANCELLOR: It's got references.

2 MR. TRAVIESO-DIAZ: Oh. There is only one
3 thing missing from the exhibit is something called
4 STRUDL Analysis.

5 Q. (By Mr. Travieso-Diaz) And I will let
6 either Dr. Ostadan or Dr. Bartlett tell me what a STRUDL
7 analysis looks like.

8 A. (Dr. Ostadan) STRUDL is the name of a
9 computer program for a structure analysis.

10 Q. And STRUDL analysis, what would it look
11 like, the result of the analysis. Would it be a few
12 pages or --

13 A. (Dr. Ostadan) Well, it depends on how
14 extensive is the model. Could be small, could be very
15 big. You know these programs.

16 MR. TRAVIESO-DIAZ: So to answer Counsel's
17 observation, the document that has been identified as
18 Exhibit 70 includes a document that is not attached to
19 it, and which is the actual calculation of which I don't
20 have the copy.

21 Q. (By Mr. Travieso-Diaz) Now, understanding
22 that you have not reviewed this document, and moreover,
23 the calculation is not attached to it, will you turn to
24 page 7.

25 A. (Dr. Ostadan) Yes.

1 Q. The conclusion reads, "It is concluded that
2 the analyses of the CTB and the bridge crane can be
3 performed independently without considering dynamic
4 coupling." Is that what that says?

5 A. (Dr. Ostadan) That's right.

6 MS. CHANCELLOR: I'm going to object to this
7 line of questioning, because these are just mere
8 conclusions. He hasn't seen the supporting calculation.

9 MR. TRAVIESO-DIAZ: You anticipated my next
10 question, which is, understanding that without seeing
11 the calculation, you cannot agree with the conclusion.

12 Q. (By Mr. Travieso-Diaz) Assuming that the
13 calculation supported the conclusion, would this
14 calculation, Exhibit 70, address the concern you raised?

15 A. (Dr. Ostadan) Yes, it would.

16 Q. Now, you cannot tell that because you don't
17 have the calculation, do you?

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

19 Q. Moving to item AR on page 70, which reads,
20 "Load Combinations for Bearing Capacity Calculations for
21 Transfer Building." Will you describe for me what the
22 concern here is? This has a familiar ring to it.

23 A. (Dr. Ostadan) Yes. I think, and I'm not
24 sure whether this is in collaboration with Dr. Bartlett
25 or entirely by Dr. Bartlett, I don't recall now, but

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1 from what I read here, the question was raised at the
2 time in the previous version of this calculation that
3 how the bearing pressure when the building was
4 calculated, and whether or not live load was included in
5 compilation of bearing pressure.

6 Q. And the calculation that would have to be
7 examined to determine that would be the one cited here,
8 G(C)13?

9 A. (Dr. Ostadan) I would think so, yes.

10 Q. Do you have a view today as to whether this
11 is still a concern?

12 A. (Dr. Ostadan) I need to look at the calc.

13 MR. TRAVIESO-DIAZ: Go off the record for a
14 second.

15 (Discussion off the record.)

16 Q. (By Mr. Travieso-Diaz) Let me ask a couple
17 of leading questions. Dr. Ostadan, we have been
18 discussing a calculation which I believe Dr. Bartlett
19 presented to you, and it is entitled "Stone & Webster
20 Calculation G(B)13, Stability Analysis of the Canister
21 Transfer Building Supported on the Mat Foundation." If
22 my recollection serves me right, at the deposition of
23 Mr. Trudeau and Dr. Chang this calculation was discussed
24 at some extent.

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

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1 Q. and some concerns were raised.

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

3 Q. Now, your concern, I understand, is not of
4 the same nature of those that were raised during
5 Mr. Trudeau's deposition. Is that correct?

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

7 Q. But the concern if it were addressed, to the
8 extent it is not addressed now, will be embodied by a
9 revision to the calculation that I believe Dr. Bartlett
10 gave you, G(B)13?

11 A. (Dr. Ostadan) It would be in the revision?

12 Q. No. I mean, if there was such an
13 adjustment, you would expect to see it in the revision?

14 A. (Dr. Ostadan) Yes.

15 Q. And what would the nature of that adjustment
16 be?

17 A. (Dr. Ostadan) I would expect loads on the
18 foundation to be somewhat higher to include the live
19 load.

20 Q. Do you expect that this would result in a
21 significant increase on the foundation loads?

22 A. (Dr. Ostadan) I do not.

23 MR. TRAVIESO-DIAZ: Off the record for a
24 second.

25 (Discussion off the record.)

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1 Q. (By Mr. Travieso-Diaz) Then let's move on
2 to Item AS, described as "Use of Full Undrained Shear
3 Strength Overstates Sliding Factor of Safety of the Mat
4 Foundation of the Canister Transfer Building." Could
5 you explain to us what Item AS refers to? I believe
6 this was one that was identified as being the result of
7 joint input or input from both you and Dr. Bartlett, so
8 either of you can address it.

9 A. (Dr. Bartlett) I think what's going on here
10 in this AS is that in the calculation for the allowable
11 bearing capacity of the Canister Transfer Building
12 supported on a mat, the -- I think that title's
13 probably -- is that the correct title of the current
14 calculation? Maybe --

15 The current calculation is G(B)13, Rev. 3.
16 In addressing seismic sliding of the mat atop the soils,
17 it's our position that when one does that, that adhesion
18 should be used in analyzing the soil's resistance to
19 that sliding instead of full cohesion.

20 Q. Now, understanding that we have now a
21 revised calculation or a different calculation than the
22 one you cited in Item AS, are you still of the view that
23 this remains a concern?

24 A. (Dr. Bartlett) It's my understanding the
25 current calculation still uses the full undrained shear

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1 strength, not adhesion between the soil and the mat.

2 Q. Do you have anything to add?

3 A. (Dr. Ostadan) No, I don't.

4 Q. Is adhesion now an applicable concept in
5 light of the fact that you have a shear key as we have
6 been discussing a little bit earlier?

7 A. (Dr. Bartlett) Maybe we'd better go back
8 and revisit what the assumptions are for the mat/clay
9 interface.

10 I'm not seeing any statement to this. I'll
11 have to look for numbers. I guess the basic assumption
12 I'm looking for is whether it was used in the clay's
13 cohesion on the bottom of the mat. I recall it was
14 coming from the passive resistance.

15 Q. Can I direct your attention to page 15 of
16 the calculation?

17 A. (Dr. Bartlett) Yes.

18 A. (Dr. Ostadan) I think -- we're looking at
19 page 16 of the calculation. It does not seem that
20 adhesion has been used. It relies on the passive
21 pressure. However, I think, as was noted, it takes
22 advantage of passive pressure for the full height of the
23 foundation embedment. I think we discussed whether or
24 not the passive pressure in the upper few feet would be
25 available or not.

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1 A. (Dr. Bartlett) So I guess to summarize our
2 concern about using adhesion now, since the design has
3 been revised with the shear key now does not seem
4 applicable. We still have issues regarding the passive
5 pressures that are developing.

6 Q. And we discussed those. Do you have
7 anything else to add?

8 A. (Dr. Bartlett) No, not now.

9 Q. Dr. Ostadan, let me ask you to return now to
10 Exhibit 12 that we talked about some time ago today.
11 According to my notes, you indicated that you had some
12 input with respect to a few of the matters raised in
13 Exhibit 12.

14 A. (Dr. Ostadan) Yes.

15 Q. And I am going to identify this for you, and
16 please tell me if I am missing any.

17 On page 28 of Exhibit 12, you indicated that
18 you have some input in the discussion of strain rate of
19 soil. It starts on page 28 and goes into page 30.

20 A. (Dr. Ostadan) I indicated I have discussed
21 this most likely with Dr. Bartlett. I don't think I
22 should get credit for ownership of this.

23 A. (Dr. Bartlett) Sure.

24 Q. Let me ask both of you, which of you will be
25 in the best position to address the item that starts on

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1 with Dr. Bartlett, but I think he gets -- he deserves
2 more credit on this than I.

3 Q. Dr. Bartlett, do you believe that you will
4 be able to explain this -- what this concern is that
5 starts on page 30 to 32?

6 A. (Dr. Bartlett) I hope so. It appears to be
7 my writing.

8 Q. Okay. You don't mean to say that you are
9 actually the author?

10 A. (Dr. Bartlett) Well, no, I'm not the actual
11 author, but I provided the major technical content.

12 Q. All right. How about the item on page 32
13 entitled "Factor of Safety Against Bearing Capacity"?
14 Again, that's one that you mentioned, Dr. Ostadan, that
15 you may have provided input on.

16 A. (Dr. Bartlett) I think this is addressing a
17 phi angle using -- of 30 degrees. I believe the
18 applicant's probably justified the use of that phi for
19 cohesionless soils.

20 Q. So your view is that this is no longer an
21 item that we need to address?

22 A. (Dr. Bartlett) For bearing capacity.

23 A. (Dr. Ostadan) Let's make sure, which topic
24 are we addressing?

25 A. (Dr. Bartlett) I think we're on bearing

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1 page 28 and goes to page 30?

2 A. (Dr. Bartlett) I would be.

3 Q. So it would be okay for you to pass on this
4 one, Dr. Ostadan?

5 A. (Dr. Ostadan) I think I will do that, yes.

6 MS. CHANCELLOR: When we went through this
7 before, I thought Dr. Ostadan had identified on page 32
8 "Factor of Safety Against Bearing Capacity."

9 MR. TRAVIESO-DIAZ: We are still on page 28.
10 We'll get there.

11 MS. CHANCELLOR: Oh, I'm sorry.

12 Q. (By Mr. Travieso-Diaz) I'm now on page 30
13 on the item identified as "Factor of Safety Against
14 Sliding" that starts on page 30 --

15 A. (Dr. Ostadan) Yes.

16 Q. -- and goes through page 32. You identified
17 again that you have provided some input into the
18 discussion on these pages?

19 A. (Dr. Ostadan) Yes.

20 Q. What -- again, would this be one in which
21 your input -- well, let me don't put words in your
22 mouth. Describe for me what your input would have been
23 and the extent to which you feel that Dr. Bartlett would
24 be a better person to ask.

25 A. (Dr. Ostadan) I think I have discussed that

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1 capacity.

2 Q. We're on bearing capacity.

3 A. (Dr. Ostadan) All right.

4 A. (Dr. Bartlett) And I think the issue was at
5 the time I reviewed this I couldn't see any basis for
6 the phi used. I think that subsequent investigations
7 have clarified that.

8 Q. Do you have anything to add Dr. Ostadan?

9 A. (Dr. Ostadan) No, I don't have anything.

10 Q. How about the next item, starts on page 32
11 and goes on top of page 33, entitled "Factor of Safety
12 Against Sliding of the Pads." Again, if I recall, you
13 identified this one as one in which you provided input.

14 A. (Dr. Ostadan) Yes, I did, and I think it
15 was a mixed response between Dr. Bartlett and I. To the
16 extent that it discusses -- however, this claimed factor
17 of safety against sliding is potentially incorrect
18 because, A, 1, no soil-structure interaction was
19 considered in determining the foundation loading for the
20 sliding analysis.

21 I think I can address that. That remains
22 there needs to be a concern. It was discussed
23 extensively, whether the use of PGA, the ground
24 acceleration, is appropriate or other spectral values on
25 the design response spectrum. And we expressed a

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1 concern that the natural frequency of the foundation
2 should be evaluated and appropriate spectral evaluation
3 used.

4 Q. Are you saying that this concern is the same
5 one that we talked about a few minutes ago in which you
6 expressed -- made the observation that you just related
7 to us?

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

9 Q. So there's nothing here different from what
10 you said earlier?

11 A. (Dr. Ostadan) There's nothing different.

12 Q. Any other part of the discussion that goes
13 from page 32 to top of page 33 that you, Dr. Ostadan,
14 contributed to?

15 A. (Dr. Ostadan) No, I think the latter part
16 probably goes to Dr. Bartlett.

17 Q. All right. I don't believe that my notes
18 showed that there was any other portion of Exhibit 12
19 that you contributed to. Will you take a quick look to
20 see if there's anything else there that I may have
21 overlooked.

22 A. (Dr. Ostadan) No, I don't seem to notice
23 any other points.

24 MR. TRAVIESO-DIAZ: I don't believe I'm
25 going to have any more questions for Dr. Ostadan at this

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1 foundation loading." In that general statement in the
2 contention, the issues that you have been retained for,
3 what issues are in the general statement of the
4 contention?

5 A. (Dr. Ostadan) I think, going back to all
6 the issues raised in the past few days, my concern
7 remains in the area of ground motion, soil stability,
8 and foundation loading.

9 Q. And then turning to the basis, is there
10 anything in Basis 1 that you will be testifying on?
11 Surface faulting?

12 A. (Dr. Ostadan) No, I don't see anything in
13 this.

14 Q. In Basis 2, does any of your expertise fit
15 into Basis 2?

16 A. (Dr. Ostadan) Very much so. I think a lot
17 of the issues we discussed with respect to adequacy of
18 ground motion characterization, number of time
19 histories, fling, location of the control point, and so
20 on and so forth, does right fall under Basis 2.

21 Q. And Basis 3, "Characterization of subsurface
22 soils," the first -- is there anything in the first
23 general statement in subsurface soils under which your
24 issues would fit?

25 A. (Dr. Ostadan) I don't recognize anything in

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1 time. I'd like to ask counsel for the state whether she
2 has any.

3 MS. CHANCELLOR: Could we take just a couple
4 minute break before we decide if I need to ask him any
5 questions?

6 MR. TRAVIESO-DIAZ: Sure.

7 (Brief Recess.)

8 MS. CHANCELLOR: I've just got a couple of
9 things.

10 EXAMINATION

11 BY MS. CHANCELLOR:

12 I wanted to thank counsel for PFS for
13 allowing Dr. Ostadan to catch his plane this evening and
14 for allowing me to ask him questions out of turn. I
15 have just a few brief questions.

16 Q. Dr. Ostadan, could you put in front of you
17 the original Contention L, which is Exhibit 3, I
18 believe.

19 A. (Dr. Ostadan) Yes, I have it here.

20 Q. The contention reads, "The applicant has not
21 demonstrated the suitability of the proposed ISFSI site
22 because the license application and SAR do not
23 adequately address size and subsurface investigation
24 necessary to determine geologic conditions, potential
25 seismicity, ground motions, soil stability, and

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1 the general statement.

2 Q. And Item A, "subsurface investigations"?

3 A. (Dr. Ostadan) No, nothing in A.

4 Q. B, "Sampling and analysis"?

5 A. (Dr. Ostadan) Yes. To the extent that
6 relates to the statement here, foundation loading, my
7 concerns remain.

8 Q. So that's the first sentence that says,
9 "Site specific investigations and laboratory analyses
10 must show that soil conditions are adequate for the
11 proposed foundation loading"? Cites 10CFR 72.102(d).

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

13 Q. Okay. Anything else?

14 A. (Dr. Ostadan) Okay. I think following up
15 on 3b, the sentence that starts under "subsurface
16 condition."

17 Q. Okay. This is on page 85, okay.

18 A. (Dr. Ostadan) Towards the end of that
19 sentence, again, the concern has been raised with
20 respect to foundation under static and dynamic loading.

21 Q. So the part of the sentence that reads,
22 "analyses are inadequate to accurately model the
23 expected behavior of the soil foundation under static
24 and dynamic loading"?

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

1 Okay. Following up, next paragraph towards
2 the end. It starts with "These data are essential in
3 order to correlate with the field seismic profiling."
4 Q. This is on the first full paragraph on
5 page 86?
6 A. (Dr. Ostadan) Yes. And it goes on. I will
7 not read the whole paragraph.
8 Q. Is it the paragraph or the sentence? "These
9 data are essential in order to correlate with field
10 seismic profiling" --
11 A. (Dr. Ostadan) That's correct.
12 Q. -- "(shear wave determination) for use in
13 the analysis of the seismic response of the buildings
14 and their contents, and to determine the potential for
15 soil collapse"?
16 A. (Dr. Ostadan) Yes. To the extent that the
17 relates to the seismic response of the buildings, we
18 have a number of open items.
19 Q. Anything in the next paragraph?
20 A. (Dr. Ostadan) Nothing in the next
21 paragraph, no. Okay, I'm following the paragraph after
22 that.
23 Q. The paragraph that says "the collected field
24 data"?
25 A. (Dr. Ostadan) No, I don't see anything

1 there.
2 Q. The license application?
3 A. (Dr. Ostadan) That's correct.
4 Q. It's in the middle of page 87?
5 A. (Dr. Ostadan) Yes. Middle of the
6 paragraph, "The basis for the selection of samples and
7 the type of test to be made is a function of the
8 structure, anticipated loading, duration of loading
9 (seismic), and the need to modify the soil's physical
10 characteristics." And again as it relates to
11 anticipated loading.
12 Q. Anything in the next paragraph at the bottom
13 of page 87?
14 A. (Dr. Ostadan) Let me make a correction in
15 the previous paragraph that starts with "the collected
16 field data."
17 Q. On the top of page 87?
18 A. (Dr. Ostadan) Right. There is I think the
19 second sentence, "The Applicant must obtain
20 representative undisturbed samples of each of the site
21 soils and determine the dynamic properties." I think we
22 discussed the soil degradation curves. That remains to
23 be the concern.
24 I don't see anything in the paragraph after
25 that.

1 Okay. Now I'm going to the long paragraph
2 that starts, "a major failing in the application."
3 Q. That's on page 88?
4 A. (Dr. Ostadan) Yes. Towards the end of this
5 paragraph is a sentence that starts, "The Applicant must
6 also show that the static and dynamic engineering
7 properties of the soils." I will not read the whole
8 thing, but I think we discussed dynamic properties
9 concerns remain.
10 Q. That's on page 89 towards the middle.
11 A. (Dr. Ostadan) Okay. I think following up
12 on that paragraph, towards the end there's a sentence
13 that starts "This demonstration should explain how the
14 developed data were used in design analysis, how the
15 test data were enveloped for design, and why the design
16 envelope is conservative." We had long discussions and
17 a number of issues open.
18 Moving to 3c. Okay, the early part of the
19 paragraph there's a sentence that says, "This is
20 especially a complex site from the standpoint of
21 assessing potential earthquakes and resulting ground
22 motion."
23 Q. This is the carry-over sentence that starts
24 on page 89 and it carries over to page 90?
25 A. (Dr. Ostadan) Yes. And the sentence goes

1 on, "that may affect plant operation." I think we
2 talked about flings, incline waves, so on. Those issues
3 remain open.
4 Okay. Following up, I think -- going down a
5 few sentences, there is a sentence that states, the
6 dynamic analyses presented instead use published
7 information from 1973, reference 3, which is
8 extrapolated to decide without any basis for such
9 extrapolation.
10 Q. Where are you?
11 A. (Dr. Ostadan) I am in 3c.
12 MR. TRUDEAU: Page 90.
13 A. (Dr. Ostadan) And there is a sentence that
14 says, "the dynamic analysis presented instead used." Do
15 you see that?
16 Q. Yes. The footnote should be 21. Footnote
17 is to Seed and --
18 A. (Dr. Ostadan) That's correct. The footnote
19 is Seed and Idress.
20 I think that was discussed; and a concern
21 was expressed that even though a resonant column test
22 were performed, applicant did not make any attempt to
23 compare site specific data with the published data.
24 Towards the end of the paragraph there is a
25 sentence that says, "In addition, strain controlled

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1 dynamic triaxial tests should be conducted." That
2 remains to be a concern, especially that applicants
3 attributed the shear strain of Bonneville clay to
4 cementation.

5 Q. So this is the last sentence on page 91, the
6 carry-over paragraph?

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

8 MR. TRAVIESO-DIAZ: Counsel, I'm concerned
9 that we may not be dealing from the same document.

10 MS. CHANCELLOR: What document do you have?
11 Do you have Exhibit 3?

12 DR. OSTADAN: It's -- I have a printout of
13 Contention L.

14 MS. CHANCELLOR: You should have Exhibit 3,
15 the actual document that should be on the table.

16 A. (Dr. Ostadan) Okay. I believe they're
17 identical. This printout may have -- may show different
18 page numbers. Exhibit 3.

19 Where were we?

20 Q. We're on page 91. And the last reference
21 was "In addition, strain controlled dynamic triaxial
22 tests should be conducted to reference one or more
23 strain intervals to support the basis of the curves."

24 A. (Dr. Ostadan) Okay. We move to Basis 4.
25 On page 92 right before Basis 4, the statement that

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1 "Such additional tests will allow a reviewer to make a
2 reasonable judgment about how the soil will perform
3 under the anticipated static and dynamic loading of the
4 short and long term conditions." Then Basis 4 has a
5 specific title of "foundation loading," and to that
6 extent we have a number of open issues.

7 I don't recognize any other item, the
8 remainder of the document.

9 MS. CHANCELLOR: That's all. I have no
10 further questions.

11 MR. TRAVIESO-DIAZ: I regret to say that,
12 based on your counsel's examination, I have a few more
13 questions.

14 FURTHER EXAMINATION

15 BY MR. TRAVIESO-DIAZ:

16 Q. First, starting from the back, you referred
17 to Issue 4, "Soil stability and foundation loading."

18 A. (Dr. Ostadan) Which page are you?

19 Q. I'm sorry. Page 92 of Exhibit 3.

20 A. (Dr. Ostadan) Yes.

21 Q. You recall -- do you recall earlier in the
22 testimony that you indicated that you were not the
23 author of any part of what is known now as Contention L?

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

25 Q. So you didn't write Contention 4?

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1 A. (Dr. Ostadan) I did not write any part of
2 this.

3 Q. Do you know who the author of Contention 4
4 was?

5 MS. CHANCELLOR: Excuse me. Do you mean
6 Basis 4?

7 MR. TRAVIESO-DIAZ: Exactly.

8 A. (Dr. Ostadan) I was told Mr. Larry White,
9 or perhaps Barry Solomon as well.

10 Q. Are you aware that Dr. Solomon testified in
11 his deposition a few days ago that he was the author of
12 Basis 4?

13 A. (Dr. Ostadan) I did not know that.

14 Q. Are you aware that Dr. Solomon testified in
15 his deposition that the concern that he expressed on
16 Basis 4 had been resolved?

17 A. (Dr. Ostadan) I'm not aware of that,
18 either.

19 Q. Do you disagree with Dr. Solomon's
20 assessment of the status of the Basis 4?

21 A. (Dr. Ostadan) I can only speak to the
22 extent that it relates to my expertise and extent of the
23 review I have performed and the interpretation I make on
24 Basis 4.

25 Q. Would you please, starting on page 92 and

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1 going through the end of Basis 4 on page 95, go line by
2 line and tell me which element on Basis 4 do you have --
3 as reading on those four pages you have a concern about?
4 I can ask you sentence by sentence, but I'd rather have
5 you give me one single answer.

6 A. (Dr. Ostadan) I cannot specifically single
7 out a statement here. However, I do recognize the topic
8 of Basis 4 specifically outlines foundation loading, so
9 I don't know what the intent of the author was. All I
10 can say is that, based on the reviews I have done, the
11 concerns raised, a number of them fall under foundation
12 loading.

13 Q. Let me ask you specifically. Putting aside
14 the type of Item 4, have you started or do you have
15 any -- expect that you're going to provide any testimony
16 with respect to any of the items that are disclosed
17 starting on page 92?

18 A. (Dr. Ostadan) Not on 92.

19 Q. How about 93?

20 A. (Dr. Ostadan) I don't recognize here,
21 either.

22 Q. How about 94?

23 A. (Dr. Ostadan) No.

24 Q. How about 95?

25 A. (Dr. Ostadan) Again, I see a statement that

1 states "foundation loading" on 95 towards the end under
2 10 CFR 72. So I think a number of issues.

3 Q. Can I read entire sentence to you? It
4 starts on page 94, and in my copy it reads, "Thus, the
5 Applicant did not consider the presence of such soluble
6 materials during the evaluation of adequate soil
7 conditions for the proposed foundation loading as
8 required under 10 CFR, Section 10 72.102(d)." Reading
9 the sentence in its entirety apart from the use of the
10 words "foundation loading," is this an area that you
11 have investigated? The presence of soluble materials --

12 A. (Dr. Ostadan) No, I certainly did not do
13 that, but if my opinion is as to what is the foundation
14 loading, I do have a input there.

15 Q. Let me ask the question this way. Other
16 than the fact that if Basis 4 uses the word "foundation
17 loading" in two places, is it your testimony you had
18 nothing to contribute to the matters specifically
19 mentioned on Basis 4?

20 A. (Dr. Ostadan) I could not find anything but
21 the foundation loading.

22 Q. Just the words "foundation loading." And
23 those words "foundation loading" might refer to all
24 other items that are raised throughout Contention L?

25 A. (Dr. Ostadan) Would you clarify the

1 question?

2 Q. Strike that question. Let's move to --
3 let's now move to what is presented on page 82, bottom,
4 the paragraph called "Ground motion."

5 A. (Dr. Ostadan) Yes.

6 Q. Okay. Let's take a look at the sentence
7 after the title "Ground motion" that reads, "The site
8 may also be subject to ground motions greater than those
9 anticipated by the Applicant due to spatial variations
10 in ground motion amplitude and duration because of near
11 surface traces of potentially capable faults (the
12 Stansbury and Cedar Mountain faults)." Is the area that
13 is identified or described on the center paragraph one
14 that you are addressing?

15 A. (Dr. Ostadan) Very much so. I think we
16 discussed extensively about characterization of ground
17 motion, amplitude, inclined wave, flings, etc.

18 Q. I believe that this sentence refers to -- of
19 spatial variations because of the near surface traces of
20 potentially capable faults, the Stansbury and Cedar
21 Mountain faults. Have you studied the effects of near
22 surface traces of potentially capable faults, Stansbury
23 and Cedar Mountain faults, on the ground motions?

24 A. (Dr. Ostadan) As I indicated, I have not
25 read the Geomatrix report in its entirety, but I do know

1 that there is a major fault near the site; the fault is
2 dipping under the site. I have expressed concern about
3 wave being inclined, which other way of saying that
4 there is a spatial variation in ground motion.

5 Q. Have you studied the characteristics of
6 either the Stansbury or Cedar Mountain faults?

7 A. (Dr. Ostadan) To the extent I see the
8 application for the engineering design, I did not see a
9 need to study that.

10 Q. Are you aware of whether there's any other
11 witness propounded by the state who will address or who
12 has addressed the matters referred to in this paragraph?

13 A. (Dr. Ostadan) I do not know.

14 MR. TRAVIESO-DIAZ: I'm going to ask
15 counsel. Counsel, do you intend Dr. Ostadan to be a
16 witness with respect to the matters set forth in the
17 first paragraph of Basis 2?

18 MS. CHANCELLOR: Dr. Ostadan will be one of
19 the witnesses for Basis 2. Dr. Arabasz, who you have
20 already deposed, will be the other witness for Basis 2.

21 MR. TRAVIESO-DIAZ: Since we deposed
22 Dr. Arabasz without the notice that Dr. Ostadan was
23 going to take part in the discussion of Basis 2, could
24 you clarify for the record what the respective roles of
25 the two will be?

1 MS. CHANCELLOR: Dr. Arabasz -- let me see
2 if I can get this straight. Dr. Arabasz will deal with
3 the issues of the deterministic seismic hazard analysis
4 and the ground motions that were developed for the
5 deterministic seismic hazard analysis. Dr. Ostadan will
6 testify with respect to the effects of the ground
7 motion, such as the amplitude and duration, and whether
8 the ground motions affect SSE's. In other words,
9 whether it would affect safety. So I think that there's
10 two different components in Basis 2.

11 MR. TRAVIESO-DIAZ: I will state for the
12 record that when the deposition of the first group of
13 Contention L witnesses was noticed, I don't believe that
14 PFS was made aware that there was going to be
15 Dr. Ostadan providing testimony as to any part of
16 Basis 2. And I have to express surprise at the fact
17 that we are now, with Mr. Ostadan about to leave and
18 with no preparation, being told that he's going to be
19 addressing an area that we did not know of before.

20 MS. CHANCELLOR: I think that is because we
21 have a distinct difference of opinion as to what is
22 contained in Contention L. And we had an exchange
23 earlier in the day where you didn't think that anything
24 that Dr. Ostadan was testifying to was contained in the
25 Contention L, and that's why I specifically went back

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1 with Dr. Ostadan to establish where his issues fit
2 within Contention L. You certainly had the opportunity
3 at the beginning of the deposition to go through the
4 contention with Dr. Ostadan to find out where his issues
5 fit into Contention L. And I'm sorry if you're
6 surprised, but we have this fundamental disagreement
7 about the interpretation of Contention L and how it fits
8 into his area of expertise.

9 Q. (By Mr. Travieso-Diaz) Let me ask
10 Dr. Ostadan again, what studies have you done today that
11 relate to the subjects raised or disclosed in the first
12 paragraph on Contention L?

13 MS. CHANCELLOR: If could I just add, if I
14 may, Basis 2 refers to the Stansbury and Cedar Mountain
15 faults, and I'd just like to clarify for the record I
16 understand that Mr. Solomon testified that -- his
17 testimony was that these were examples of potentially
18 capable faults and that at the time the contention was
19 written, the other identified -- PFS had not identified
20 other faults.

21 Oh, I beg your pardon. The example was the
22 reference to Sommerville, et al.

23 Q. (By Mr. Travieso-Diaz) The subject of this
24 deposition today, as I understood it when it was
25 arranged, was soils. So I don't want to get into the

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1 details of Issue 2, which I believe were already
2 explored in other depositions. But I will ask again of
3 Dr. Ostadan to what extent to date he has done any
4 studies or valuations with respect to the subject of the
5 effects of the spatial variations in ground motion
6 amplitude and duration because of near surface traces of
7 potentially capable faults, the Stansbury and Cedar
8 Mountain faults. Is this a subject you have studied to
9 date?

10 A. (Dr. Ostadan) Yes, to the extent that
11 ground motion has been characterized for application or
12 design.

13 Q. Have you studied the characterization of the
14 Stansbury and Cedar Mountain faults?

15 A. (Dr. Ostadan) I think I know enough about
16 them.

17 Q. What do you know?

18 A. (Dr. Ostadan) That they are a nearby fault,
19 that they are capable fault, they are capable of
20 generating large magnitude earthquake. And as a result
21 of that, as I indicated earlier, the ground motion used
22 for design need to look at other variations in the
23 ground motion, such as the possibility of incline waves,
24 different types of flings, number of different time
25 histories involved above and beyond one set considered,

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1 so on and so forth.

2 Q. Have you studied, are you aware of the
3 spatial variations in ground motion amplitude and
4 duration because of the faults in the vicinity of the
5 site? Can you disclose that for me?

6 A. (Dr. Ostadan) Yes. I think another way of
7 explaining spatial variation, what it means to me as an
8 engineer is that if you assume vertically propagating
9 wave, the motion in the ground at all points are the
10 same. There's no spatial variation. Whereas if the
11 wave come in an angle, and that will happen only if
12 you're near a major fault, then the motion in the ground
13 will not be identical. It will be other phase. It
14 depends on the angle of incidence.

15 Q. Have you studied the characteristics of the
16 ground motion that is provided or assumed to be provided
17 by earthquakes cited as the Stansbury and Cedar Mountain
18 faults to determine their potential impact on ground
19 motion amplitude and duration?

20 A. (Dr. Ostadan) I have studied the
21 engineering design calculations where these results have
22 been used.

23 Q. Of what?

24 A. (Dr. Ostadan) Where ground motion
25 characterization has been used.

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1 Q. And how have you studied them? For what
2 purpose?

3 A. (Dr. Ostadan) Well, I have looked at, as I
4 mentioned, Holtec calculation that specifically uses the
5 assumption of vertically propagating waves. I have
6 reviewed Geomatrix' calculation for degradation of soil
7 properties. They also used vertically propagating
8 waves. The canister transfer building dynamic analysis
9 is based on vertically propagating. So no special
10 variation of ground motion is considered in any of these
11 design calculations.

12 Q. Other than the fact that there have been
13 no -- let me just rephrase the question. Have you
14 studied the earthquake analysis report by Geomatrix?

15 A. (Dr. Ostadan) I have not studied that, no.

16 Q. Are you aware of the characterization of the
17 ground motion that is the result of the output of that
18 study?

19 A. (Dr. Bartlett) Yes, we have. We looked at
20 the response spectrum.

21 Q. Are you aware of the extent to which there
22 will be spatial variations in ground motion amplitude
23 and duration as a result of the specific spectrum that
24 is the result of Geomatrix study?

25 A. (Dr. Bartlett) Yeah, that's part of the

1 probabilistic process to take care of that.

2 Q. So you wouldn't agree with that?

3 A. (Dr. Ostadan) No. I think once you have
4 the motion, there is another piece of information that
5 the designer needs to consider during the design
6 calculation: What type of wave would comprise that
7 design motion? Is it vertically propagating, or is it
8 inclined that would create a spatial variation?

9 Q. Can you testify today as to the first
10 sentence of Basis 2 that says, "The site may be subject
11 to ground motions greater than those anticipated by the
12 Applicant"?

13 A. (Dr. Ostadan) Yes.

14 Q. How can you enlighten us?

15 A. (Dr. Ostadan) Well, again, I will not
16 comment on the issue of deterministic and probabilistic
17 and the level of the motion anticipated. That is a
18 position the state will take. It's beyond my expertise.
19 Having said that, given one of these motions, whether
20 it's deterministic or probabilistic, I express concern
21 that the motion should have been placed on top of a
22 competent layer, and if it's done so, it would amplify
23 by propagating through the upper 10 feet.

24 Q. But just to clarify the areas as to which --
25 as of today you will be competent to provide testimony:

1 it would be in the first sentence that says, "The site
2 may be also subject to ground motions greater than those
3 anticipated by the Applicant"; is that correct?

4 A. (Dr. Ostadan) Are you saying I would or
5 will not?

6 Q. Well, will you?

7 A. (Dr. Ostadan) I think to the extent, as I
8 indicated, that the upper 10 feet and the new velocity
9 data has been ignored in the development of ground
10 motion, I would testify to that.

11 Q. Could you testify to -- answer questions
12 today for me as to what the extent of the nature of the
13 ground motion will be?

14 A. (Dr. Ostadan) Would you clarify the
15 question, please?

16 Q. Yes. My question is, I want to know whether
17 you know about, first, what -- where are the ground
18 motions that were anticipated by the applicant. Are you
19 aware of those?

20 A. (Dr. Ostadan) I still don't understand your
21 question. I'm sorry.

22 Q. I'm referring you to the first part of the
23 first sentence at the bottom of page 82, and I'm
24 referring to "ground motions greater than those
25 anticipated by the Applicant."

1 A. (Dr. Ostadan) Yes.

2 Q. Can you explain to me now or talk about what
3 are the ground motions that applicant expects or
4 anticipates, the ones that are referenced to here? Do
5 you know what those are?

6 A. (Dr. Ostadan) I think I -- again, I can
7 only speak on the area that I -- my expertise is.

8 Q. That's what I'm trying to -- is this not
9 your area of expertise?

10 A. (Dr. Ostadan) I think to the extent that in
11 the development of the ground motion the latest
12 information from seismic cone data has not been
13 considered, and therefore the amplification in the upper
14 10 feet is not reflected. I could testify to that.

15 Q. Are you aware of the ground motions that, as
16 of today's analysis by applicant, applicant expects to
17 be found -- to be experienced at the site? Is this an
18 area that you're aware of today?

19 A. (Dr. Ostadan) Please clarify the question.

20 Q. My question is very clear. I'm sorry, may
21 not be clear. I'll go again.

22 This contention speaks about "ground motions
23 greater than those anticipated by the Applicant."

24 A. (Dr. Ostadan) Yes.

25 Q. What are the ground motions that the

1 applicant anticipates?

2 MS. CHANCELLOR: That's a little unfair to
3 not read the qualification to the sentence.

4 MR. TRAVIESO-DIAZ: Well, I think it's fair,
5 because I need to know what he knows about it. Since
6 you're telling that me he's going to be testifying on
7 Basis 2, I want to know what part of it he is aware of
8 today and what part of it he expects he'll be talking
9 about. One part of it is what is the ground motion that
10 the applicant expects to see, and I want to know what he
11 knows about that.

12 MS. CHANCELLOR: I already stipulated that
13 Dr. Arabasz will be our expert with respect to the
14 development of deterministic and probabilistic seismic
15 hazard analysis and ground motions that are a function
16 of that analysis.

17 MR. TRAVIESO-DIAZ: Okay. Are you
18 stipulating to the fact that this witness will not be
19 involved in what is discussed in the first sentence of
20 paragraph 2?

21 MS. CHANCELLOR: I cannot stipulate whether
22 he's going to be involved in this first sentence. I
23 just don't understand it well enough. I have to rely on
24 Dr. Arabasz and Dr. Ostadan to tell me what part of this
25 they can support.

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1 MR. TRAVIESO-DIAZ: That's what I'm trying
2 to get to, because I need to decide whether I need to
3 bring him back to answer questions on this or what we
4 need to do about it.

5 MS. CHANCELLOR: Okay.

6 A. (Dr. Ostadan) Well, all I can say is, as it
7 says after that "anticipated by the Applicant due to
8 spatial variations in ground motion." And I emphasize
9 spatial variations. Yes, I think that is an area that I
10 have raised a number of questions.

11 MS. CHANCELLOR: Could we go off the record
12 for a minute?

13 (Discussion off the record.)

14 MS. CHANCELLOR: We had a discussion off the
15 record as to what Dr. Ostadan will be testifying to. We
16 have agreed that we'll go back on the record and
17 describe what Dr. Ostadan will be testifying to.

18 He will not be testifying as to Basis 2. He
19 will not be testifying about foundation loadings --
20 strike that. We have agreed -- the state has agreed
21 that Basis 2 ground motion does not address or challenge
22 foundation loading, that foundation loading is contained
23 in Basis 3, and Dr. Ostadan will be an expert witness
24 with respect to Basis 3 in which it addresses foundation
25 loading.

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1 The applicant disagrees with the state with
2 respect to whether foundation loading is contained in
3 Basis 3, and we have agreed to disagree.

4 Is that a correct statement?

5 MR. TRAVIESO-DIAZ: That's a fair, correct
6 statement. However, I would like you to add also that
7 you do not anticipate that Dr. Ostadan will be
8 testifying with respect to Basis 4.

9 MS. CHANCELLOR: Oh, that's correct. I'm
10 sorry. I thought that I did that. No, Dr. Ostadan will
11 not be testifying with respect to the -- the caption to
12 Basis 4 is "Soil stability and foundation loading."
13 Dr. Ostadan will be testifying with respect to
14 foundation loading, but the text of Basis 4 does not
15 address foundation loading.

16 MR. TRAVIESO-DIAZ: Will you stipulate that
17 he will not present testimony on Basis 4?

18 MS. CHANCELLOR: Provided that foundation
19 loading, you don't say that foundation loading is
20 precluded because it's in the caption of Basis 4.

21 MR. TRAVIESO-DIAZ: I will stipulate that to
22 the extent there is any foundation loading issue
23 admitted into this, the litigation of this contention
24 will be part of Basis 3.

25 MS. CHANCELLOR: So stipulated.

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1 MR. TRAVIESO-DIAZ: I have no further
2 questions for Dr. Ostadan.

3 MS. CHANCELLOR: I have no further
4 questions.

5 MR. TRAVIESO-DIAZ: I want to thank you very
6 much for your cooperation.

7 DR. OSTADAN: Thank you very much.

8 (Recess from 5:28 to 5:38 p.m., during which
9 Dr. Ostadan left the deposition.)

10 EXAMINATION OF DR. BARTLETT, Continued

11 MR. TRAVIESO-DIAZ: Back on the record.

12 Q. (By Mr. Travieso-Diaz) Dr. Bartlett, good
13 evening.

14 A. Good evening.

15 Q. If I recall when we --

16 MS. CHANCELLOR: Could we just establish
17 that Dr. Ostadan has left?

18 MR. TRAVIESO-DIAZ: Yes, I was going to say
19 that.

20 MS. CHANCELLOR: Oh, beg your pardon.

21 Q. (By Mr. Travieso-Diaz) When we broke for
22 the night last night and through most of the day today,
23 you were testifying as a panel with Dr. Ostadan; is that
24 correct?

25 A. That's correct.

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1 Q. And he has now left the deposition and
2 you're testifying by yourself; is that correct?

3 A. Yes, that's correct.

4 Q. Again, when we broke for the night last
5 night, you were in the middle or started to disclose
6 what has been identified as Exhibit 59; is that correct?

7 A. Correct.

8 Q. Now, I know we went through this to some
9 degree last night, but just to provide continuity, will
10 you briefly describe for the record again how Exhibit 59
11 was prepared and what the purpose of the exhibit is?

12 A. I'll explain the preparation first and then
13 what I was trying to accomplish through the preparation.

14 The applicant has done a grid of cone
15 penetrometer testing throughout the pad emplacement
16 area, and also not a grid but, however, some cone
17 penetrometer testing in the area of the canister
18 transfer building.

19 One of the issues that we're trying to --
20 let me stop before I get into -- one of the issues that
21 we're trying to understand is what is the potential for
22 variation of undrained shear strength across this site
23 to see if the applicants used reasonable and
24 representative values for that -- for the analysis that
25 pertains to dynamic sliding and dynamic bearing

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1 capacity.

2 The cone penetrometer I think when we looked
3 at that data did reveal to us a layering system that was
4 slightly more -- well, more complex than we saw from the
5 first phases of investigation, and revealed that the
6 shallow surface soils have an Eolian silt approximately
7 three feet thick underlain by approximately seven feet
8 of upper Bonneville predominantly clays that are
9 probably best characterized as silty clays/clayey silts
10 with low to some high plasticity to them. We understand
11 that the applicant plans to treat the Eolian silts, and
12 so we also then wanted to look to see what would be the
13 resistance that the underlying clayey silts/silty clays
14 could provide to these dynamic analyses.

15 The laboratory data really did not help us
16 greatly in understanding the variability, because based
17 on our understanding of the way the data were used for
18 the dynamic -- the dynamic sliding and bearing capacity
19 analyses, that they were based on laboratory testing,
20 and the number of data for the laboratory testing are
21 probably not large enough to really make a statistical
22 sampling of the area.

23 For example, it's our understanding that the
24 canister transfer building relied for the dynamic
25 bearing capacity analyses on UU testing. I believe the

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1 value that was used in the design is approximately 2.2
2 kips per square foot. And as I recall, those were
3 coming from I believe Borehole C-2 and No. 4, but I
4 could be wrong. And we had concerns about the proximity
5 of some of those boreholes to the canister transfer
6 building.

7 Also, for dynamic sliding, my recollection
8 is that the results were coming from the direct shear
9 test. For the pad emplacement area, I believe the
10 borehole was C-2. The design value was approximately
11 2.1 kips per square foot. And for the canister transfer
12 building, I can't exactly recall where the direct shear
13 test came from, probably a couple borings within that
14 area. And the design value, best I can recall for the
15 loads due to the mat foundation was about 1.75, 1.8 ksf.

16 So we wanted to know whether those values
17 represented low-bound values, mean values, upper-bound
18 strengths for the design; and I believe in our
19 discussions Wednesday when we discussed these, they were
20 characterized as mean, though we may be using "mean"
21 maybe not in a statistical sense. I'm not sure what the
22 mean meant in that context.

23 We realize then because of that sparse
24 sampling that it may not give us an idea of variation
25 across the site. However, the cone penetrometer data

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1 were pushed in I would say a nonbiased fashion. It was
2 pushed as a grid, so it did not appear to be any bias in
3 where those cone penetrometer data were pushed. Also,
4 because the cone penetrometer gives you a continuous
5 vertical profile, it allows you to understand the
6 variation in the vertical direction quite well so one
7 can see subtle but insignificant changes in the tip
8 resistance.

9 Likewise, if one would compare cone to cone
10 to cone laterally across the site, one could begin to
11 understand if there were significant variations in the
12 strength of the soils by just doing comparisons from one
13 cone to another for the particular layer of interest.
14 And again, most of our interest has been focused really
15 on layer -- what we've been terming layer 2.

16 When I went to try to do that analysis, I
17 couldn't really find any composite plots to try to
18 understand that. I was in haste to prepare for this
19 deposition, did not have the digital data available to
20 me to plot it up. So I got some overhead transparencies
21 and began with my pen to just trace down the traces of
22 the tip resistances from the cone penetrometer. In
23 preparing to do that I enlarged them on the photocopy
24 machine and then traced them in different colors
25 according to groups of five. I did not really bias the

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1 way I was grouping them. I just went through them
2 numerically 1 through 5 and then 6 through 10. I didn't
3 want to get too many traces on one plot, or I couldn't
4 really make any sense of it.

5 Also, if you notice on the sheets that have
6 been provided in Exhibit 59, there's the -- one of the
7 heads, for example, the first one says CPT 1 through 5,
8 and the dash by it which is brown just means that I used
9 brown for that. And as I went through the zone of
10 interest, which would be layer 2, I tried to make a
11 mental note when I went through a group of five which
12 one out of the group of five potentially had the lowest
13 tip resistances in layer 2. So that's what it means by
14 "(CPT lowest)" underneath it.

15 The reason for doing this is, I think that I
16 had in my mind that undrained shear strength is
17 correlated with tip resistance. We discussed it being
18 linearly correlated. There are published correlations
19 that establish that there's a linear correlation between
20 tip resistance and undrained shear strength.

21 So maybe we cannot really use these in
22 quantitative manner to do design, and the I think
23 applicant has also said they have not used the cone
24 penetrometer in a quantitative way to do design;
25 however, they have used it in a qualitative way to

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1 adjust their undrained shear strengths according to
2 corresponding and relative changes in the tip stress.

3 So I was hoping to just discover by the
4 variation in tip stress the potential range of undrained
5 shear strength. For example, a variation in tip stress
6 by a factor of 2 would suggest that the undrained shear
7 strength in this layer could also vary by approximately
8 a factor of 2.

9 And I think we were starting to look at the
10 variation on some of these. I believe we started on the
11 first plot, CPT 1 through 5, and saw something. We were
12 discussing values and ranges as we last left. And I
13 don't know if you want to continue doing that, or --

14 Q. Well, I do, but before we look at results,
15 let me try to get some better understanding of the
16 record as to what the parameters of interest are here.
17 I take it that you are using the cone tip resistance as
18 a proxy to try to estimate the changes in the parameter
19 that you really care about, which is undrained shear
20 strengths.

21 A. That's correct. They are correlated.

22 Q. And your belief is that there's a
23 correlation that's linear, so it's that. If for a given
24 value of cone penetration resistance there is a
25 corresponding value of unstrained shear strength --

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1 A. Correct.

2 Q. -- and if we move, say, horizontally,
3 laterally across a layer of soil --

4 A. Right.

5 Q. -- that parameter that relates to the two
6 of them remains a constant.

7 A. If the soil was homogeneous.

8 Q. Exactly. Well, try this again. In order to
9 determine, assuming that in fact that correlation factor
10 is a constant, if you move from point A to point B
11 horizontally --

12 A. Correct.

13 Q. -- you get the same tip resistance or a
14 small variation in it --

15 A. Correct.

16 Q. -- you are entitled to assume that the
17 corresponding undrained shear strength is essentially
18 the same according to points. Is that the reasoning?

19 A. Correct.

20 Q. In order to do that, it requires for you
21 that the correlation be indeed linear, that the constant
22 be -- that the number that relates to two, whatever that
23 may be, be a constant.

24 A. Be nonchanging, yes. And the assumption
25 then would be, the soils are relatively homogeneous.

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1 Q. Now, with that background, let's go back to
2 your previous, the calculation that you gave me, the
3 Exhibit 49. Remember it was --

4 A. Oh, yes, I remember that.

5 Q. I believe that one identified the
6 parameters.

7 A. It does. It's one of the correlations, yes.

8 Q. That's what I'm trying to use. Identified
9 the parameters of interest.

10 A. It's entitled N sub K.

11 Q. Now -- I'm looking now at Exhibit 49, and
12 I'm looking at the -- there are a number of equations on
13 the exhibit, but the one that I'll ask you to look at is
14 the last one that reads as follows. And I don't know if
15 this may be captured by our able reporter, but I'll try.
16 $S_u = (Q_c - \sigma_{mv})/N_k$. Did I read that right?

17 A. Uh-huh.

18 Q. Now, please identify for the record what
19 each of these four parameters are.

20 A. Okay. S_u is the undrained shear strength.
21 Let's see if it mentions what units it's in. I think
22 for this example we haven't probably plugged any values
23 of N_k in, but it looks like it would give you values in
24 ksf.

25 Q. And that would be?

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1 A. Kips per square foot.

2 Q. Thousand pounds per square foot?

3 A. Thousand pounds per square foot. Q_c would
4 be the tip resistance or tip stress that would have to
5 be in the same units which the undrained shear strength
6 was in.

7 Minus σ_{mv} would be the overburden
8 stress. It doesn't say whether it's effective or total.
9 However, that would be fairly minor for this --
10 differences would be fairly minor for this case.

11 And then divided by a coefficient that
12 relates the two determined by regression analysis or
13 some other method is called N_k .

14 Q. All right. So that again the record is very
15 clear: in this equation what we want to do is get a
16 better understanding of S_u , and the variable, if you
17 will, that we're using to understand S_u is Q_c ?

18 A. Q_c .

19 Q. Now, tell me a little bit more about
20 σ_{mv} , since that's another factor that is involved.

21 A. σ_{mv} is essentially the weight of the
22 materials overlying where the particular reading was
23 taken. The readings are taken somewhat continuously as
24 you push down through the profile, so as you get deeper
25 and deeper in the subsurface, σ_{mv} is changing. It's

1 a function of the unit weight of the soil above and the
2 thickness of the material above.

3 Q. Right. Now, based on the results of the
4 tests the applicant has conducted and samples taken from
5 the site, is the unit weight for a given layer of soil a
6 constant, or does it exhibit variability?

7 A. The unit weight for a given layer?

8 Q. Yes.

9 A. I'm not sure I've seen a breakdown according
10 to layer by layer in the system. That was one of things
11 that --

12 Q. Let me show you, and we can make this an
13 exhibit --

14 A. Sure.

15 Q. But the SAR has a Figure 2.6-31, which I
16 will turn into an exhibit, which I'd like to show you.
17 Do you have a copy of the SAR?

18 A. I do.

19 Q. Can you take a second and find your copy,
20 and we can look at it at the same time?

21 A. Sure. The figure was --

22 Q. I'm sorry. Figure 2.6-31. It's entitled
23 "Dry Densities of Subsurface Soils at the Site."

24 MR. TRAVIESO-DIAZ: We have -- we can turn
25 this into an exhibit now because we have a sufficient

1 number of copies, I believe. This will be Exhibit 71,
2 and I will provide more copies tomorrow, but we have at
3 least one for the court reporter. And the witness has
4 his own copy.

5 A. I do. I do remember seeing this.

6 Q. This plot appears to be one of dry unit
7 weight in pounds per square foot versus depth for
8 locations both of the pad emplacement area --

9 A. Yes.

10 Q. -- and the canister transfer building.

11 A. Yes, it does.

12 Q. And they're identified differently. The
13 ones in the pad emplacement area are circles, and the
14 ones in the canister transfer building are little
15 diamonds; is that correct?

16 A. That's correct.

17 Q. Now, will you take a look across -- let's
18 take a look at the layers that we're interested in that
19 we believe is from three to ten feet. Take a look for
20 me at the data points that are shown in this figure for
21 the pad emplacement area, which I believe are the
22 circles.

23 A. Yes.

24 Q. Go across for me -- the values are recorded,
25 and if I read this graph properly, you are recording dry

1 weights anywhere between 40 and 70?

2 A. Correct. But I would wonder if the two data
3 points between 60 and 70 may be of a higher unit there.
4 They're quite a bit out of range from the other data.
5 So I think one would have to verify that those are
6 actually part of the data set.

7 Q. All right. Well, how about in that same
8 layer, the value for the canister transfer building? I
9 see that those vary in terms of unit weights anywhere
10 between like 45 and as high as almost 80.

11 A. Yes, but I see again two points that are
12 quite out of the data set. There may be something
13 abnormal about those two data points. They may be in
14 the right zone. Maybe there's something different about
15 them.

16 Q. But would you agree with me that aside from
17 the potential fact that some of this may be outliers,
18 that you believe the data as plotted could be almost a
19 factor of 2 variation in the unit weights?

20 A. That I can't testify to.

21 Q. Well, okay. What it would be -- take just
22 the values across on the -- for the pad emplacement area
23 going --

24 A. Sure.

25 Q. Do they go anywhere from 40 to 70, assuming

1 that you give credit to all the data points?

2 A. For the pad emplacement area?

3 Q. Yes. The circles, don't they go from 40 to
4 68 or something?

5 A. They do, but the depth to the Eolian silt
6 which may be denser is not always exact, and I still
7 don't know if 60 and 70 are in or out of that data set.
8 But for the moment for the argument, let's go ahead and
9 discuss what they are.

10 Q. But as an engineer, would you tend to at
11 least have a question in your mind as to whether you can
12 assume -- based on the data as presented in this
13 exhibit, that it is correct to assume that the sigma sub
14 V, the dry unit weight, is uniform across the layer?

15 A. I'm sorry. I missed question.

16 Q. I don't know if I said this right. Let me
17 try again. Without trying to reach a conclusion, as an
18 engineer wouldn't at least you have a question raised in
19 your mind by looking at this plot --

20 A. Correct.

21 Q. -- as to whether it is a correct assumption
22 to assume that the dry unit weights are uniform across a
23 layer of soil?

24 A. What I would do as an engineer with this
25 data set is I would come in and say I have potentially

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two ranges now, particularly where I see a couple data points that are somewhat out of the rest of the data range, and first try to verify where those particular samples were stratigraphically. Then if I can determine that, then I would feel more comfortable where I place them. So I guess I could be looking now with potential two ranges, something between 40 and roughly 55, or something between 40 and possibly as high as 70.

Q. All right. But let me put the question this other way. Without further investigation, would you feel that it would be prudent to assume looking just at this data as you have it and looking further into it that the dry unit weights are constant across a layer horizontally?

A. Well, "constant" defines one point or line. There's variability to any data.

Q. Right. Would it have low variability across a given layer of soil without reaching conclusions without -- I'm sorry. Strike that question.

My question is, can you assume based on this data as reported without looking more into it that in fact sigma sub V --

A. Correct.

Q. -- is a constant across a given layer?

A. We talked about differences in approach and

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philosophies of how investigations are done, and if I were going to use data that have been attained to determine unit weights -- that's why I preferred when we talked about these to have paired CPT and boring data together. Then there would be no question to where potential outliers fall. I would be hesitant to assign a range -- I think the data tend to support more between the 40 and 60 range than the 40 to 70 range.

I would also then get all the unit weights of the overlying Eolian soil, which are not plotted here, and see where they lie in relation to the data that I'm looking at. I'm only looking at the -- from five feet down. And I assume this was done on five-foot sampling, so it's kind of a hit-and-miss proposition what layer we're in.

Q. Dr. Bartlett, I guess it should be no secret to you where I'm going with this question.

A. I know where you're going.

Q. And my question is only -- and I'm going to ask you the question just based only for the moment on this particular parameter, sigma sub V. I understand what you have done with Exhibit 59 --

A. Correct.

Q. -- and I understand that you're trying to derive some feel for whether you have variation or not.

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A. Right.

Q. But before you could print an opinion or have a conclusion based on Exhibit 59, wouldn't you with respect to unit weights have to look more into it?

A. Well, I think before we worry about whether we have a unit weight that could be somewhat variable, I guess the next approach would be is to go back in and look at the effect of sigma-V on the parameter that we're trying to calculate. Even if we looked at variations between 40 and 70, if the component of sigma-V which is contributing to the shear strength is not large, then this may be somewhat of a trivial thing we're doing here.

Q. Are you saying that perhaps if Qc is so much larger, that --

A. Yes, that it may override the variation that we see in sigma-V.

Q. Okay. That's a fair consideration. But then you'd have to do that analysis?

A. I would just have to plug in the values. It's not a very difficult thing to do if we know the weights of the materials.

Q. Before we do that, let's talk now on Nk. I take it that you are assuming, as you said, Nk is a constant?

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A. Well, Nk would vary according to different types of soils. That's reasonably known. In fact, it's unfortunately a very variable parameter, and that's what makes this correlation hard to apply to soils without some prior experience of calculating it. What I'm saying is Nk should be locally correlated and used not trying to apply an Nk for soils here versus soils somewhat quite a distance away.

Q. Let me ask the question this other way. In order for the relationship between the cone penetration tip resistance --

A. Correct.

Q. -- and the undrained shear strength to be able to draw up the conclusions, you testified earlier that you would need to have Nk be a constant across a layer?

A. It would have to be assumed if you're going to use it to predict a certain layer that it is constant, yes.

Q. All right. And what is your basis for assuming that Nk is constant across a layer of soil?

A. Just from the cone penetrometer data, it seems to be that the upper Bonneville clay seems to be relatively homogeneous, at least in the interval from about somewhere around five feet. It's hard, you know,

1 that five-foot boundary gets a little blurred.
 2 Sometimes it's as high as three feet. Down to about
 3 eight to ten feet we seem to get a monotonous, if you
 4 will, tip stress signature, and my prior experience with
 5 the upper Bonneville clay is it's somewhat of a
 6 monotonous clay. It can vary from a silty clay to
 7 clayey silt.

8 Q. Even within a monotonous layer, as you
 9 describe it, would Nk be a function of factors such as
 10 plasticity?

11 A. It could, yes.

12 Q. Let me show you -- let's mark this as an
 13 exhibit. Let's call that Exhibit 72.

14 (Exhibit-72 marked.)

15 Q. (By Mr. Travieso-Diaz) Now, what I have
 16 provided you as Exhibit 72 I believe is a portion of a
 17 treatise called -- or it's not a treatise, at least -- a
 18 monograph perhaps is the word, called "Cone Penetration
 19 Testing in Geotechnical Practice" by Tom Lunne,
 20 L-u-n-n-e, Peter Robertson, and John Powell.

21 A. Yes, I see.

22 Q. Are you familiar with this treatise or this
 23 monograph?

24 A. I haven't seen it in this form, but I may
 25 have seen parts of the equation. So it's -- there's

1 been several people investigating Nk.

2 Q. I know. Let's look at page 64, the bottom
 3 of the page in an equation that is identified as 5.16.
 4 Is that equation the same as the one that you have at
 5 the bottom of the front page of Exhibit 49?

6 A. Yes.

7 Q. So the parameters are the same?

8 A. Yes.

9 Q. Let's turn, then, to the next page, which is
 10 page 65. And I'm not going to, but I invite you if you
 11 wish to, review the discussion on that page, which I
 12 believe talks about how you go about predicting or
 13 estimating Nk.

14 MS. CHANCELLOR: Do we know the date of this
 15 document? Do you know if it's recent or if it's --

16 MR. TRUDEAU: It's in the SAR reference
 17 list. I can find that for you.

18 MR. TRAVIESO-DIAZ: I can tell you there is
 19 a list -- more -- no older than 1985, because if you
 20 look at the last page, 106, it references a 1985 study
 21 by Greig, and he says "recent data." So without
 22 attempting to testify, I will guess that this document
 23 is of approximately 1985 vintage.

24 THE WITNESS: In fact, I could probably find
 25 it. If I may pull out the EPRI manual, it may be

1 referenced in here. The EPRI manual does reference
 2 these authors. We could get the exact date.

3 MS. CHANCELLOR: I was just trying to
 4 establish whether this was recent.

5 THE WITNESS: It may not be. Well, it has a
 6 1986 reference, so it's -- wait. Excuse me. There is a
 7 1996 here, so it's within the last four years.

8 Q. (By Mr. Travieso-Diaz) Well, I am shown a
 9 page 2.8-6 of the SAR that has a list of references.

10 A. Okay.

11 Q. And it lists this work as being a 1997 date.

12 A. Okay, fair enough. That's fine. So it's
 13 relatively recent.

14 Q. Again, I'm not requiring or asking you to
 15 read it in detail, but I'm inviting you to look at how
 16 they go about estimating Nk. And what I want to draw
 17 your attention is to two figures. First figure is on
 18 top of the page on the left, in which there is a plot of
 19 Nk versus something known as the rigidity index, and it
 20 is described in -- within a rectangle by what appears to
 21 be a logarithmic relationship.

22 A. That's correct.

23 Q. And I'm not technically competent to render
 24 a judgment, but that would tend to indicate to me --

25 A. Tremendous scattering.

1 Q. -- that this is a logarithmic scale that is
 2 not a straight line.

3 A. No. And there could be potential large
 4 scattering of these data, too.

5 Q. And now I invite your attention to look at
 6 two plots of Nk again versus plasticity index.

7 A. I see it.

8 Q. And they are in fact I believe identified
 9 for particular types of soil. They have a series of
 10 plots for onshore Norwegian clays and a series of plots
 11 for North Sea clays.

12 A. Yes, I see that.

13 Q. Without attempting to imply that these are
 14 the same soils as at the PFS site --

15 A. I understand that.

16 Q. -- the published data appears to indicate
 17 that there is a wide range of values for Nk depending on
 18 what plasticity index you have.

19 A. I disagree.

20 Q. Oh. Well, help me here. Maybe I'm
 21 misreading it.

22 A. The lines that are plotted on this figure,
 23 you can see they plotted an upper and lower bound based
 24 on it looks like ranges of data that they plotted to
 25 either horizontal or vertical bars with the two lines on

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1 the end.

2 Q. Right.

3 A. And the authors here have chosen to draw a
4 relationship based on no statistical analysis. When you
5 do statistical analysis, you should show all data points
6 and fit with regression line. And you'll notice there
7 on the plasticity index between about 5 and 10 several
8 significant points of their data above their upper bound
9 line. I might argue that if one would use the
10 correlation of the whole data, there might be
11 essentially a flat line across there.

12 Q. If you circumscribe yourself just to looking
13 at what you describe as being the extreme bounds of the
14 set of data points.

15 A. Sure.

16 Q. For example, in the first of the two
17 figures, I see that for a variational plasticity index
18 going from, say, what is shown here as 5 percent to
19 maybe 45 percent, you have values of N_k that go anywhere
20 between 15 and -- I don't know. Can you read the graph?

21 A. I can't.

22 Q. Well, let me just ask you a question.
23 Again, presented with data of this sort, and without
24 asking you to draw any conclusions, would it be prudent
25 to look more into the extent to which it is fair to

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1 have a variation on undrained shear strength across a
2 layer using cone penetration tip resistance, you
3 couldn't just do a single plot by this and draw a
4 definitive conclusion. Is that correct?

5 A. No, I think it's just a possible approach.
6 And that's all it was for me was a possible approach to
7 try to understand potential variability. Because we
8 have discussed differences in plasticity, void ratio,
9 water content, and potential -- now slight cementation
10 in this zone, it is reasonable to assume that the
11 undrained shear strengths in this layer is variable.

12 Q. On the other hand, you could also assume
13 that the undrained shear strength is fairly constant and
14 the other things have changed. Is that right?

15 A. I have a hard time assuming that.

16 Q. Well, you cannot rule it out. You cannot
17 rule it out because you --

18 A. Well, I can say definitively if the void
19 ratios are changing, if the moisture contents are
20 changing, and if the plasticity is changing, the
21 undrained shear strength is changing. And I'll say that
22 definitively.

23 Q. All right.

24 A. If those are true.

25 Q. Right. And you can do that even without

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1 assume that N_k is a variable or is a constant?

2 A. That's a fair question because, you know,
3 when we look at the borehole data we do see CML
4 materials in this range, and we also see indications of
5 some CH and MH materials. And given all things
6 constant, I still think there is a relationship between
7 plasticity index and N_k . I'm not sure if this document
8 doesn't slightly overstate it in its presentation.

9 So yes, the assumption that N_k is constant
10 through this layer may not be valid because we do see
11 indications from for the borehole data that the
12 plasticity is changing, and my experience with the
13 Bonneville clays elsewhere have suggested there's some
14 high plastic zones in it. For whatever reason, they
15 show up.

16 Now, I think again all I was doing, this was
17 in a relative sense, trying to understand, and yes, the
18 assumption was that N_k in this monotonous zone was
19 somewhat constant.

20 Q. I'm not trying to denigrate what you did,
21 I'm just trying to explore the bounds of what you can --

22 A. Explored the assumptions that we're going
23 through, yes.

24 Q. And would it be fair to say that, while
25 useful to try to figure out the extent to which you may

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1 referring to --

2 A. I can pull you a standard textbook and show
3 you those statements.

4 Q. And you can do that even without doing --

5 A. I do not have to do analyses to make those
6 assumptions.

7 Q. One more question that I have on this
8 Exhibit 59. And just keep looking just between five and
9 ten feet, if you will, which is I think the layer that
10 you are interested in.

11 A. Yeah.

12 Q. Even though they are in your plots, and
13 assuming for purposes of this discussion that in fact
14 there's a linear relationship in these two parameters,
15 that there is some variability. To my very untrained
16 eye, they appear fairly homogeneous throughout all
17 layers in terms of you're going to assume that there is
18 a band, the band as such is pretty uniform throughout.

19 A. Out of all that we see in this system, it is
20 the most monotonous, yes.

21 Q. In fact, the layer that relates most
22 uniformly as compared to --

23 A. Is layer 2. That's fine. That's why we can
24 pinpoint it so well from these data.

25 Q. All right. Do you think there's anything

1 else that we can draw from this Exhibit 59?

2 A. No, other than it's just a potential
3 approach to look at the variability. Do with it what
4 you may. It was just something I was trying to
5 understand.

6 MR. TRAVIESO-DIAZ: All right. Off the
7 record for a second.

8 (Discussion off the record.)

9 MR. TRAVIESO-DIAZ: Let's go back on the
10 record.

11 Q. (By Mr. Travieso-Diaz) And before we talked
12 about Exhibit 59, we were beginning to go over Basis 3b
13 as it is described on Exhibit 3, page 85.

14 A. Exhibit 3?

15 Q. Exhibit 3 is the statement of the
16 contention.

17 A. Got it.

18 Q. If I recall, yesterday we did go through
19 Basis 3.

20 A. Yes. This is the copy I had yesterday,
21 because I recall my markings on it.

22 Q. Right. And we were on b on page 85.

23 A. Okay.

24 Q. And I am embarrassed to tell you that I
25 don't recall exactly where on page 85 we were, but at

1 homogeneous, we need one sample. If there's
2 variability, then our challenge is try to understand
3 whether we've captured somewhat that variability in our
4 sampling program. So that's why determining the number
5 of samples is not always an objective process. But we
6 try to keep it as objective as possible.

7 Q. Now, I am going to show you -- I'll mark as
8 an exhibit, which is I guess now 73.

9 (Exhibit-73 marked.)

10 MR. TRAVIESO-DIAZ: For the record, Exhibit
11 73 consists of a two-page drawing identified as Figure
12 2.6-20 of the SAR, and it's entitled "Soil Properties
13 Vs. Depth in Storage Pad Area." And again, has two
14 sheets. It doesn't show a revision number. If it does
15 have it, it's not on my copy.

16 Q. (By Mr. Travieso-Diaz) Are you familiar
17 with this figure?

18 A. Yes, I've seen this before.

19 Q. As I understand, the intent of this figure
20 was to try to group and present as a function of depth
21 various properties of samples taken in various borings
22 in the pad emplacement area. Is that a fair
23 characterization of what this appears to be?

24 A. Yes. It's trying to summarize data versus
25 depth for these borings.

1 the risk of repeating what has been covered already, and
2 if I have, I apologize, I believe we have not talked
3 about the statement that starts in the middle of
4 paragraph b on page 85 that says, "For example, only
5 five undisturbed samples were collected." Do you recall
6 our discussing that before?

7 A. I'm not sure.

8 Q. Am I in the right place? Thank you much.
9 Now, tell me first as to the numbers that
10 are outside there. Are those correct numbers as of
11 today?

12 A. Well, no, not of today, because there has
13 been additional sampling, yes.

14 Q. So you will say that even though your
15 opinion may be that the sampling, even though maybe it's
16 not enough, the sampling certainly is significantly
17 bigger than what's shown in that sentence?

18 A. There is more basis for undrained shear
19 strength than there was when this was initially written.

20 Q. Okay. Now, if I remember, I asked you
21 yesterday how many more you think would be sufficient,
22 and you were not able to tell me how many more.

23 A. It's a difficult question, because it does
24 again go back to our understanding of the potential
25 variability within the layer. If it's perfectly

1 Q. All right. And now looking at the first of
2 the data sets, if you will, which is a plot of N blows
3 per foot versus depth.

4 A. Correct.

5 Q. I take it N, as we discussed earlier, is the
6 number of --

7 A. Blows to drive the split spoon sampler one
8 foot with a 140 pound hammer falling 30 inches.

9 Q. Now, it has as a key -- it's trying to do
10 something similar to what did you in Exhibit 59, I
11 guess, in that it's trying to superimpose the results of
12 borings --

13 A. Correct. Data approximately taken every
14 five feet, yes.

15 Q. And from four different borings, A-1, B-1,
16 C-1, D-1?

17 A. Yes.

18 Q. Okay. Now, if you look at that data set and
19 you try to look across again, we're interested in the
20 layer between I guess zero and ten feet -- three and ten
21 feet?

22 A. Yes.

23 Q. Okay. For that figure on top, I see that at
24 least three of the data points, the N value is
25 essentially the same. I don't know where the fourth one

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- 1 lies. There may not even be a fourth one, or --
 2 **A. They may have done an undisturbed sample, so**
 3 **you're missing a blow count in that interval.**
 4 **Q. Will you read that figure for me on that**
 5 **layer?**
 6 **A. At five feet?**
 7 **Q. Yes.**
 8 **A. The blow counts -- do you want the blow**
 9 **count values?**
 10 **Q. Well, yes, if you can do it.**
 11 **A. Looks like approximately 8, probably 12 and**
 12 **then maybe 13.**
 13 **Q. So the range is from 8 to 13 or so?**
 14 **A. Correct.**
 15 **Q. And if you look at -- the same figure looks**
 16 **at -- I'm sorry. The same type of information is**
 17 **presented in the graph immediately below?**
 18 **A. Correct.**
 19 **Q. Which is N versus depth. But now we're**
 20 **talking about Borings A-2, B-2, C-2, and D-2?**
 21 **A. Correct.**
 22 **Q. And if you look at -- again at 5, I think**
 23 **that you have here only two data points.**
 24 **A. Yeah.**
 25 **Q. Two data points are pretty close, correct?**

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- 1 **A. Yes.**
 2 **Q. And they are in the order of what, say, five**
 3 **or six, five and six? Six and seven?**
 4 **A. Yeah, approximately.**
 5 **Q. Continuing, let's just try to look at these**
 6 **parameters throughout. The second page of the exhibit**
 7 **has N versus depth for another set of data points**
 8 **corresponding to Borings A-3, B-3, C-3 and D-3. And**
 9 **here you have three data points that go from like -- I'd**
 10 **say maybe 5 to 15?**
 11 **A. Yeah, 6 to 15.**
 12 **Q. All right. And the last one again is for**
 13 **four data points, A-4, B-4, C-4 and D-4, for those four**
 14 **borings?**
 15 **A. Correct.**
 16 **Q. And the values -- actually, there are very**
 17 **few values. There are no values that corresponds to the**
 18 **ones we talked about before. We're a little below.**
 19 **They range from, what, 5 through 15? That's the number**
 20 **of blows?**
 21 **A. On the last one?**
 22 **Q. Yeah, I'm on the last one.**
 23 **A. I'd say more from about 4 to 17 or 18.**
 24 **Q. Four to seventeen, okay. Now, if you were**
 25 **going to look at N count alone versus depth, and you**

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- 1 were going to look only at the depth that we are talking
 2 about, which appears to be the one of interest which is
 3 layer 2, would you conclude based only on this data, and
 4 there may be limitations to using just this data, that
 5 the blow counts are going to be uniform for the 16
 6 samples that we looked at?
 7 **A. No, you wouldn't conclude that. But we do**
 8 **get into the same issue again that we see some fairly**
 9 **high blow counts. For example, I'll point out the last**
 10 **diagram we looked at, the one approximately 17 or 18.**
 11 **Again, I would make sure that that didn't capture some**
 12 **of the bottom of the Eolian silts, because it certainly**
 13 **is inconsistent with the other data and it seems to be**
 14 **inconsistent with the monotonous layer that we've seen**
 15 **in the cone penetrometer.**
 16 **And might I add that really I personally**
 17 **believe, and I think others would substantiate this,**
 18 **that the cone penetrometer data are better for trying to**
 19 **do just this, because there is -- the standard**
 20 **penetration test is, due to many, many different errors,**
 21 **the cone penetrometer test is a much more standardized**
 22 **test.**
 23 **Q. Well, what I'm trying to gather is an**
 24 **understanding from you and taking into account the**
 25 **limitations of the data that you just mentioned -- and**

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- 1 by the way, if you have a higher blow count, it means
 2 that your soil is stronger?
 3 **A. It can mean two things. In sands, it means**
 4 **it's usually denser and stronger. In clays, we use the**
 5 **term "stiffer."**
 6 **Q. And if you throw that data point out as**
 7 **being an outlier, you're being conservative in a way?**
 8 **A. If you're trying to predict strength, that's**
 9 **correct.**
 10 **Q. All right. But my question is, can you draw**
 11 **any inferences, or would it appear to you that**
 12 **understanding the limitations of using N --**
 13 **A. Right.**
 14 **Q. -- to predict uniformity, but at least as**
 15 **far as the N values that you agreed, they are reasonably**
 16 **uniform for layer 2?**
 17 **A. I don't like that 17. Something just**
 18 **bothers me about it. I'm not going to include it in the**
 19 **data set. I just can't. Not in these units.**
 20 **Q. Okay. You take the 17 out?**
 21 **A. Yeah, I'll take the 17 out. Then we're**
 22 **looking at something between 8 and 12, 6 and 13, 5. So**
 23 **somewhere between 5 and maybe 12 to 13 blows would be a**
 24 **representative. That's a reasonable amount of**
 25 **differences in this unit. A factor of two, two and a**

1 half.

2 Q. And what conclusion would you draw -- be
3 able to draw, if any, based on that observation as to
4 the possible uniformity of the soil in layer 2 using N
5 only as a reference point?

6 A. But there's suggestion that there are
7 stiffer or denser layers in here, if that's what we're
8 truly measuring when we pound that thing in the ground.

9 Q. Let's go to -- let's go back to Exhibit 3.

10 A. Sure.

11 Q. I think you did testify that with respect to
12 the next sentence that reads, "Unless subsurface
13 conditions are predictably uniform across the site, the
14 number of tests and analyses are inadequate to
15 accurately model the expected behavior of the soil
16 foundation under static and dynamic loading."

17 A. That I cannot remember what I've said.

18 Q. Well, if I recall, your testimony was that
19 you consider this still to be a valid concern and that
20 the reason it was a valid concern is that in fact you
21 had some doubts as to where -- whether the soils on
22 layer 2 were uniform horizontally across the site.

23 A. Yeah, that was I think the reason why I went
24 to the cone penetrometer data to try to discover that
25 variability, and it looked like the tip stresses varied

1 roughly by a factor of two. And maybe that's not a bad
2 estimate, because we now see the standard penetration
3 values varying by roughly a factor of two to two and a
4 half. But I'm not inferring that the undrained shear
5 strengths vary that largely, but we do see penetration
6 values from both sets of data suggesting a variation by
7 a factor of two, possibly two and a half.

8 Q. Going to -- I'm sorry.

9 A. I'm not sure if I said this yesterday, but I
10 guess the reason why we're focusing in so closely on
11 this issue is because we discussed Wednesday that the
12 applicant has used the peak strength to estimate
13 foundation loadings. And we've pointed out a couple
14 things that concern us with using peak strength if
15 indeed the values that they have picked are peak
16 strengths.

17 First, the free field ground motion that
18 comes up through the soil column mobilizes some of the
19 shear strength. There has to be something to resist the
20 free flow motions, and we do not know how much of that
21 peak strengths is being mobilized, or, in other words,
22 how much of the capacity is left of peak to resist for
23 foundation loading. And we can't really determine that
24 yet from the applicant's data.

25 And then secondly, we were concerned that

1 potential degradation -- I'm going to use degrading,
2 degrading of peak due to cycling. The applicant has
3 done stress controlled triaxial cyclic shear, and we
4 believe that it would be prudent to revisit the strains
5 that are developed in this key layer from the 1-D shake
6 analyses and run strain controlled tests at that level
7 to see if there's any potential for degradation. And
8 our concern for potential degradation really is not so
9 much that the clays will degrade, because my experience
10 with the Bonneville clay is it doesn't degrade
11 significantly, but we have heard suggestions that some
12 of the strength is derived from cementation. If there
13 is cementation going on, we need to know at what strain
14 level, not what stress level, but what strain level
15 might that degradation occur.

16 And those I guess are our concerns under
17 static and dynamics. So that's why this 2.2 kips per
18 square foot or approximately there that's used in a lot
19 of the analyses became -- become important to us. Fair
20 enough?

21 Q. Yes. Let me ask you a question about
22 cementation, though, because we really have not
23 addressed that totally before.

24 A. Yes.

25 Q. And we'll talk more.

1 A. Sure.

2 Q. Now, to have the record be clear: the
3 applicant has never taken any credit for the potential
4 strengthening of the soil due to cementation?

5 A. Maybe we misunderstood, but Wednesday we
6 thought we heard that there was some credit taken to
7 these soils being potentially stiffer due to
8 cementation, and we don't preclude that because these
9 are calcareous sediments. They have calcium carbonate
10 in them. So we just don't know the degree to which
11 cementation is affecting the undrained shear strength.

12 Q. Apart from what may have been said at the
13 deposition two days ago, have you seen any calculation
14 or analysis by applicant in which expressed credit is
15 taken for cementation of soil?

16 A. I believe the applicant suggests in the
17 calculations that there's cementation going on and it
18 could be contributing to some of the undrained shear
19 strength.

20 Q. Well, but is that just a qualitative
21 statement, or is there a value assigned to it for which
22 they take credit?

23 A. Well, the issue is if cementation does exist
24 and it is making these layers stiffer, if it is existing
25 there, there's a potential for the soil to behave more

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1 brittlely. In other words, it will reach a peak and
2 then the peak will drop off with more strain. And
3 that's our concern is if that could occur, then we could
4 see some degrading. If the undrained shear strength is
5 not derived any from cementation, my experience with
6 this clay is that the drop-off and peak will not be
7 marked.

8 Q. I understand. But what I'm trying to
9 clarify is --

10 A. Sure.

11 Q. -- whether you are aware of any particular
12 analysis in which a number has been developed.

13 A. You can't break it out. You can't say that
14 30 more percent is due to cementation. I don't see any
15 place where undrained shear strengths have been
16 increased due to cementation. We are taking the tests
17 at face value.

18 Q. And to the extent that cementation was
19 mentioned in documents where applicant would be perhaps
20 along the lines of saying that the result that we are
21 showing is conservative because we're not taking credit
22 for cementation?

23 A. Well, my issue is --

24 MS. CHANCELLOR: Object to the form of the
25 question.

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1 Q. How can I make the question better? Okay.
2 Strike that question. We don't need to go into that.

3 A. We are taking the 2.2 ksf at face value. I
4 have not seen anything that the applicant has said that
5 there is no cementation in that value, so we have to
6 assume that there could be some even of that 2.2 ksf
7 that could be potentially cementation. We're just
8 looking at the data at face value. We do not I think
9 fully understand the mechanism that's going on with
10 cementation and what role it is or is not playing to
11 these shear strengths.

12 Q. Fair enough. You have raised a variety of
13 issues which I think we may better take one by one at an
14 appropriate point rather than trying to deal with them
15 all at once. Let's just follow on, because they're
16 going to come up, I believe, as we go through Exhibit 3.

17 Could you turn to the top of page 86. And
18 the first sentence says, "The investigations (sampling
19 and analysis) to determine the properties of the various
20 materials underlying the site are not sufficient." And
21 what I would like to understand is, because there is a
22 discussion that follows through several sentences in the
23 rest of the paragraph, and my question, see if you can
24 follow what I'm asking you. --

25 A. Fair enough.

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1 Q. -- whether the first sentence says anything
2 different from what the totality of the others do say.
3 We need to examine the first sentence separate from the
4 rest.

5 A. Yes, this first sentence seems to be a
6 general statement.

7 Q. So it is like a summary or a general --

8 A. Of what should follow, yes.

9 Q. All right. So let's keep that sentence and
10 go to the others. Second sentence says, "The scope of
11 investigations should match the design requirements of
12 the facility and complexities of the site." Again,
13 would you characterize this as a general statement as to
14 what should happen?

15 A. It may imply that because we're dealing with
16 a nuclear safety facility that we should pay prudent
17 attention to the requirements for design at such a
18 facility. That's what I would interpret maybe in the
19 design requirements. And then complexity of the sites I
20 guess is inferring that somebody's already got some idea
21 about -- that this may be a very complex site.

22 Q. Okay. But in itself, is there any assertion
23 that is made in that sentence with respect to the
24 investigations that were conducted at the site?

25 A. Well, I think it also implies that when one

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1 goes through a design that one should consider the
2 appropriate tests to resolve design issues.

3 Q. Okay. Fair. But let's move now to the
4 third sentence, which says, "For example, the analysis
5 of soil is not based on the results of dynamic testing
6 of insitu samples either in a stress or strain
7 controlled manner."

8 A. Correct.

9 Q. Now, as I read that sentence, that one is
10 making an assertion --

11 A. That is correct. It says that --

12 Q. -- of a problem.

13 MS. CHANCELLOR: It's got "for example," so
14 I want to make sure that you're not limiting it to just
15 this.

16 MR. TRAVIESO-DIAZ: Well, I think when you
17 say "for example," it's hard to limit it to what follows
18 grammatically.

19 A. So for example, it's saying at this point in
20 time when this was reviewed that there were no dynamic
21 testing in either a strain or stress controlled manner.

22 Q. And my question would -- just with respect
23 to this, for example, is it -- has the concern raised
24 with respect to this particular sentence remained viable
25 based on the additional testing that has been conducted

1 by applicant?

2 A. I think we discussed Wednesday about, again,
3 looking at the amount of strain developed particularly
4 in layer 2 and doing cyclic triaxial strain tests to
5 look at degradation. The applicant has done stress
6 controlled testing, but it appears that the stress level
7 at which those tests were done may not be applicable in
8 light of some of Dr. Ostadan's comments about the
9 foundation loadings. They may have been underestimated.
10 And generally when we want to look at degrading of
11 strength, a strain controlled manner would be
12 preferable.

13 Q. I know it's hard to try to correlate a
14 sentence I was reading three years ago with current
15 concerns.

16 A. Correct.

17 Q. Now, what I'm trying to do throughout this
18 examination is to figure out what your current concern
19 is with respect to the issue that is addressed in the
20 sentence that we're talking about; and if I hear you
21 correctly, you have a concern with that the testing was
22 done as of today only in a stress controlled manner and
23 that no strain control tests have been conducted?

24 A. For cyclic triaxial.

25 Q. For cyclic triaxial. All right.

1 Now, take a look at -- well, the last
2 sentence on that paragraph, if I remember your testimony
3 and Dr. Ostadan's, is trying to correlate the fact that
4 these tests have not been run with the ability or lack
5 thereof to create a seismic profiling of the site. I'm
6 trying to follow the text.

7 A. I'm trying to understand what this -- we did
8 raise issues of, you know, potential adjustments that
9 need to be made to the refraction data as a result of
10 the seismic cone penetrometer. I remember those
11 discussions with Dr. Ostadan. This sentence, though, I
12 don't think is alluding to that. It's alluding again to
13 the use, and I think it's -- when it says "these data,"
14 it's talking again about stress controlled or strain
15 controlled manner. And I assume when it says "field
16 seismic profiling," again that's out of my area of
17 expertise, but in some way maybe these data from these
18 laboratory tests help in determining shear wave
19 velocities because one can also determine a modulus or
20 stiffness from it.

21 Q. Okay.

22 A. So I think that, frankly, the seismic cone
23 penetrometer data and how we suggested that looking at
24 that and at the refraction data, because of -- in light
25 of the seismic cone penetrometer data need to be

1 adjusted is a better way to go. And I do not see really
2 any advantage in using stress or strain controlled
3 triaxial data -- cyclic triaxial data and the
4 appropriate -- and the moduli to go back and help with
5 the field seismic profiling.

6 Now, let me see what the rest of this is.

7 Q. Let me try to help you in the rest of the
8 sentence.

9 A. Okay.

10 Q. The last clause I think we already talked
11 about earlier, "determine the potential for soil
12 collapse." That's not really a concern?

13 A. No. We've seen cyclic triaxial testing done
14 for that, and I think that's why some of the stress
15 controlled tests were done initially is to try to
16 determine the potential collapse of these soils. I'm
17 not so concerned about collapse, and I think we've
18 already talked about that in Basis 4 and dismissed that.

19 Q. Let me ask you something that I think I
20 understood you to say.

21 A. Sure.

22 Q. And if I didn't get you right, just correct
23 me. Did you say a moment ago that your recommended
24 approach would be perhaps to enhance or increase your
25 cone penetration data?

1 A. No. What I was saying is, Dr. Ostadan
2 suggested that when the geophysicists develop their
3 refraction profile that part of the assumption that they
4 have to do in developing their model is make an assumed
5 shear wave velocity profile. And that model is kind of,
6 I think they call it an inversion process. You kind of
7 guess and then take the data, and you keep going through
8 this process until what you're gathering back and what
9 you assume have some convergence, and then you think you
10 have a realistic seismic model with depth. Again, I'm
11 not a geophysicist.

12 But the initial survey was done with an
13 assumed velocity model in the shallow layer. And we now
14 see the seismic cone penetrometer showing that layer 2
15 perhaps had lower shear wave velocities than what was
16 anticipated when the refraction survey was done. And I
17 think he suggested that one should revisit that and see
18 if the seismic cone penetrometer data would help in
19 adjusting that deeper refraction data.

20 We do see some -- even some inconsistencies
21 with the deeper data. Well, no, I'm not going to --
22 that may not be correct. I'm going to not go into that
23 area.

24 Q. Okay.

25 A. And this sentence seems to suggest to me

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1 that one could use the strain controlled or stress
2 controlled cyclic triaxial data to help calibrate your
3 geophysical model, but I think that the seismic cone
4 penetrometer data is more valuable in doing that.

5 Q. It's a better tool?

6 A. Yes. Leave it at that.

7 Q. Let's go to the first sentence on the second
8 paragraph on page 86. And the sentence indicates
9 that -- I'm going to paraphrase it slightly -- that
10 there is not enough test data to determine that the
11 strength tests have been performed on undisturbed
12 samples and that there is sufficient relevant test data
13 to support the selection of the design parameters.

14 Now, I understand this to be saying two
15 different things, and correct me if I'm wrong in my
16 interpretation. But the first half is saying, you don't
17 have enough test data to determine that you indeed have
18 run your test on undisturbed samples. Is that how you
19 read the first half?

20 A. Let me really focus on it.

21 Q. Yes. I'm sorry. It's difficult.

22 A. Yes, I think I read that the same way, that
23 here is somebody trying to understand whether there has
24 been disturbance on the tests, and there's not enough
25 data to support that. Again, we've seen examples of

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1 applicant tended to do that.

2 I'm not sure in the canister transfer
3 building quite the strategy, but maybe continuous
4 sampling. I'm worried about doing continuous sampling
5 down one borehole because of the effects of disturbance
6 and things that we could do. But in the area where we
7 see very low tip resistances, maybe two boreholes where
8 we alternate depth so that we get essentially a roughly
9 ten-foot continuous sampling of these layers and do just
10 a little bit more testing to be sure.

11 Q. I will be glad to convey the suggestions.

12 A. Will you? Thank you.

13 Q. It's not within my purview to --

14 A. Because I really -- I think we're going to
15 see maybe this insufficient sampling to determine design
16 parameters throughout this. And maybe we could just say
17 this is our position right now, that we're still a
18 little uncomfortable again, and go on.

19 Q. Is it in fact -- I don't want to
20 characterize it in any particular way, but is it in fact
21 your main concern with respect to the testing that has
22 been done that you don't feel that enough testing has
23 been done to feel comfortable that you have selected
24 properly the design parameters?

25 A. Repeat the question.

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1 minor disturbance, but I don't think that that's a large
2 issue here.

3 The second part of the sentence then again
4 says that there are sufficient relevant tests to support
5 the selection of design parameters. We still, as we've
6 discussed, feel uncomfortable about the design with the
7 few number of tests we've seen.

8 Q. So again, I thought that that's what you
9 said earlier. But just concentrating on this particular
10 sentence here, the first half isn't really your concern;
11 what you're concerned about is that we haven't done
12 testing to feel comfortable that we --

13 A. About the undrained shear strengths, right.

14 Q. It's ten minutes to seven. Do you want to
15 take a break?

16 A. I'm fine.

17 May I offer a suggestion?

18 Q. Yes. Always open to suggestions.

19 A. Since it is such a key parameter and we do
20 have I think some idea from the cone penetrometer where
21 potentially weak zones may be, one could easily go
22 through the data and select, like I did, looking for a
23 fairly low value that's consistent through a reasonably
24 thick interval, thick meaning two to three, four feet,
25 and do somewhat targeted sampling around that. The

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1 Q. Let me try it again. Would it be fair to --
2 just to have a big picture description of your concern
3 in the testing area --

4 A. Right.

5 Q. -- that enough sufficient testing has been
6 done to be comfortable that you have selected values for
7 the same parameters that are appropriate?

8 A. Yes, That's correct.

9 Q. Okay. And then the rest of the detail as to
10 what kind of test you do and how you do them and how
11 much --

12 A. Yes, and how much -- you know, we've talked
13 about other issues, that even once we get the proper
14 representative values, there are still issues about,
15 again, how much peak is available and all of those
16 things. But at least whether this roughly 2 to 2.2 ksf
17 that we've been designing with could probably be
18 relatively substantiated now that we have such a good
19 sampling of cones across the area.

20 Q. I'll ask to have you clarify your
21 recommendation as to whether you mean two borings in one
22 specific area, targeted area, or multiple pairs of
23 borings.

24 A. Well, maybe -- I think there was a better
25 strategy for the canister transfer building in the

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1 investigations. That's obvious.

2 Q. Okay.

3 A. But I'm not sure continuous sampling was
4 done there. So I'm going to reserve my judgments on
5 that, but suggest that it may be considering two borings
6 in the pad emplacement area where the -- after one goes
7 through -- carefully through the cone penetrometer data.
8 And if this assumption that tip resistance equals low
9 strength is true, then target a cone that seems to be --
10 have a fairly low tip stress throughout a fairly thick
11 unit, six, five, six feet, and try to continuously
12 sample that. And to do that you'll have to do two
13 borings right adjacent to that cone so that you can
14 alternate the borings. You'd sample one, and then in
15 the adjacent one you would go down to the interval just
16 below that sample, and you just kind of piggyback down.
17 I think that's not unreasonable.

18 Then you get continuous samples, but you
19 essentially avoid the impacts of disturbance trying to
20 sample that one borehole. And the canister transfer
21 building, perhaps something can be considered the same
22 approach. But then we can feel very comfortable that we
23 did indeed capture some of the apparently lowest
24 strength zones in the cone penetrometer. We did sample
25 very closely to that and discovered what those undrained

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1 shear strengths are.

2 Q. I want to say for the record that I hope
3 that this transcript does justice to the description you
4 gave so people can follow and can understand.

5 A. I believe key people on the applicant's side
6 understood what I said.

7 Q. I would be presumptuous if I said that I
8 understood half of it.

9 A. Now, there may have to be a little bit of
10 additional sampling, perhaps, to support cyclic strain
11 controlled testing. That may involve another boring. I
12 don't know. We may not be able to get everything we
13 need.

14 Q. Now, we did talk as to the next sentence on
15 the second paragraph of Exhibit 86 that reads, "For
16 example, the soil test data did not include samples
17 taken from each of the soil strata, did not include each
18 foundation of buildings or structures, did not include
19 the PMF diversion dike foundation, and did not evaluate
20 compacted soils."

21 I don't want to repeat what we talked about
22 the other day, but if I understand your interpretation
23 of what this sentence means today, it's essentially not
24 too different from what you have been saying, because as
25 to whether samples were taken from each soil strata,

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1 that has happened, perhaps not as much as you would
2 like. And dealing with the foundations, again it has
3 also happened.

4 So would it be fair to say that again the
5 concern that is expressed in that particular sentence is
6 still your concern with respect to the number of the
7 samples that have been taken as to -- as it appears to
8 say here as to whether samples are taken at all?

9 Is that an understandable sentence? No? I
10 didn't think so. I tried. It sounded good to me.

11 A. I think we talked about this yesterday, and
12 we now have information that we didn't have when this
13 was written, a much better idea of the soil
14 stratigraphy, at least in the upper 30, 35 feet where
15 the cone penetrometer data are. We can now do more
16 focused studies and resolve issues in key layers. I'm
17 not implying that in this five layer system that we're
18 looking at in the upper 30 feet, 30, 35 feet that we
19 need to worry about fully -- worry about certain layers.
20 There seems to be certain layers to me that are not of
21 particular interest now. The Eolian silt is no longer a
22 real particular interest to us. It may have some
23 interest when you design your soil cement and some of
24 the issues associated with it, but those are different
25 types of testing we're talking about here.

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1 Layer 2 we've discussed extensively.

2 Layer 3 appears to be siltier, denser,
3 probably from a standpoint that I can see is not as
4 great a concern.

5 Layer 4 is again a Bonneville clay sequence.
6 At least it seems to be more plastic, but again stiffer
7 because it's deeper. I'll leave it up to -- I haven't
8 really gone through and seen the data in that layer. I
9 again defer to Dr. Ostadan in maybe if there are some
10 things that are unresolved in layer 4. But from a
11 strength perspective, I don't see a lot there, because
12 it's deeper and stiffer. And if Nk is somewhat constant
13 between these two layers, I think you can figure out,
14 and you've already done, that how to increase the
15 strength in that layer. Fair enough.

16 Layer 5 is extremely dense.

17 Q. Layer 5 is where?

18 A. It's that dense -- I can't -- is it a sandy
19 silt/silty sand that we start getting quite high blow
20 counts.

21 Q. Just so that we on the record --

22 A. Let's look at that.

23 Q. We're talking about where potential depth.
24 Let's see if we can get that. You know what I'm looking
25 for. Here it is.

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1 A. Let's use -- let's do the first one, because
2 that's probably the best.

3 Q. And we are looking at Exhibit 53, which was
4 the 14-sheet set of foundation profiles. And --

5 A. Correct.

6 Q. -- those foundation profiles have various
7 soil layers identified, and we're just trying to figure
8 out where layer 5 starts.

9 A. Layer 5 in this profile on the left-hand
10 side where there's a labeling CPT-36 begins at
11 approximately 433, 34 feet.

12 MS. CHANCELLOR: Four hundred?

13 A. Let's try 4,433 feet elevation. And you can
14 see a marked increase in the penetration resistance as
15 it's going up to about 36 there. Likewise we can see
16 the cone trace going up to near refusal just below that
17 depth.

18 Q. In terms of depth below surface, how many
19 feet is that?

20 A. Oh, let's see. The ground surface is
21 approximately 4,463. So it would be about 33 feet below
22 ground surface, and is also labeled silty sand/sandy
23 silt.

24 Q. Again, could you repeat the depth?

25 A. I believe I said 33 feet.

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1 Q. So it's below 30 feet?

2 A. Yeah. I think it's characterized in the SAR
3 somewhere between 30 and 35 feet. It has a little bit
4 of variability in its depth.

5 Q. Would it be fair to summarize that from your
6 standpoint, the layer of concern, using the
7 classification that is on that exhibit, would be
8 layer 2?

9 A. Layer 2 primarily, though I haven't really
10 strongly focused on layer 4, but I don't see how it
11 would affect sliding or perhaps bearing capacity
12 calculations. But I will defer a little bit on dynamic
13 response analyses if there's any issues remaining with
14 it in its characterization.

15 Q. And not trying to short change, if you will,
16 what has been said here. What I'm trying to -- if there
17 is a way that we can summarize the concern to translate
18 what is in this exhibit into things that the state is
19 fairly worried about now in this area. And with that in
20 mind, could you look at the last two sentences in this
21 second paragraph of page 86 to tell me if there is
22 anything in the discussion there that is different from
23 what we have already discussed with respect to
24 essentially we haven't seen enough data to feel
25 comfortable that we have picked the design parameters

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1 properly?

2 A. I'm a little bit hesitant to get into rock
3 characteristics. But soil characteristics, again, other
4 than maybe characterization for shake or dynamic
5 response analyses, I'll defer to Dr. Ostadan's
6 characterization. And what he said, I can't remember
7 all of what's been said today about that, but from my
8 perspective, the soils are fine -- well, not fine, but
9 I'll defer to what I said the last ten minutes or so.

10 MR. TRAVIESO-DIAZ: Can we go off the record
11 for a second?

12 (Discussion off the record.)

13 Q. (By Mr. Travieso-Diaz) Let me rephrase the
14 question. My understanding of the current perception of
15 the state of the concern expressed in the last two
16 sentences of page 86 has to do that there is
17 insufficient information in your perception with respect
18 to the characteristics of the soil of layer 2 to make
19 you feel confident that the design parameters for this
20 facility have been selected appropriately based on the
21 results of tests performed today.

22 A. That is correct.

23 Q. Would you like to elaborate on that?

24 A. Yes. The engineering analyses that deal
25 with seismic dynamic sliding and dynamic bearing

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1 capacity really rely upon soils that are in the shallow
2 profile, namely layer 2, though for the canister
3 transfer building are fairly wide foundations. I
4 imagine that issues come up with even layers 3 and 4
5 because of the width of the foundation. I don't know
6 how deep the bearing capacity, the bearing capacity
7 circle goes. But it seems to me the key layer is layer
8 2. We understand from this data that apparently layer 3
9 is denser. It appears to be perhaps more granular,
10 though it may have some plasticity to it.

11 Layer 4 is a much thinner layer. It has
12 apparently higher tip resistances. I'll defer whether
13 it's cohesive or cohesionless. It appears to be
14 cohesive, and the applicant's already come up with, once
15 they have determined the appropriate undrained shear
16 strengths in layer 2, a way to ratio that layer 4 up,
17 and they've used that already. We have no I think major
18 objections to that.

19 So from my perspective, layer 2 seems to be
20 the one that we just had outstanding issues with. I
21 will defer for dynamic response to any additional data
22 that maybe Dr. Ostadan may have suggested.

23 Q. Now, I take it that your response does not
24 include, because he's not here to expand on it, concerns
25 that Dr. Ostadan may have as to the dynamic performance

1 of some of the layers?

2 A. Correct. The dynamic characterization and
3 the properties you get there are a little bit different
4 than the shear strength properties that we've been
5 talking about. And I believe he talked a little bit
6 about some of the assumptions in the modulus and damping
7 curves that were used in the shake analyses. And I'll
8 defer to his testimony about those type of properties
9 and how he derived those.

10 Q. Now, can we turn to the top of page 87? The
11 first sentence on page top of 87 says that "The
12 collected field data must be compared with the soil
13 information found in the literature, and correlated with
14 other data for similar soils when comparing the shear
15 modulus values."

16 I have difficulty asking questions on this
17 particular sentence because there's so much that I don't
18 understand what I'm talking about. Can you help me? Do
19 you -- can you try to actualize what the concern is, if
20 any, with respect to this first sentence?

21 A. I think it's trying to state when we predict
22 shear modulus values that one should compare the
23 collected field data and the appropriate parameters.
24 Again, for shear modulus I'm not an expert on, but for
25 granular soils it's most likely a function of density or

1 something to that effect for clayey soils, plasticity,
2 and make sure that one's using appropriate curves when
3 you do -- when you assign shear modulus values from the
4 literature.

5 I think Dr. Ostadan is a better -- his
6 testimony is better on this issue, but I'll defer to --
7 he I think suggested that we had seen for this soil
8 profile some resonant column testing data to develop
9 shear modulus curves. I'm not sure exactly how they
10 were applied and also whether they -- well, since they
11 came from these soils, they would have to be considered
12 more representative of textbook values.

13 Q. In fact, that's what my concern is. The
14 concern that Dr. Ostadan expressed is exactly the
15 opposite of what it says here, that we haven't given
16 enough credence or haven't done enough with site
17 specific data and would rely on the literature too much.
18 So I don't know what to make of this concern based on
19 his testimony.

20 A. Yes, I see what you're saying. I will just
21 say I confer with Dr. Ostadan's recommendation. If we
22 do have site specific data and curves developed, it
23 seems to me always a more -- a better, better set of
24 data because it is representative of the site. When one
25 applies textbook values, then you have to be careful to

1 make sure that you can say that they are representative
2 of this site.

3 I don't know exactly. Obviously there are
4 not resonant column data for all of these layers in the
5 system, and I'll defer to Dr. Ostadan's testimony where
6 he believes that those site specific modulus curves
7 should be applied. I believe they'll be predominantly
8 in the shallow surface. For the deeper layers maybe
9 textbook values may be appropriate. I'll defer to him.
10 That's I think somewhat consistent with what's been said
11 today.

12 Q. Isn't it a fact that general engineering
13 principles, which I suspect apply to soils as much as is
14 where, that to the extent you're able -- reasonably able
15 to collect site specific data, you prefer to use that --

16 A. Correct.

17 Q. -- as opposed to resorting to literature?

18 A. That is correct.

19 Q. And the literature's a fallback when you
20 have nothing better to resort to?

21 A. Or when maybe your analyses are not too
22 sensitive to the assumed values. And I think that's
23 what Dr. Ostadan was trying to say, and we're not -- we
24 couldn't tell whether we saw that site specific data
25 really being applied. So the question is why was it

1 not.

2 Q. Yeah, I believe that both you and
3 Dr. Ostadan mentioned that before.

4 A. Sure.

5 Q. Now, look with me at the second sentence in
6 that paragraph that says "Applicant must obtain
7 representative undisturbed samples of each of the site
8 soils and determine their dynamic properties." Again,
9 this sentence is really not -- not what we're talking
10 about anymore, is it? I mean, in terms of that you like
11 to see more samples for the layers of interest, which in
12 this case is layer 2, and perhaps --

13 A. Dynamic properties infers a couple different
14 types of testing, perhaps. We just finished discussing
15 the resonant column type testing. I'll defer to his
16 testimony about what he thought about that resonant
17 column data, how it should be applied. I think we've
18 already discussed in layer 2 cyclic triaxial strain
19 controlled testing that can also be inferred as a
20 dynamic test. And we discussed our feelings about that.
21 So I think we kind of already covered what this is
22 saying.

23 (Recess from 7:17 to 7:35 p.m.)

24 Q. (By Mr. Travieso-Diaz) When when we took
25 our break we were about to discuss the last sentence,

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1 the next to the last sentence of the first paragraph of
2 page 87, which starts with "The apparent differences in
3 Poisson's ratio as cited in SWECO calculations should be
4 evaluated, not assumed to be an appropriate value, and
5 then used for safety related calculations." Is this an
6 issue that has already been addressed?

7 A. Trying to decide what the SWECO calculation
8 refers to.

9 Q. I believe that SWECO is Stone & Webster.

10 A. Okay. Poisson's ratio, from my perspective,
11 is not usually used. However, in dynamic analyses it is
12 an input. I don't recall any testimony by Dr. Ostadan
13 that raised significant issues with this, but I guess
14 all we can say at this point is go back and look at
15 those assumptions of Poisson's ratio. If there are
16 newer data that could help -- help in determining
17 Poisson's ratio, fine, look at that.

18 Q. Do you personally have any concerns that you
19 would like to discuss with respect to this sentence?

20 A. I do not in my review, no.

21 Q. Moving to the next paragraph, the first
22 sentence that starts with "The license application does
23 not provide a detailed and quantitative discussion." I
24 won't read the rest of this paragraph into the record.
25 Is there any concerns that are expressed in that

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1 I think also we discussed one sample that
2 was left two and a half years before testing. My
3 preference is that that type of data would not really be
4 used. Again, I think there's a little bit of a chance,
5 a significant chance still of drying just due to the age
6 of that sample, and perhaps not all seals are airtight.
7 So just encourage relatively rapid testing after the
8 sampling event has occurred. Those I think are the only
9 issues that we've seen regarding ASTM standards.

10 So I guess what we like to see is good
11 discussion of a test program, what standards are used
12 and what procedures, and if you vary from them, why, and
13 why did you vary from them. And sometimes you do vary
14 from the ASTM standard because it doesn't make sense in
15 light of what you're trying to accomplish for design
16 input.

17 Q. Are you aware whether such standards are in
18 place now for how the applicant conducts his test
19 program?

20 A. Oh, yes, there are ASTM standards for these
21 tests. Is that what you're --

22 Q. No, no. Are there also project specific
23 standards that you have had the opportunity to review?

24 A. Project specific standards, the ones that I
25 think that were most complete that I have been involved

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1 paragraph that have not been addressed in your prior
2 testimony?

3 A. Did you say the paragraph or first sentence?

4 Q. I'm sorry. I do that all the time. The
5 first sentence that runs for five lines on the second
6 paragraph on page 87.

7 A. Thank you. I think most of the issues
8 related with the sentence have been discussed. I have
9 seen in my review citations of applicable ASTM standards.
10 In some cases it may be well to look at those standards,
11 but consider potential deviations from them. We have
12 discussed some key issues, at least in resolving
13 strength characteristics, and when explained why one's
14 deviating from an ASTM standard, and the purpose for
15 deviation is perfectly acceptable as long as it fits in
16 with the -- within the framework of what we're trying to
17 determine. For example, I was initially concerned about
18 allowing a sample to sit for 90 minutes or more before
19 we shear it because of potential moisture content
20 changes. Perhaps ASTM standards suggest that you do
21 that, but that didn't make sense for this particular
22 program. So all I'm saying is that the appropriate
23 standards appear to have been followed for the most
24 part, but deviation from standards are allowable if
25 there is reason to do it.

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1 with were developed at Savannah River. Those testing
2 methods and sampling methods, some of them are
3 applicable here, some may not be. I have seen, yes, the
4 development of site specific standards, if you will, or
5 procedures to meet the goals of an investigation.

6 Q. Actually, what I meant is, have you seen any
7 specific standards developed for the PFS site with
8 respect to how samples are taken and tested?

9 A. They seem to -- I saw a document that Stone
10 & Webster provided us that it seems to be their manual
11 for testing, field testing. And I can't recall if it
12 included also laboratory testing, but I have seen, yes,
13 their procedures, if you will. I didn't review them
14 thoroughly.

15 MR. TRAVIESO-DIAZ: Let's put it on the
16 record. Will you mark this as Exhibit 74.
17 (Exhibit-74 marked.)

18 Q. (By Mr. Travieso-Diaz) Describing this
19 document is going to take a little while because the
20 actual document starts, the pages of this document,
21 there's a set of numbers on the bottom right-hand side,
22 starting with 00857 and going through No. 911.

23 Now, the document itself, as I understand
24 it, consists of or starts in the page that's marked
25 00868, which is like ten pages from the first page, and

1 is entitled "Engineering Service Scope of Work for Test
2 Borings and Laboratory Testing." And that is dated
3 October 14, 1996. Well, then the other ten pages that
4 precede the one that I just identified appear to be
5 addenda to that -- Addendum 1, Addendum 2, and Addendum
6 3 to the document, and that's why the first page of
7 Exhibit 74 is labeled "Addendum 3."

8 **A. Okay.**

9 **Q.** Now, I believe that in the testimony that
10 Mr. Trudeau and Dr. Chang gave a few days ago, they
11 refer to this document as the ESSOW or Engineering
12 Service Scope of Work. And what I would like you to do
13 is just review with me the table of contents that
14 appears on pages Roman Numeral i, ii, and iii at the
15 start of the document, and the page numbers at the
16 bottom are 869, 870, and 871, just for the purpose of
17 telling me whether the document appears to include
18 standards for taking samples and performing laboratory
19 tests.

20 **A. It does, yes.**

21 **Q.** And it has also a section of quality
22 assurance requirements that apply to these programs?

23 **A. Yes.**

24 **Q.** To the programs we're talking samples and
25 performing tests. And I take it you have not reviewed

1 this document recently?

2 **A. No, not recently. I recall seeing it. I**
3 **think we requested this in discovery, or it was provided**
4 **to us. So I think I have a copy of this, but it's**
5 **reasonably lengthy, and probably most firms that do this**
6 **type of work have such similar documents. I've seen**
7 **them before.**

8 **Q.** Okay. The next sentence on the second
9 paragraph on page 87 indicates that "The basis for the
10 selection of samples and the type of tests to be made is
11 a function of the structure, anticipated loading,
12 duration of loading (seismic) and the need to modify the
13 soil's physical characteristics." Do you find anything
14 in this sentence that has not been discussed before?

15 **A. No. We've discussed reviewing the dynamic**
16 **loading of Dr. Ostadan and making sure that the sampling**
17 **program, whether it be strain control, cyclic triaxial**
18 **testing, reflect those anticipated loadings. We've also**
19 **discussed degradation and making sure that that program**
20 **to investigate potential degradation considers the**
21 **strains.**

22 **I see a sentence here talking about the need**
23 **to modify the soil's physical characteristics. I**
24 **believe we talked about -- I think that refers to some**
25 **type of modification of the soil so that it becomes more**

1 of an engineering structure or feature. The applicant
2 has suggested to use soil cement. I think we've talked
3 about the need to consider tensile strengths in the
4 design and some way of understanding tensile strength.

5 **We may have discussed some other items, but**
6 **for the most part I think everything's fine.**

7 **Q.** Okay, let's look at then the next sentence,
8 because it indicates, "The boring location plan appears
9 to be merely a grid across the site and not structure
10 specific."

11 **A. This has changed. This is a historical**
12 **comment. When this review was done, it was done with a**
13 **simple grid across the site. That was the plan of the**
14 **first investigation, and perhaps that's not a bad plan.**
15 **I assume at the time maybe the location of major**
16 **facilities hadn't been identified. And there has been**
17 **subsequent testing in at least the safety-related areas.**

18 **Again, we discussed our concerns about -- a**
19 **little bit about some of the sparsity of the sampling**
20 **and the number of borings, but those are already on the**
21 **record.**

22 **Q.** Let's move on, then, to the first sentence
23 of the last paragraph on page 87, which says, "The
24 descriptions of the test results for field and
25 laboratory tests are generally insufficient to allow

1 detailed analysis." Let me ask you, is your
2 understanding of this sentence that the complaint
3 appears to be that the report that talks about the test
4 doesn't provide enough information?

5 **A. Which page?**

6 **Q.** I'm sorry. Look at the first sentence at
7 the bottom of page 87.

8 **A. This seems to be addressing the issue to me**
9 **about how the data are tabulated from those test**
10 **results.**

11 **Q.** Do you have a current concern as to the
12 presentation as opposed to the content or the scope of
13 the tests?

14 **A. For a reviewer, since the layering system**
15 **has somewhat changed, it would be nice to see the data**
16 **now put into that layering framework and described**
17 **according to that layering framework.**

18 **We earlier expressed concerns about**
19 **averaging properties over a 30- to 35-foot interval.**
20 **That seems kind of not useful to us anymore. So maybe**
21 **putting the test results in a framework according to the**
22 **stratigraphy we discussed.**

23 **Q.** Is this a nice-to-have or a must-have kind
24 of a --

25 **A. I consider it not a nice-to-have. I think**

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1 it's a must-have, because one can be misled if the data
2 are not put in their proper layering by simply just
3 using -- the chance of using values that may not be
4 appropriate for that layer. And we've seen a little bit
5 of that today where we've been trying to compare
6 standard penetration values very near a layer boundary.
7 So if the parameter is being used for design, I think it
8 should be just the best possible put in its proper
9 layering context.

10 And I would also add that the CPT data, yes,
11 this -- the cross-sections we've seen show this layering
12 across the pad emplacement area and the canister
13 transfer building, but at least I found it useful to do
14 some composite plots similar to what I did. And I think
15 one would have to do that to try to decide where is the
16 actual lower strength zones if we do agree that tip
17 resistance is somewhat correlated with undrained shear
18 strength. It helped me do these exploratory plots that
19 I did as a reviewer just to try to understand the
20 variability laterally across the site. So composite
21 plots might be considered at just the cone penetrometer
22 data. Those are easily done. And that's not a very
23 difficult effort if one has the data to do it.

24 The tabulation of the data, and I think even
25 in the RAI's, I think there was some request to kind of

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1 tabulate the data and present the data in type of the
2 forms. I think those have improved over when this
3 comment was made.

4 Q. Now, the next sentence goes from page 87 to
5 the page top of page 88. It says, "While the conditions
6 of the testing were explained to be in accordance with
7 accepted testing procedure, any deviations from the
8 normal procedure recommended in the standard test should
9 be documented." Have we talked about this?

10 A. I think we have when we talked about ASTM
11 standards. Again, ASTM standards are standard practice
12 in the industry, but once in a while one is asking a
13 specific question from a test program. So it's
14 perfectly acceptable to deviate from ASTM standards if
15 that deviation makes sense from what we're trying, as
16 long as it's documented and explained what was being
17 done.

18 Q. Are you aware that as the SAR is organized
19 today, the attachments to Appendix 2-A reporting the
20 results --

21 A. Right.

22 Q. -- of tests, at the front of each attachment
23 there is a description --

24 A. Right.

25 Q. -- of the extent to which there are any

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1 deviation from the standards?

2 A. And I've read them, yes. So I just
3 encourage that to continue. I haven't found that
4 markedly deficient. Once in a while if there are
5 additional questions about a testing program, certainly
6 maybe we'll request further explanation.

7 Q. But the concern would be whether the tests
8 show as to whether do I understand how they did the
9 tests. Is that a good way of saying it?

10 A. Yes. The concern is what do the tests show,
11 and also was the test procedure set up specifically to
12 resolve design issues that we have.

13 Q. But it no longer is, have you told me how
14 you did it? Is that --

15 A. What's that?

16 Q. But there is no longer a concern as to
17 whether the applicant explained how they did it and to
18 the extent that there were exceptions?

19 A. Not what I reviewed in the most recent
20 testing programs.

21 Q. Okay. Now, look with me at the rest of the
22 paragraph that starts on page top of page 88 to the
23 bottom, because I believe, according to my notes, that
24 all of that was described to be historical and being now
25 resolved. That's what I wrote when we talked about this

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1 yesterday.

2 A. I think so. I recall talking about unit
3 weights, and we felt that there was really no issues
4 with unit weights. We've already gone on the record
5 discussing our issues with strength and its
6 characterization.

7 Consolidation, no, I don't see major issues
8 with consolidation. Dynamic response, I think we've
9 gone on the record our concerns about dynamic response
10 and the testing that needs to support that.

11 Q. Why don't you go through the rest of the
12 paragraph, you might as well do it, and if there is
13 anything you want to add to either -- I understood you
14 to say that these things were historical concerns, but
15 to the extent that you have a current concern, just
16 either state for the record that you already discussed
17 it and identified, or else let's talk about it.

18 A. Okay. Well, also it says here with assumed
19 values, so it appears that some of the values in the
20 earlier calculations were assumed. There's now a body
21 of data that assumed values do not have to be used. And
22 in my review, at least for the most part, assumed values
23 are not being used in response to strength. I think
24 Dr. Ostadan had some talk about assumed values in his
25 dynamic issues, and I'll defer to that testimony.

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1 And the sentence, "The justification of the
2 values should be provided before their use is permitted
3 in the static and dynamic analyses, particularly when
4 determining the dynamic strain response of the soils
5 under cyclic testing." I think we've already gone on
6 the record quite frequently about our beliefs on cyclic
7 triaxial testing. Not our beliefs but our position
8 about triaxial testing.

9 We've already gone on the record about
10 stating that one should use site specific data when
11 possible and obtainable in lieu of using, quote,
12 textbook values.

13 The last part of this talks about a
14 calculation involving bearing capacity reports. My
15 review at least for the static bearing capacity suggests
16 that that's not a large issue. I think this must be a
17 bearing capacity on top of a structural fill. So this
18 must be somewhat historical.

19 Q. Yes. I believe this predates the possible
20 use of soil cement.

21 A. Okay. So I think that is historical, and
22 the issues raised throughout the rest of the paragraph
23 are historical and not an issue anymore.

24 Q. Then let's move to the first sentence in the
25 last paragraph of page 88. Let's talk about the first

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1 sentence on the last paragraph of page 88, which talks
2 about "A major failing in the application is the lack of
3 a detailed discussion of field and laboratory sample
4 preparation for testing, the omission of which prevents
5 independent review and assessment of the quality of data
6 collected." That sentence appears to indicate to me that
7 the concern of the writer at the time was that not
8 enough was said on how the samples were collected and
9 prepared for testing.

10 A. Correct.

11 Q. Is that your concern now? Or is that
12 concern resolved?

13 A. In subsequent investigations that have gone
14 on since this statement, I haven't noted that to be a
15 major inadequacy. We've got a few points I think we've
16 brought up through the last few days. It would be good
17 to see maybe in the laboratory reports, specifically now
18 if we're going into more refined issues of how the
19 program was set up to resolve those design issues,
20 specifically what the issues were and what was the test
21 program set up to resolve specific design issues.

22 Q. In other words, you'd like to see for future
23 tests not only a description of how the test was set up
24 but what was it intended to accomplish and what issue it
25 was trying to resolve?

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1 A. Right. For example, we discussed maybe
2 targeting certain CPT data according to the load tip
3 stresses, how those were identified, how the samples
4 adjacent to those CPT data were gathered, how the
5 sampling was done, how the data -- how the samples were
6 transported and preserved, and how the test program went
7 through to resolve the specific issues at hand, whether
8 they be changes in moisture content and how that affects
9 the undrained shear strength. We discussed other
10 issues, too. Now we need to be very targeted and
11 specific about what we sample and what we -- how we do
12 our testing. Not more just the generic get tests, take
13 samples, report results. Not the more general initial
14 type of sampling that one does of just going out and
15 sampling blindly, testing, and reporting results.

16 Q. You wouldn't expect at this stage to be
17 doing that anymore; is that correct?

18 A. No. We're focusing in and honing on
19 specific issues. So our sampling is not generalized,
20 but it's targeted specific to resolve specific issues.
21 And one should go through and be very thoughtful and
22 careful about those issues, and set up a program to make
23 sure that when we get done those issues are no longer
24 there.

25 Q. Fair enough. Could you move to the next

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1 sentence, which is the last complete sentence on page 88
2 that indicates, "How samples are prepared and tests
3 performed can significantly impact test results and
4 their interpretation, potentially making the test
5 results and interpretations meaningless." I take this
6 sentence just to be caution as to what may happen if you
7 don't do --

8 A. The right type of testing to solve the type
9 of issues that are at hand, or if your type of testing
10 program does not consider the type of loading that's
11 going to be imparted to the soils. You can perform a
12 test, but if it is outside the bounds of the loading
13 that's anticipated, then the test results are
14 meaningless. Well, I won't say meaningless to you, but
15 they're not as valuable.

16 Q. Would it be fair to say that this sentence
17 is a general description of why it's important to do the
18 sample testing the right way as opposed to bringing up
19 particular problems? In other words, is this a general
20 sentence without any specific issues being raised by it?

21 A. Right. I think it's a general sentence, and
22 I think through the last three days of testimony we've
23 already discussed specific issues and how to make the
24 testing more meaningful.

25 MS. CHANDLER: Could we just go off the

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1 record for a second?

2 (Discussion off the record.)

3 (Recess from 8:06 to 8:27 p.m.)

4 Q. (By Mr. Travieso-Diaz) We were, if I
5 recall, on the bottom of page 88. And we were
6 discussing the sentence that starts at the end of page
7 88 and goes over to page 89. Starts with the word
8 "Additionally, the test results may not reflect those
9 conditions to be modeled in the field and therefore
10 either underestimate or overestimate the response of the
11 foundation system to actual field loading conditions."
12 And I want to ask you to comment as to what your
13 understanding is of the concern that is expressed here.

14 A. I think what is being said here is that when
15 one sets up the test program, it's important to go
16 through and look at the demand side. What I mean by the
17 demand side would be the loads imposed on the soil by
18 either the foundation system or, in this case also,
19 since this is seismic, the earthquake loadings, and make
20 sure that once one understands the demand side that what
21 is being done in setting up the field test program, or
22 now also laboratory test program, that you bound those
23 conditions which the demand side may give you. It makes
24 no sense to not have a program thought out that could
25 potentially leave you still in an unsafe envelope when

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1 you consider the dynamic loadings on -- just a moment.

2 I can just maybe give a couple examples from
3 previous discussion of maybe what I'm interpreting this
4 as saying. I know the state's had reservations about
5 the soil cement mat particularly in tense -- tension,
6 and it seems like that was never really considered. And
7 certainly a large soil cement mat like that will not
8 behave rigidly, and one must now consider not only
9 compressive strength but tensile strength of this and
10 also consider whether cracking is going to affect its
11 tensile strength and how it's going to perform.

12 Q. Can I ask you a question for a second?
13 Given that this sentence is worded kind of broadly,
14 would it be fair to say that the specific concerns that
15 you had that relate to this sentence have already been
16 put on the record?

17 A. I think so. I just want to go on the record
18 as stating that we feel it imperative to consider what
19 we would call the demand side, i.e., the loadings,
20 whether they be static or dynamic loadings, and to fully
21 understand them prior to setting up a program, a
22 laboratory program. And also making sure then that the
23 test results and the analyses reflect those actual
24 conditions. I guess we've gone on the record already
25 with our issues regarding that.

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1 Q. I'm going to skip the next sentence, because
2 I believe you told earlier that this is a historical
3 concern. Is that right?

4 A. That's correct. Let me -- I want to make
5 one point, maybe, that I'm not sure has gone on the
6 record quite as emphatically maybe as we could. It's
7 the state's -- I do not want to use the word "concern,"
8 but we still have some uncertainty about how layer 2
9 seems to gain its apparently high undrained shear
10 strength. And we have postulated that possibly it may
11 be sensitive to changes in the moisture content.
12 Perhaps the applicant can think of a reasonable test
13 program to vary the moisture content somewhat within
14 reasonable ranges -- we do believe that some drying and
15 wetting do occur even when mats or foundations are
16 placed upon these soils due to capillary action and
17 unsaturated flow, which are documented phenomenon -- and
18 see if within reasonable ranges that, all else equal,
19 that these soils are not sensitive to dramatic losses in
20 strength due to moisture content.

21 I don't believe the sample has to absolutely
22 saturate it. That may be an extreme. But maybe some
23 controlled increases in moisture content could help us
24 better understand whether this apparent stiffness is due
25 to some cementation phenomenon, or if it also might be

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1 partly controlled by changes in moisture content and
2 partial saturation.

3 Q. Now, the next sentence that reads, "For
4 sites that are underlaid by cohesionless soils." I
5 won't read the next sentence in its entirety. I don't
6 think we need to. Could you summarize your current
7 position on the issues discussed there?

8 A. This I think -- the cohesionless soils I
9 think implies that the applicant should check to see if
10 that potential cohesionless soil could become unstable
11 due to liquefaction. And I think we've gone on the
12 record already saying that liquefaction is not an issue.

13 We have discussed I think extensively the
14 potential for some strain softening due to earthquake
15 loading. I'm not sure we're completely resolved on that
16 issue. We've gone on the record on that, so I guess --
17 and I'm not so much concerned about collapse. Maybe
18 marked settlements, but I think the issue is could we
19 lose capacity that we thought we had because of the
20 strain levels and how much we're straining this layer 2.

21 Q. Okay. Let's go to the next sentence. "The
22 Applicant must also show that the static and dynamic
23 engineering properties of the soils, such as unconfined
24 compressive strength, shear strength parameters for
25 strength parameters from cyclic triaxial tests, were

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1 properly determined and that reasonable and conservative
2 values were used in the design."

3 A. Dr. Ostadan talked about this. I don't
4 think I have anything really more to add to this.

5 Q. Going to the next sentence. "This
6 demonstration should explain how the developed data were
7 used in design analyses, how the test data were
8 enveloped for design, and why the design envelope is
9 conservative."

10 A. I think this was a concern of Dr. Ostadan,
11 particularly talking about the design envelope and the
12 margins of safety or factors of safety. I don't think I
13 have any more substantial to add to this.

14 Q. The last sentence in section b reads, "A
15 table indicating the values of the parameter used in
16 design should be provided and should be supported by
17 field and laboratory test records." What do you make of
18 this sentence?

19 A. I think some of this has been met by the
20 engineering calculations that try to -- well, the
21 engineering calculation, and I don't know its number,
22 trying to tabulate how different data were used and
23 input in the various geotechnical analyses. I guess I
24 would encourage maybe some kind of tabulation like I
25 discussed before according to the current layering

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1 system as we understand it. And then certainly anytime
2 any calculation uses design parameters, that should be
3 referenced in where those values are coming from. And I
4 sense that that's improved over when this was written.

5 Q. Let me just bring to your attention two
6 items that you probably are aware of. First, you're
7 aware that now the attachments to the appendices of the
8 SAR have tables that summarize the results?

9 A. Correct. I've seen those.

10 Q. Are you aware also that the geotechnical
11 design criteria calculation G(B)05, I'm not sure if I
12 can remember the complete name, but it does have a
13 number of complete tables that appear to be trying to do
14 what you just said?

15 A. Yes.

16 Q. Shall we look to Item c on page 89.

17 A. Uh-huh.

18 Q. Okay. Let's just go to the first sentence
19 of Item c, the one that starts with the words "The
20 static and dynamic properties of materials." Do you see
21 that sentence?

22 A. Yes.

23 Q. Could you describe for me the current --
24 your current understanding of what the concern for this
25 sentence is?

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1 A. I don't think we have any really substantive
2 things to add to this.

3 Q. This is things that should be -- how things
4 should be done?

5 A. Yes. And we've discussed I think our issues
6 and how we believe things -- how we -- the concerns
7 we've had and how we believe things should progress.

8 Q. Can we go to the next sentence, then. "This
9 is especially a complex site from the standpoint of
10 assessing potential earthquakes and resulting ground
11 motion that may affect plant operation." Again, is
12 there any concern, either explicit or implicit, in that
13 sentence that we haven't discussed?

14 A. Dr. Ostadan I believe had discussed his
15 issues and what he felt about this particular sentence.
16 I agree with his testimony. I don't have anything to
17 add.

18 Q. All right. Let's go to the next sentence on
19 top of page 90. "However, it is not possible to
20 ascertain if the Applicant's field and laboratory test
21 data have been conservatively interpreted to determine
22 the design parameters recommended for the various
23 materials at the site."

24 A. Correct. I think we've discussed that
25 considerably. We've suggested some potential

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1 unconservatisms, both in the capacity side, as I'll
2 refer to it, which would be the soil strength and
3 capacities to resist earthquake motions; and I think
4 we've also suggested some potential unconservatisms on
5 the demand side where loadings may not have been
6 considered properly. And I will defer to our previous
7 testimony.

8 Q. So that means that we're now looking at the
9 sentence that starts, "The SAR relies heavily on the
10 published values for static and dynamic strength and the
11 performance of compacted materials, not the physical
12 characteristics and specific site soils." Could you
13 address the status of that concern?

14 A. I believe we've already discussed this also.
15 I don't know if there's anything substantive to add to
16 this over our last three days of discussion.

17 Q. The next sentence, "Because of the limited
18 number of tests and generalizations made with respect to
19 the soil profile and use of general uncorroborated
20 published soil data, a reasonable judgment cannot be
21 made regarding the applicability of the averaging
22 conditions as assumptions used in the design
23 calculations." You need to help me with this one. Can
24 you rephrase it in a way that expresses your current
25 concern?

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1 A. We've already discussed the issues with the
2 limited numbers of tests.

3 Q. Yes.

4 A. I don't see any issues of that. We've
5 discussed some generalizations. One obvious
6 generalization that we felt was potentially
7 nonconservative was rigidity. I remember that.

8 I'm not sure if there's much to add here
9 with respect to the soil profile. We've discussed
10 some -- the soil profile quite extensively over the last
11 few days where we think some maybe potential
12 uncertainties are in the shallow zone of this profile.
13 I think we have also suggested maybe some deeper data,
14 at least one borehole down to rock might be useful.

15 I'm not going to try to summarize it all,
16 because it's been quite extensive. So I think we said
17 enough about the soil profile. Our opinions are that
18 the -- from when this statement is written, we're
19 learning more about the soil profile.

20 Q. I -- sorry, go ahead.

21 A. We discourage averaging whenever possible
22 unless averaging can be justified by the data, i.e.,
23 there's not a large variability or doesn't appear to be
24 any significant zones where low strength zones can
25 control the failure.

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1 We've already discussed our uncertainties
2 about the published data at this site.

3 Q. Can I ask you a question or two about
4 something you just said, to clarify the record, which
5 is, you said that you would like to see at least one
6 boring down to rock. I take it that you mean down to
7 the bedrock?

8 A. Yeah, I'll defer -- we've discussed that, I
9 believe. And my experience at other sites has been that
10 that's been typically done. Not being -- generally when
11 we've done a deeper borehole site was to identify the
12 exact depth to rock and log shear wave velocities in the
13 deeper profile. I am going to suggest that if there's
14 still uncertainties about the deeper profile, that that
15 could be considered.

16 I can't remember in the last few days if we
17 discussed large uncertainties other than -- we have
18 discussed the refraction data. Whether that data would
19 be -- a deep hole would be useful in resolving that, I
20 don't know. And perhaps when we review the Geomatrix
21 report it may say something about that issue and whether
22 there's sensitivity to the analysis to that assumed
23 depth, whether it makes a difference whether it's 800
24 feet or 500 feet.

25 Q. Can I put the question this way to you.

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1 First from the geotechnical standpoint, do you care in
2 any way --

3 A. From a geotechnical standpoint, I do not
4 care. I am giving a lukewarm recommendation here about
5 a deeper hole, not quite knowing whether there are
6 issues with the dynamic profile and response, which
7 really is somewhat out of my area of expertise.

8 Q. What you're saying, if I understand you, is
9 that to the extent that there is a use or a need for
10 such a big boring would be for issues such as surface --
11 as wave velocities in the deep layers and so on?

12 A. Yes, it would help maybe understand or
13 clarify the design basis ground motion and its
14 variability as it comes to the site. I -- from a
15 geotechnical perspective relating to the stability of
16 the pad emplacement area and the canister transfer
17 building, and that hole doesn't really help with those.
18 It's not needed because these are shallow profile
19 issues.

20 Q. One question that maybe I need to ask. You
21 are aware, of course, that there have been at least two
22 borings that have come down below 200 feet. I don't
23 believe they have reached the assumed layer of where
24 bedrock is understood to be.

25 A. Okay.

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1 Q. But they have gone fairly deep. Are you
2 aware of that?

3 A. Yes. It's fairly distant in my memory.

4 Q. I don't want to examine you on this, but
5 there is -- let me say this to refresh your memory. Are
6 you aware that Borings CTB-1 and CTB-5 were drilled
7 deeply, and CTB-5 in fact was used to install a
8 monitoring well?

9 A. Yes, I do recall the discussion that a
10 monitoring well was installed, that there was one on the
11 site. I remember. That was one of our recommendations.
12 I guess my -- I'm -- not knowing what data was collected
13 in those two deep borings, I'm not sure what the purpose
14 was.

15 MS. CHANCELLOR: I'd like to make a request.
16 If there's any data that you get from a monitoring well,
17 we'd like a copy of it.

18 MR. TRAVIESO-DIAZ: Well, in fact, I think
19 it has been -- it's already included in the attachments
20 to the SAR.

21 MS. CHANCELLOR: I see. Okay.

22 MR. TRAVIESO-DIAZ: Because those are --
23 those borings were part of the boring program. They
24 served multiple purposes, as I understand it.

25 Q. And maybe you can confirm this. One purpose

1 was to get to the point where you could try to find
2 where the ground water was and monitor the levels, but
3 also you were taking samples as you were going down. Is
4 that your understanding of what was done?

5 A. I don't know if sampling was done or not,
6 because I obviously -- these holes, I haven't reviewed
7 the data that was collected in them.

8 Q. Fair enough.

9 A. I think when I'm talking about a deep hole
10 was if a deep hole was useful in helping resolve any of
11 the shear wave velocities and any uncertainty in the
12 geophysical or ground response modeling that was done
13 for the site. But maybe others that reviewed this more
14 thoroughly than I may feel maybe this may not be
15 necessary or necessary. I'm not sure.

16 Q. Fair enough. I think this is very clear.

17 Okay. The next sentence that we haven't
18 gone over yet I believe starts in the middle of the page
19 with the words "Because of the limited number of tests
20 and generalizations made with respect to the soil
21 profile," etc. I'm only trying to identify the sentence
22 to the record.

23 Could you address that sentence and tell us
24 what the current state of your understanding is as to
25 what the issue is and whether it has been addressed in

1 previous testimony?

2 A. I do not see anything in this that we have
3 not discussed fairly extensively.

4 Q. Let's go to the next one, that simply
5 states, "There is too much uncertainty regarding the
6 applicability of published data to the site." Can you
7 comment on that sentence?

8 A. I think we discussed our concerns about
9 uncertainty, about certain key soil parameters and how
10 they may impact mainly the seismic design.

11 Q. The next sentence starts, "For example, the
12 dynamic analyses presented instead use published
13 information from 1970 which is extrapolated to the site
14 without any basis for such extrapolation." Do you see
15 that sentence?

16 A. I think that sentence and also the following
17 sentence Dr. Ostadan commented on, and I'll just defer
18 to his testimony.

19 Q. How about the next sentence, which is the
20 last one on the page and goes to the next page. It
21 says, "This data is not applicable for characterizing
22 dynamic properties of slightly cemented silts found at
23 the site based on SW-AJA (1972) at 39 of SWECCO
24 calculation.

25 A. I think the concern here is that the

1 properties using that particular calculation, which I
2 assume is somewhat historic, may not be applicable to
3 slightly cemented soils. And we've discussed issues
4 regarding the slightly cemented soils and particularly
5 where -- in the shallow profile where they may affect
6 ground response, that the applicability of standard,
7 quote, textbook curves and relationships should be
8 considered by the applicant. And we have seen the
9 applicant gather some resonant column data for these
10 that perhaps are more applicable than what was used in
11 this calculation.

12 Q. Let me ask perhaps as a way to shorten the
13 discussion with the next two or three sentences. Would
14 it be fair to say that the sentence that you described
15 and the sentence that follows it that talks about
16 "please note the variation in shear modulus," etc. --

17 A. Right.

18 Q. -- is either historical to the extent that
19 it addresses something that has been superseded --

20 A. Correct.

21 Q. -- or has been addressed by Dr. Ostadan and
22 you in your testimony?

23 A. That statement would be correct.

24 Q. Okay. And then I take it that's also true
25 with respect to the next sentence, that reads, "The

1 Applicant should explain why the data extrapolated from
2 this curve is appropriate considering the various shear
3 strain levels?"

4 A. Yes. And I think Dr. Ostadan discussed that
5 and also the following sentence, so I'll just defer to
6 his testimony.

7 Q. So that we are finished, then, with the
8 first paragraph on page 91?

9 A. Yes.

10 Q. Let's go to the second paragraph. The first
11 sentence of the second paragraph indicates that "some of
12 the data do not fit together, and it appears data
13 presented from different sources have been combined
14 without assessing their applicability to the site."

15 A. I think there was concern as I see here
16 regarding void ratio and consistency amongst void ratio
17 and blow counts which had some inconsistencies. I think
18 a lot of this was addressed in a subsequent RAI, as I
19 understand it. The void ratios in some of these upper
20 soils are reasonably high.

21 Q. If I recall, there's an extensive
22 discussion --

23 A. There is.

24 Q. -- in the SAR now that addresses this issue.
25 Is that correct?

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1 A. Yes. And I'm not remembering quite fully.
2 I guess I'm not sure what's been said in the SAR about
3 this right now, about the high void ratio. But I
4 believe it's been -- the reasons for it have been
5 explained by the applicant.

6 Q. Okay. And then the next sentence that says,
7 "the void ratio for soils indicate very loose soil
8 conditions yet blow counts from standard penetration
9 tests are indicative of dense soils." Would it be fair
10 to say with respect to this particular sentence that
11 there is a much better understanding today of the
12 layering of the site?

13 A. Yes. This suggests there is potential for
14 cross-layering where maybe void ratios were coming from
15 one layer and standard penetrations from another. And I
16 have seen this before. What happens when one is
17 undergoing a test solely with a drilling program, you
18 can change into different layers and essentially
19 cross-layer or cross-stratify things and misclassify
20 things. And I think with the cone penetrometer data,
21 our chances of doing that are much, much less now.

22 Q. So I take it this in fact is sort of a
23 historical concern as of today based on the information
24 that we now have?

25 A. Yes. I guess the only thing I would add is,

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1 we discussed about trying to put the data now in our new
2 layering framework which will help probably clear some
3 of these issues.

4 Q. Now, could you please maybe with respect to
5 the next few sentences, you can deal with them together,
6 because, if I understand it, the discussion on the
7 sentence that starts with the words "the void ratio
8 equation," and the sentence that starts -- that follows
9 it and says -- well, "See laboratory data results," and
10 then the sentence that says, "This soil structure may be
11 typical of cemented sands," are all these sentences
12 addressing the same concern as to what the meaning of
13 the high void ratio was?

14 A. Yes, I think it's trying to explore why the
15 large void ratio existed, and --

16 Q. In fact, that discussion goes all the way up
17 to the end of this sentence -- this paragraph on top of
18 page 92?

19 A. Yes. Again it's a concern about the high
20 void ratio. And the last sentence, "The Applicant
21 should verify if this abnormally high void ratio is
22 typical of cemented soils." Again, the part in the SAR
23 where this is discussed is not fresh in my memory, but I
24 would encourage, if the applicant has not done so, go
25 back and see if there are similar cemented soils

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1 somewhere to verify that these high void ratios do fall
2 in the ranges of similar calcarious or cemented soils
3 elsewhere.

4 Q. And you have explained for the record what
5 your concerns are with the potential cementation of
6 layer 2; is that correct?

7 A. We have. We've discussed that extensively.

8 Q. So we don't need to go over that again.

9 A. Correct.

10 Q. Now, moving to the last paragraph on issue
11 3. It starts with the words "Further, the Applicant
12 performed only limited soil engineering tests ...
13 omitting a number of additional widely accepted index
14 and engineering property tests." Rather than putting
15 words in your mouth, can I ask you to update the
16 discussion that appears in this sentence?

17 A. Well, we've already discussed our concerns
18 with the limited engineering testing.

19 Q. So this paragraph doesn't add anything to
20 what you already have said?

21 A. The first sentence certainly doesn't.

22 Q. How about -- I'm sorry. When you say the
23 first sentence, where are you? Where --

24 A. I think it ends after "Annual Publication
25 (1997)." Oh, excuse me. No. First sentence ends after

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1 "layer 1 and 2 soils."

2 Q. And then the rest is citation?

3 A. That's correct, it is a citation.

4 Q. All right.

5 A. So those sentences, I did not see anything
6 really to add to them.

7 Q. Okay. Now, going to the last sentence now
8 on this paragraph under Contention 3, "Such additional
9 tests will allow the reviewer," etc. Is there
10 anything on that -- anything on that paragraph that has
11 not been addressed before?

12 A. This seems to be somewhat of a summary
13 sentence. So we've discussed these issues quite
14 extensively. We still at this point in time have
15 uncertainties about the performance of the soil and
16 foundation system under seismic loading.

17 Q. Yes.

18 A. And we believe calculations should be
19 revised. Additional mechanisms and loadings that were
20 not considered should be considered. The soil mat -- at
21 this point, the soil cement mat seems to be very
22 conceptual, and we discussed our concerns about that
23 philosophy and encouraged the applicant to consider
24 those. And we cannot really comment further on the soil
25 cement mat until further is known about its actual

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1 design.

2 And we've discussed today a little bit about
3 passive resistance that will be developed by the soil
4 mat. We encourage the applicant maybe to think of maybe
5 a field testing program. We could do that. And when I
6 mean field testing, I mean not a sampling and submitting
7 to the lab but perhaps some type of in-place prototype
8 or full-scale test that could help us understand how
9 much of the soil mat passive resistance can be
10 mobilized.

11 However, there are still significant issues
12 again with tensile and torsional stresses to such a
13 large area of mat and how that will perform.

14 Q. Finished?

15 A. I'm just looking at a couple of other
16 scratches that I have here.

17 Q. Okay. I'm not rushing you, just -- you
18 paused.

19 A. Yes, at this point I guess we cannot say
20 that the adequate margins of safety or factors of safety
21 have been demonstrated according to our concerns.

22 Q. For the reasons you have been testifying
23 about the last couple of days?

24 A. Right. I cannot think of anything I want to
25 add. I know this is my last chance to say something,

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1 and nothing new is coming. We believe there's still
2 additional work and analyses that have to be done.

3 MR. TRAVIESO-DIAZ: We can go off the record
4 a second.

5 (Discussion off the record.)

6 Q. (By Mr. Travieso-Diaz) I tell you what I
7 would like to do. Would you go back to Exhibit 10 and
8 identify on the record first, again, each of the
9 interrogatory responses by the state that are contained
10 in Exhibit 10 that you have provided information for,
11 and as to each of those, would you please go down
12 through that and tell us what your current -- well, tell
13 us either whether it is a current concern or a
14 historical one or one that has been resolved, and to the
15 extent there is a current concern, whether you have
16 already addressed it in prior testimony.

17 A. Do you want me to identify them first?

18 Q. Yes. No, go --

19 A. Identify them as I go?

20 Q. As you go along. I think it will be faster.

21 A. Okay. On page 28, Response to Interrogatory
22 No. 3, subsection A, I remember having discussions with
23 the review team on this issue. However, I believe
24 Dr. Arabasz has already testified and addressed this, so
25 I'm going to not saying anything further on it.

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1 Q. Could you, just so the record is very clear,
2 give the title of the response?

3 A. Sure. It's the "Inadequate justification
4 for qualifying for the Frequency-Category-1 design basis
5 ground motion (1,000-year return period)."

6 The next one is found on page 40,
7 Interrogatory No. 5. The first few sentences of this
8 interrogatory just refer to other interrogatories for
9 other types of data and deficiencies that are discussed
10 in those interrogatories, so I don't see any need to go
11 into that. So I guess I'll go to the general response
12 part.

13 Q. That's part A?

14 A. That's part A.

15 Q. Page 40?

16 A. Correct. The first sentence just
17 acknowledges that there was additional analysis still
18 going on. And it's somewhat of a disclaimer that these
19 statements may not have considered that additional data
20 that was ongoing at the time that this was written.

21 Q. Is it your understanding that the test
22 program that at least the applicant envisioned coming
23 out is now completed?

24 A. Yes. That was the ConeTec report and the
25 data gathered by ConeTec. I do not see anything in the

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1 paragraph beginning "In addition Section 2.6 of the SAR
2 is poorly written." I think this was expressing
3 concerns about how to understand key design assumptions
4 and put some parameters, tabulation of data, where the
5 data actually came from, and difficulties in
6 referencing. I believe subsequent revisions of the SAR
7 improved and clarified much of that.

8 I believe part B, which begins "Geotechnical
9 Design Profile Has Not Been Adequately Defined," refers
10 to the old two-layer system. So there's really not much
11 to discuss about this. We felt initially that that
12 two-layer system was inadequate for the design.

13 Q. But that has been superseded by --

14 A. That has been superseded by Figure 2.6-5 and
15 all of its various sheets.

16 Q. Yes.

17 A. We've already discussed the spacing of
18 geotechnical borings. I think we referred to the Reg
19 Guide 1.132, I believe, regarding spacings of borings in
20 investigations. We've also discussed ways of removing
21 uncertainties in key layers. We've discussed critical
22 layers that we feel that were still undersampled.

23 At this time when this was written it
24 appears that there were still no borings on the canister
25 transfer building and other non safety related

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1 buildings. Those have been -- subsequent borings have
2 been done since this was written, and I think we've
3 already gone on the record discussing those.

4 Q. In connection with Item B, do you remember
5 having a discussion a few minutes ago about borings that
6 you might not remember having done at different layers
7 than 100 feet? Do you recall that discussion?

8 A. About the two borings that went down to 200
9 feet?

10 Q. Right.

11 A. Correct. I remember.

12 MR. TRAVIESO-DIAZ: Let me, just so that the
13 record has a reference point of what we talked about,
14 mark this as Exhibit 75.

15 (Exhibit-75 marked.)

16 Q. (By Mr. Travieso-Diaz) For the record, I
17 will identify Exhibit 75 as being a copy of the boring
18 logs for Boring CTB-1, and that goes for seven pages,
19 and CTB-5 that immediately follows, and that goes for
20 five more pages.

21 MR. TRAVIESO-DIAZ: Can we go off the record
22 for a second?

23 (Discussion off the record.)

24 MR. TRAVIESO-DIAZ: Going back on the
25 record.

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1 Q. (By Mr. Travieso-Diaz) Will you just
2 confirm for me that these two boring logs correspond to
3 the items of which we had a brief discussion before we
4 took the last break?

5 A. Yes. I remember discussing two deeper
6 borings down to approximately 200 feet which I could not
7 recall reviewing when I looked at the SAR. They have
8 just been provided to me.

9 Q. Okay. I'm sorry. Would you please go on.
10 I believe you were on Item E on page 42 of Exhibit 10.
11 Oh, I apologize. I'm attributing you a -- I'm sorry. I
12 presume to direct which way you're going.

13 A. Yes. Still on item D. I think the data
14 that I see in front of me from a geotechnical
15 perspective seemed to be adequate. I don't believe
16 there are major geotechnical issues in this deeper
17 profile, and now we have a little bit better
18 understanding about some of the deeper sediments down to
19 200 feet. I still think I have gone on the record
20 discussing maybe the potential of logging shear wave
21 velocities deeper, but not being in my area of
22 expertise, cannot say if that data -- I'll defer to
23 other testimony whether that data is needed or not to
24 complete the analysis.

25 Q. Could you help me make a correction in the

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1 record. Go back to Exhibit 75 for the second and look
2 at the very last page of the exhibit. The very last
3 page of the exhibit shows where Boring CTB-5 ends.

4 A. Yes. I see it's 158 feet.

5 Q. So when I said 200 feet respecting this
6 particular boring, I misspoke. Is that correct?

7 A. Yes.

8 Q. Thank you.

9 A. Item No. E discusses no variability in the
10 shear wave velocity profile. I believe Dr. Ostadan has
11 commented extensively about this. And his concern again
12 about thin layers near the surface and what the effects
13 of that thin layer on the geophysical model, and how the
14 deeper velocity may be adjusted because of the newer
15 data that we saw from the seismic penetrometer. I don't
16 believe there's anything really new to add to this.

17 Seems to express a concern that the seismic
18 refraction data may not be able to resolve a thin layer,
19 but the cone penetrometer certainly identified it.

20 Q. Do you have anything to add yourself to the
21 statement?

22 A. No. The cone penetrometer data I think at
23 least identified a lower velocity zone. It is now
24 characterized. So the issue of the refraction survey
25 missing a thin layer seems to be irrelevant now. It's

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1 already been identified by other data.

2 Item No. F again points out that the depth
3 to bedrock and the nature of bedrock has not been
4 established by physical sampling. We've made
5 recommendations to consider doing that. But again, not
6 having read other testimony -- not having read the -- I
7 don't want to use the term "read." Not having reviewed
8 the conclusions about Geomatrix and whether they feel
9 this data is valuable and other testimony, I'm just
10 going to point out that it still has not been done.
11 Fair enough?

12 Q. Only a clarification. When you mean -- when
13 you say "the depth and nature of bedrock has not been
14 established in the SAR," from the viewpoint of stiffness
15 of soil or strength of the soil, there comes a point --
16 I don't know -- whatever number of feet below the
17 surface, where from the geotechnical standpoint it
18 doesn't make any difference whether you call it bedrock
19 or something else, right?

20 A. Yeah, this issue does not have really to do
21 with the geotechnical investigations. There's no need
22 to go that deep with the geotechnical investigations.
23 What I'm pointing out here is that there's uncertainty
24 to the depth of the bedrock, and I'm not sure how that
25 affects the characterization of the ground motion. And

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1 if characterization of the depth of the bedrock and
2 nature of the bedrock would remove uncertainties, it
3 would be prudent to do that. But again, I'm not sure
4 Geomatrix's conclusions on whether they would really
5 need that data. Obviously it hasn't been drilled, so it
6 seems like that they haven't needed that data.

7 I think we discussed some discrepancies a
8 little bit between the shallow refraction data and the
9 cone penetrometer data, but I'm not certain right now at
10 this point whether a deep hole is beneficial or not. I
11 guess at the time when one was reviewing initial
12 investigation, my experience at other facilities is, we
13 had done this. But I will defer to the experts who do
14 this type of modeling, whether they need that data or
15 not.

16 MS. CHANCELLOR: Can we go off the record
17 for a second?

18 (Discussion off the record.)

19 MR. TRAVIESO-DIAZ: Back on the record. We
20 were on Item G on page 43.

21 A. Item G addresses hydraulic gradient,
22 seasonal variations. When this was written I was trying
23 to anticipate perhaps the need for doing any ground
24 water hydrological modeling. I understand the applicant
25 has now installed a ground water well within the site,

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1 thus seasonal variations in the height of the ground
2 water will be able to be documented. One cannot
3 establish a gradient from one well, but from my
4 viewpoint from a geotechnical perspective, there is no
5 need to establish a seasonal gradient for modeling of
6 ground water. If others within the state have testified
7 they would like to see gradients, i.e., you need
8 multiple wells to establish a gradient, I'll defer to
9 that testimony. But from my perspective, it's been
10 resolved from a geotechnical standpoint.

11 Q. The next one, Item H on page 44.

12 A. Item H discusses a potential for confined
13 aquifer conditions. Most likely the well that has been
14 installed will indicate whether there are confined
15 conditions in the aquifer. How that confinement varies
16 spatially across the site right now, again, unless one
17 is doing ground water modeling, is not that particularly
18 useful from a geotechnical perspective. So I'll just
19 say, from my perspective, one well will define whether
20 we have a confined or unconfined condition in that
21 aquifer.

22 Q. Item I, "Potential Variations of the
23 Preconsolidation Stress Have Not Been Considered."

24 A. I think the first paragraph is kind of a
25 picky point. The uppermost clayey layer has an apparent

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1 overconsolidation to it, and the SAR maybe at this point
2 mentions something about -- well, I'll read what it says
3 here. "It is assumed that this maximum pressure was
4 caused by approximately of an additional [such is the
5 case] 80 feet of soils above the current ground
6 surface." I do not know, but I believe that statement
7 should have been removed from the SAR because that is
8 not the cause of the preconsolidation stresses. There
9 were never 80 feet of materials, soils above the current
10 ground surface at this site.

11 Q. I should have asked you before you began
12 addressing this paragraph whether it is your
13 recollection that this calculation has been superseded.

14 A. It's probably been superseded, and I said it
15 was the SAR and I didn't look at that to realize that
16 this was a calculation. I apologize. I would assume
17 that that statement has been struck from any
18 calculation.

19 Then the next paragraph elaborates about
20 potential mechanisms of overconsolidation and
21 specifically mentions dessication, cementation, and
22 aging. We have discussed these processes considerably.

23 Q. Cementation in particular?

24 A. Cementation and dessication. I want to get
25 my dessication issue in. And there's still a little bit

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1 of uncertainty of which of these mechanisms are playing
2 a dominant role, if not both.

3 Q. And you have already testified about this?

4 A. We've already discussed about this. And
5 then also aging is to remind the applicant that these
6 sediments are anywhere from 30,000 to 10,000 years old,
7 and apparent overconsolidation due to aging is a known
8 phenomenon also.

9 I believe the applicant's assessment of the
10 preconsolidation stresses seem to be reasonable. Just
11 warn of averaging them in the upper 30 feet. Look at it
12 layer by layer in our current layering system.

13 Q. Item J, "Uncertainty in Estimates of
14 Poisson's Ratio."

15 A. I believe we talked about this when we went
16 through Contention L, so let's just defer to that and go
17 on.

18 Q. And Item K, "Dynamic Soil Properties Are
19 Poorly Defined."

20 A. I think we've discussed extensively the
21 dynamic properties and the uncertainties that we have
22 with them, and also Dr. Ostadan has discussed the
23 frequency dependency of these parameters. So I believe
24 there's not much to add to this statement. There still
25 are some issues.

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1 Q. And we've discussed this?

2 A. Yes, we discussed this.

3 Q. Let's look at response to Interrogatory
4 No. 6, Item A, "Split Spoon Sampling Procedures and
5 Documentation of Sampling Methods." I don't believe we
6 have discussed this before.

7 A. We haven't, but I don't know if there's any
8 really significant issues left here. When I was
9 reviewing the applicant's documents, it appears that I
10 did not find documentation of the types of hammers that
11 were being used, types of procedures to do a standard
12 penetration testing, whether there were liners included
13 or not, what type of drill rod was going to be used.
14 Those factors affect the SPT sampling, need to be
15 documented, and there are correction factors for them.
16 So when these data are used for analyses, these
17 adjustments should be accounted for and documented.
18 However, I think we've already gone on the record
19 discussing dynamic settlement, and it's not -- from our
20 evaluation, it's not a major issue here.

21 Q. Item B, "Type of Sampling Used in the Upper
22 35 Feet of the Soil Profile is Inappropriate for Soil
23 Conditions."

24 A. This was written before the CPT data were
25 available, and the first paragraph -- and as is commonly

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1 done sometimes in geotechnical investigations, that you
2 do the wrong sampling for the type of layer that you're
3 in because you're what I call drilling blind, blindly.
4 And you do not know what you're going to encounter below
5 you, so you sample with a split spoon when you should
6 have Shelby Tube sampled, and vice versa. Obviously the
7 CPT data that are now collected makes it so that we do
8 not have to, quote, drill blindly. And we will have no
9 really great uncertainties in what type of sampling we
10 should be doing in key layers.

11 The second paragraph, first sentence
12 beginning with "also" -- just a moment -- addresses the
13 issue that there appears to be an undersampling of the
14 shallow profile using undisturbed sampling. It appears
15 that the initial sampling used split spoon sampling in
16 an apparently -- split spoon or disturbed sampling in an
17 apparent cohesive layer, and the number of undisturbed
18 samples recovered in this layer were few. And the table
19 tabulates that the number of undisturbed samples were in
20 the upper 35 feet only nine, whereas 177 split spoon
21 samples were taken.

22 This would not be a major concern for future
23 investigations here because, again, we do not have to
24 worry about uncertainty of layering, and we know which
25 type of sampling to do when we do it. We've already

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1 expressed our concerns about the under-representation of
2 undisturbed samples in layer 2.

3 Q. Item C, "Type of Undisturbed Sampling Used
4 by Applicant May Still Cause Significant Disturbance."

5 A. Yes, I recognize this. In the first
6 paragraph, and I think we discussed this -- I can't
7 remember if it was yesterday or this morning, frankly.
8 But it was the idea that our experience in saturated
9 Bonneville deposits, that even with reasonably good
10 quality Shelby Tube sampling, a significant portion of
11 the Shelby Tubes indicate disturbance. This was
12 surprising to us and actually something that was given
13 to us by Chuck Ladd in his review of our data. And
14 currently UDOT has a research topic looking into this
15 issue, because we extensively use Shelby Tube sampling
16 in general practice here in the valley. Probably not as
17 great of an issue at the PFS site because of the
18 stiffness of these soils.

19 Q. And in fact, if you recall, I showed you two
20 or three curves of --

21 A. Oh, yes, the test you gave me yesterday.

22 Q. It wasn't a test.

23 A. The quiz. I hope I passed.

24 Q. Well, I think that you said that two of them
25 appeared to be undisturbed or reasonably undisturbed and

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1 one wasn't.

2 A. Right. And by the way, the reason why
3 disturbance is not as large an issue here is because
4 these are stiffer soils, and any disturbance would tend
5 to most likely cause a conservative estimation on your
6 part. So we're not going to make a big issue about
7 disturbance.

8 And the sampling seems to be, at least the
9 recent events of sampling, there has been some
10 indication of minor disturbance, but I leave it up to
11 the judgment of the evaluators to look that. And if
12 they feel disturbance has occurred, potentially remove
13 some of those sample on their program.

14 Q. Can we turn to Interrogatory No. 7 on page
15 49, which I believe has only two parts, and look to part
16 A that talks about "RAI No. 1, Question 2.8 is Not
17 Applicable to Addressing the Potential for Collapsible
18 Soils." Did I understand your testimony before that the
19 collapsibility, potentially collapsible soils has been a
20 concern?

21 A. Yes. Our initial issue with this was
22 potential collapse in the Eolian deposits. Those have
23 had problems with collapse. The applicant intends to
24 treat them with soil cement.

25 Q. How about Item B, which says "The Applicant

1 May Have Mistaken Collapsed During Consolidation Testing
 2 as Secondary Consolidation." Is that --
 3 A. I think when I researched this further I was
 4 confused by what was being said in a particular
 5 laboratory report, and the subsequent RAI's have
 6 addressed this.
 7 Q. So will you say that this is no longer a
 8 concern?
 9 A. I don't believe there's any concern here.
 10 Q. Let's move to No. 8 on page 51. Item A,
 11 "Undrained Shear Strength May Have Been Overestimated
 12 Due To Consolidation During Triaxial Testing." I
 13 believe we covered this yesterday morning. Is that
 14 correct?
 15 A. I did. It was just pointing out that
 16 soils -- saturated soils consolidate, and one has to be
 17 careful to make sure that effective stresses represent
 18 the anticipated vertical loads.
 19 Q. And you have nothing to add to what we
 20 discussed yesterday?
 21 A. I do not.
 22 Q. Paragraph B on page 53, "Applicant Did Not
 23 Consider Soil Anisotropy During Shear Strength Test
 24 Program and Subsequent Calculations."
 25 A. Yes, we've discussed anisotropy extensively.

1 Q. I believe we did. And you have nothing to
 2 add to the previous discussion?
 3 A. I do not.
 4 Q. Item C, "Applicant May Have Used An Improper
 5 Modulus of Subgrade Reaction for Foundation
 6 Calculations."
 7 A. I believe we've already discussed this also.
 8 I have nothing else to say about it.
 9 Q. Item D, "No Consideration in Foundation
 10 Design of Potential Ground Rupture of Faulting."
 11 A. We discussed the Geomatrix report and its
 12 assessment of potential magnitude of displacements at
 13 the site. I have nothing else to add to this.
 14 Q. Item E, "No Consideration of Potential Basin
 15 Effects in Developing Ground." Probably a word missing
 16 there.
 17 MS. CHANCELLOR: It should be "motion."
 18 A. Yeah, motion. This appears to be
 19 Dr. Ostadan's.
 20 Q. In fact, if I recall --
 21 A. It's got a red tab by it. I was about ready
 22 to answer that.
 23 MR. TRAVIESO-DIAZ: Let's go off the record
 24 for a second.
 25 (Discussion off the record.)

1 Q. (By Mr. Travieso-Diaz) Which is the next
 2 item that you --
 3 A. X.
 4 Q. And Item X is on what page?
 5 A. Page 64.
 6 Q. "Use of Full Undrained Shear Strength
 7 Overstates Sliding Factor of Safety of the Pad."
 8 A. Yes. This is historical. The initial
 9 design considered sliding on -- of the concrete pad on
 10 top of a clay, clay layer, and we were pointing out that
 11 adhesion should be used. But this has been changed now.
 12 Q. And that's the last one that you have that
 13 you provided input on Exhibit 10?
 14 A. Yes, I believe so.
 15 Q. Would you like to take a break?
 16 A. Oh, wait. There was another one hidden
 17 here. Maybe there's a dual one. It's on page 71.
 18 MS. CHANCELLOR: I'd just like to make a
 19 comment. I think on some of these dual ones we
 20 discussed it together with Dr. Ostadan.
 21 THE WITNESS: Yes. We've discussed the -- I
 22 believe we've discussed this already.
 23 Q. (By Mr. Travieso-Diaz) This is Item AS on
 24 page 71?
 25 A. Yes.

1 Q. My recollection is both you and Dr. Ostadan
 2 talked about it.
 3 A. Yes.
 4 MR. TRAVIESO-DIAZ: Would you like to go off
 5 the record for a minute?
 6 (Discussion off the record.)
 7 Q. (By Mr. Travieso-Diaz) Could we turn now to
 8 Exhibit 12, which is the State of Utah's Objections and
 9 Responses to Applicant's Fourth Set of Discovery
 10 Requests to Intervenor State of Utah and Confederated
 11 Tribes, and what I would like to ask you to do is to
 12 repeat the procedure that we went through with respect
 13 to Exhibit 10 and go over those element or those
 14 responses to discovery requests that you were involved
 15 with, stating as to each what your current position of
 16 that discovery response is.
 17 MS. CHANCELLOR: Can we go off the record
 18 for a moment?
 19 MR. TRAVIESO-DIAZ: Sure.
 20 (Discussion off the record.)
 21 Q. (By Mr. Travieso-Diaz) Modify my last
 22 question. The question that I intended to ask was,
 23 going -- I'd like to ask you to go through Exhibit
 24 12. --
 25 A. Correct.

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Q. -- which is the State of Utah's responses to the fourth set of discovery requests; and limiting yourself to those discovery requests in which you provided substantive commentary, could you go through those and tell me what your current position with respect to that commentary is?

A. I'm on page 27, Response to Admission Request No. 4. That was denied, and the reason was that we didn't see any really geostatistical or statistical analysis to discuss the extent of variation.

Q. And your current view on this response?

A. I think we've discussed our ideas about still uncertainty, particularly in layer 2.

Q. In terms of horizontal --

A. Variation of the potential shear strength and some potential ways of looking at that.

Q. So this has been amply discussed?

A. We've discussed this. No. 5, we've discussed also the depth and nature of bedrock at the site.

Q. You are talking about the response to Item 5 on page 27?

A. Right.

Q. And this is one that we have discussed?

A. Right. The idea of the deep hole and

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establishing properties to bedrock.

Q. Okay.

A. We've also discussed Response to Admission Request No. 6 about depth of ground water, hydraulic gradient, and seasonal variations. We just did that a few moments ago.

Q. No. 7 on page 28?

A. We do not see there's any outstanding issues with collapsibility of soil.

Q. And No. 8, with respect to the determination of soils and undrained shear strength, I take it you're not providing any additional information?

A. No. We've already discussed undrained shear strength probably too much.

Response to Interrogatory No. 1, strain rate of soils at the bottom of page 28 is where this discussion starts. I don't think I need to go through this, because I know the issues. And I do not want to read several pages. It's our position that the strain rate effects are used, and our current understanding is they haven't been. They've been alluded to but have not been used in the calculations. They may not be as high as some of the other literature suggests. We've given a few quotations of where some literature suggests that there's only a 10 percent rise in peak strength per each

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one log cycle increase in strain rate.

If this is going to be used, we suggest that using site specific testing and data would put this to rest. And if the applicant intends not to use this effect or needs not use this effect to demonstrate adequate margins, then let's not discuss it.

Q. And your comment at the end of this question and this particular response that, "hence, without site specific testing, it appears more appropriate to consider a possible 25 to 30 percent increase"?

A. I think we'd accept that. That is supported by a textbook that we've cited here, but also we got into this quite extensively on the I-15 project. Our senior advisors were Chuck Ladd and also a person named Yoshi Moriwaki from Woodward-Clyde. I was a party to the conversations, and ultimately we used a 10 percent increase for each log cycle as stated. And in that case the rate of our strains and testing yielded a 30 percent increase in peak strength due to strain rate effects. And I guess we would accept that value without site specific testing. But if we consider it a conservative value, yes; but if one's going to use less conservative values, i.e., higher multipliers for strain rate effects, then they should be justified by site specific testing.

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Q. In other words, if they're going to take credit for anything over 30 percent, they should prove it by testing?

A. Well, let's not characterize it as 30 percent. At least 10 percent for each log cycles of increase in strain rate over the laboratory. So carefully compare the rate of strains induced by the earthquake motion and the strain rate done in the laboratory, and adjust it 10 percent for each log cycle increase. Just use the rule of thumb by Kramer.

Q. Okay. That's simple enough.

A. We will accept that.

Q. Undrained shear strength on page 30.

A. We've discussed the potential reduction in peak strength due to degradation. I don't see anything more to add to this. We also discussed the percent of peak that may be mobilized due to free field motion and action.

I don't recall how much we've said about Newmark sliding block analyses.

Q. We have not talked about that.

A. So maybe we need to make a comment about that, because the next pages -- on 31 I see some discussion on Newmark analysis.

Q. As I recall the discussion today,

Dr. Ostadan deferred to you on this one.

A. Yes. For shallow sliding we feel very reluctant to accept any factors of safety less than 1.1, and justify sliding -- justify factors of safety of less than 1.1 based on the use of sliding Newmark analysis.

I think these studies were done to cover somewhat uncertainties in characterization and understanding of the soils beneath certain facilities, so I hope that they're somewhat historical. But it seems that we could potentially move into an area that NRC may not allow us to go to a factor of safety of less than 1.1. So I guess we would like to see that factor of safety demonstrated for all case, not rely on deformation analysis.

Q. Can I ask only one clarification, which is, when you said "shallow sliding," where are you assuming the sliding?

A. Shallow sliding to me would be anything from the foundation system down through to the bottom of layer 2.

Q. In your last answer, do you combine your comments of factor of safety against sliding and the next factor of safety against bearing capacity, or are these two different issues?

A. Discussed factor of safety against bearing

capacity. This was dealing with an issue of maybe a fee that had not been justified.

MS. CHANCELLOR: I'd just like to make a comment. I think we already have testimony on --

THE WITNESS: I think we have.

MR. TRAVIESO-DIAZ: I believe we have.

MS. CHANCELLOR: -- this, and also on the next one.

THE WITNESS: We've covered this, as I recall. Yes, I think I also recall much testimony on factors of safety against sliding on the pads and the subsequent issues in this section.

Q. I don't believe that we have discussed settlement. That is on page 33. Would you summarize your current position on settlement?

A. As I recall, the design has built in some margins for a potential 3.5 inches of settlement with time. I consider settlement somewhat of an operational issue. I hope you're right in your guesses, but I think you can cover -- this settlement I would expect to be -- and when I'm referring to settlement, I'm talking about consolidation settlement or creep settlement also. It will be fairly uniform, so it really becomes to me an operational issue of how much of a nuisance it is, but not a real concern.

Q. The next one, soil cement. May I suggest that we have discussed this?

A. Yes. This is a -- still we consider this soil cement idea conceptual. We've discussed it considerably.

Q. Will you turn to the next set of questions, which I believe is a response to Interrogatory 2.

A. Yes, I see.

Q. That's on page 34. What is the first item that you care to address?

MS. CHANCELLOR: I could stipulate --

A. I believe that there's -- if I have any part to this, it's probably in the first part of this. So let me just see if I can identify where I may have said some things.

Q. May I help you refresh your recollection, perhaps?

A. Sure.

Q. My recollection is that with respect to the response to Interrogatory 2, there were two parts to what is in that paragraph. The first part is, you indicated that you provided input to others that were discussing the various issues that are raised in that portion?

A. Correct. And as I think -- I'm looking at

the sentence here -- see if I can find the beginning of it. I believe it's "notwithstanding."

Q. Can we stipulate that a lawyer wrote that?

A. I believe so.

MS. CHANCELLOR: It's all right if you don't stipulate it was me. I can stipulate that the primary author to this was not Dr. Bartlett.

THE WITNESS: Right. And I may have had some input into a couple key words that I saw here.

MS. CHANCELLOR: I believe Dr. Allison was responsible for this interrogatory response.

A. Identifying faults would not be mine. Ground motions. Perhaps ground displacements I assume would refer back to any potential offsets across the site due to the seismic event.

I did have input to the depth of the nature of the bedrock. This is the deep hole again that we've talked about.

Obviously the analysis of collapsible soils, we discussed that. That's not an issue.

Perhaps now the overestimation of undrained shear strength is a little strong, but the verification of undrained shear strength values in key layers.

I'm not sure I see anything else that I would have contributed to in here.

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1 Q. Anything else on this document, in this set
2 of discovery responses?

3 A. No. It appears to be mostly Dr. Allison's.

4 Q. Could I ask you to turn now to Exhibit 13,
5 which is the State of Utah's Objections and Response to
6 Applicant's Fifth Set.

7 A. Yes.

8 MS. CHANCELLOR: Off the record a minute.

9 (Recess from 10:22 to 10:28 p.m.)

10 Q. (By Mr. Travieso-Diaz) Again, let me
11 just -- would you please go through Exhibit 13, State of
12 Utah's Objections and Responses to Applicant's Fifth Set
13 of Discovery Requests, and go through the same process
14 that we went through with respect to Exhibit 12, please?

15 A. Sure. I think earlier I identified some
16 part in Response to Admission No. 2 on page 6. I recall
17 having some phone call discussions. This appears to be
18 discussing the use of probabilistic seismic hazard
19 analyses and talking about their use when the state has
20 used them before.

21 Q. Is it fair to say --

22 A. This is mostly I think Dr. Arabasz's
23 writing. I think my conversations were just to point
24 out to Dr. Arabasz that the deterministic approaches are
25 still used, too, and pointed out that the dam safety

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1 group within the State of Utah still uses deterministic
2 events for dam design. So that's why I think -- I think
3 that was my input to this was just that dam safety --
4 that dam safety evaluations are still done with
5 deterministic events and maximum credible earthquakes.

6 Q. But you have nothing to add to what's here?

7 A. No. I don't have anything to add to 3,
8 either. I recognize my participation by citing a
9 reference here that deals with I-15, and a probabilistic
10 seismic hazard analysis.

11 Nothing to add on response to request No. 6.

12 I think No. 7, there's nothing to add here.
13 We've clarified and come up with a consistent
14 nomenclature I think even for the upper five layers.

15 Q. I think we did.

16 A. I don't see anything on the next page that I
17 can contribute beyond that. Is this the beginning --
18 I'm confused now.

19 MS. CHANCELLOR: Can we go off the record a
20 minute?

21 MR. TRAVIESO-DIAZ: Sure.

22 (Discussion off the record.)

23 THE WITNESS: I have nothing to add to 8.

24 MS. CHANCELLOR: I'd like to make a comment.
25 No. 9 refers back to another admission. I think it's

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1 going to be difficult --

2 THE WITNESS: I'm wondering why we're hung
3 up on competent soil layers.

4 MS. CHANCELLOR: Can we go off the record a
5 minute?

6 MR. TRAVIESO-DIAZ: Yes.

7 (Discussion off the record.)

8 THE WITNESS: I have no additional comments
9 on 9. I believe the issue has been discussed by
10 Dr. Ostadan. Yes on 10. We still admit that the
11 applicant has discussed soil cement mixtures with us.

12 Q. And would it be fair to say that on 11 we
13 have discussed the potential concerns that exist to the
14 use of --

15 A. Correct. And I think also 11's objecting to
16 the term "stronger." It doesn't lend itself to a good
17 engineering terminology.

18 Q. And again, No. 12 also addresses the
19 properties of soil cement?

20 A. Yes. That still is conceptual and must be
21 demonstrated.

22 Q. Did we discuss that today? Maybe yesterday?

23 A. Yes. On 13, it's still our understanding
24 that that's what's intended, and we have nothing to
25 comment on that yet. We have nothing further to comment

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1 on. I'm so jumbled, I can't speak. We have nothing
2 additional to comment about on this.

3 Q. Do you have any additional comments that you
4 wish to make on No. 15?

5 A. We've discussed extensively our current
6 concerns still of layer 2 being able to be a bearing
7 capacity layer. So I have nothing more to add to that.

8 Q. According to my notes, the next item which
9 you provided input was No. 37 on page 22. Is that
10 correct?

11 A. Correct.

12 Q. Will you address that item?

13 A. Depth of bedrock still remains an
14 uncertainty. We talked about it, but I've deferred to
15 others to determine whether that data is germane.

16 Q. We discussed that today.

17 A. Yes.

18 Q. 38 again addresses bedrock. We have talked
19 about that. Is that --

20 A. Yes, that's the same issues -- or those two
21 are together, linked together. The next I see is -- we
22 didn't cover 39, correct?

23 Q. My notes don't show that you covered 39, but
24 you can look at it.

25 A. Coring to bedrock is not necessary to

1 establish the competency of the overlaying soils from
 2 the geotechnical perspective.
 3 Again, we've discussed I guess the use of
 4 the term "competency" and what it should mean. We admit
 5 that for shallow bearing capacity and consolidation
 6 that --
 7 Q. With respect to items 41 -- I'm sorry, 40
 8 and 41, are those items related to testing?
 9 A. Yes, they are.
 10 Q. Have we discussed those items?
 11 A. Yes, we have. I see nothing else there.
 12 Q. With respect to item 42, do you have
 13 anything to add with the conservatively -- the
 14 conservatism or lack thereof on the soil parameters?
 15 A. No, I don't.
 16 Q. 43, the question is whether there have been
 17 additional cone penetration tests.
 18 A. Yes, we admitted there was additional cone
 19 penetrometer tests.
 20 Q. We have discussed those at length.
 21 A. Yes.
 22 Q. And 44, again, whether cone penetration
 23 tests are accepted industry methods. I believe we
 24 discussed those as well.
 25 A. Yes. I think the objection here is a

1 clarification that soil properties are not determined
 2 from the cone penetration tests, that properties are
 3 derived from correlations to the base measurements you
 4 make from the cone through statistical correlations.
 5 Q. Is that it for Exhibit 13?
 6 A. That's it.
 7 Q. Just confirm for the record that this, as
 8 far as you remember today, is your last -- the totality
 9 of contribution with respect to the issues related to
 10 Contention L?
 11 A. Yes, to the best of my recollection.
 12 Q. May I ask you for a second, just for
 13 completeness, will you look at page 27, item C on the
 14 page. And Item C, the title of that particular
 15 paragraph is "Soils and foundation loading."
 16 A. Yes.
 17 Q. Take a look at that paragraph and tell me
 18 whether this has been already discussed.
 19 A. Yes, I believe collapsibilities have already
 20 been discussed.
 21 MR. TRAVIESO-DIAZ: I have no more questions
 22 for Dr. Bartlett.
 23 MS. CHANCELLOR: Can we go off the record
 24 for just one second?
 25 (Discussion off the record.)

EXAMINATION

1 BY MS. CHANCELLOR:
 2 Q. Dr. Bartlett, I would just like to ask you a
 3 question for point of clarification. During your
 4 testimony, I think it was yesterday, I heard you testify
 5 that Dr. Arabasz would be the state's expert supporting
 6 Basis 1 of Contention L, which is surface faulting and
 7 deals with seismic reflection, seismic refraction. Is
 8 that what you meant to say?
 9 A. No. Dr. Lee Allison would have covered
 10 those. I must have just had the numbers mixed up.
 11 Q. And Dr. Arabasz, is he the state's expert
 12 for ground motion, Basis 2?
 13 A. Yes, that's my understanding.
 14 MS. CHANCELLOR: I have no further
 15 questions. Thank you.
 16 MR. TRAVIESO-DIAZ: I have nothing else to
 17 ask.
 18 On the record, I would like to thank you
 19 very much for your testimony and your patience.
 20 MS. CHANCELLOR: And I want to thank
 21 everybody for enduring, too.
 22 MR. TRAVIESO-DIAZ: And I'd like to extend
 23 my compliments and my thanks to the court reporter.
 24 (Deposition was concluded at 10:48 p.m.)
 25

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CONDENSED TRANSCRIPT

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

)

) Deposition of:

)

) PAUL TRUDEAU and

)

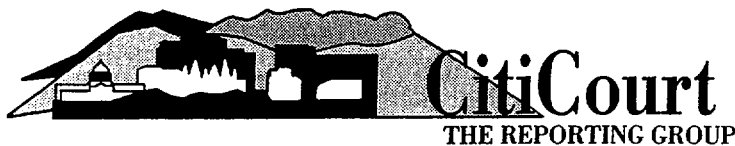
) THOMAS Y. CHANG

)

Wednesday, November 15, 2000 - 9:14 a.m.

Location: Utah Attorney General's Office
160 E. 300 S.
Salt Lake City, Utah

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



801.532.3441

TOLL FREE 877.532.3441

50 South Main, Suite 920
Salt Lake City, Utah 84144

FAX 801.532.3414

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1 mean, really mean, it's really have a high density. So
2 we have to really be careful what we talk about for what
3 type of soil and what condition.

4 Q. Do you consider that the undrained shear
5 strength numbers from the Supercollider, because --
6 because of the higher ground water table, that those --
7 that that undrained shear strength is not applicable to
8 the PFS site because of the difference in ground water?

9 A. (Mr. Trudeau) I consider it to be a
10 different material geologically, because it's so much
11 lower in the profile than our materials are, a hundred
12 feet further away from the water table than they are.
13 You know, again, I don't recall exactly what's in the
14 Superconducting Supercollider reports, because it's been
15 a long time since I looked at it. But my general
16 recollection was that they were closer to the ground
17 water table than we are, hence I felt that the material
18 properties weren't applicable to our site. So we used
19 our site properties.

20 Q. Dr. Chang, are you familiar with matrix
21 suction and capillary stress, as a general matter?

22 A. (Dr. Chang) Yes, somewhat. As a
23 geotechnical engineer, yeah.

24 Q. Does that have any effect on the undrained
25 shear strength?

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1 shear strength?

2 A. (Dr. Chang) I really cannot make a very
3 general here, because you have to know what contribute
4 to the undrained shear strengths of the soil. Sometimes
5 they may have some kind of a cementation there. If you
6 have a cementation that's contributing more to your
7 undrained strengths, even you change the water content,
8 if that cementation still exists, you probably not going
9 to change undrained shear strengths.

10 Q. Are the soils in layer 2 cemented?

11 A. (Dr. Chang) I suspect so, somewhat.

12 Q. What do you base that on?

13 A. (Dr. Chang) Basis on we -- I think we
14 had -- some of the soil we tested may have some kind of
15 a react to HCl, hydrochloric acid. So maybe there's
16 some company there, and I don't know exactly what the
17 company that play the role in the cementation. And also
18 the soil has been dry. There may be some kind of
19 chemical or something deposited during the drying
20 process. So that may contribute another cementation.

21 Q. If you know, at what strain level do you
22 expect cementation to break?

23 A. (Dr. Chang) I'm glad you asked.

24 Q. Good.

25 A. (Dr. Chang) All right. From the very

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1 A. (Dr. Chang) Yes, it does have some effect
2 of undrained shear strengths.

3 Q. And what effect does it have?

4 A. (Dr. Chang) Well, overall if you have a --
5 the water column water deficiency, and then you have a
6 capillary tension in the pore water, that will come out,
7 give a soil that have a little bit higher strengths,
8 because effective stress will -- in the soil particle is
9 higher.

10 Q. Do you know whether changes in moisture
11 content can change the undrained shear strength?

12 A. (Dr. Chang) I think you have to qualify a
13 little bit. Be specific.

14 Q. For fine grain, unsaturated soil.

15 A. (Dr. Chang) For fine grain, unsaturated
16 soil, the normal one, yes. That's a -- the water
17 content going to have some effect on the undrained
18 strength.

19 Q. Is unit 2 on Figure 2.6-5, is that fine
20 grain, unsaturated soil?

21 A. (Dr. Chang) Yeah, that's -- have a wide
22 degree of saturation. It's a partially saturated, not
23 fully saturated.

24 Q. Can changes in its undrained shear -- can
25 changes in unit 2's moisture content affect undrained

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1 beginning, we know that soil has got a high water ratio.
2 And that's why we suspect this is some -- this is some
3 of soils there for that particular type of the soil with
4 that kind of high water ratio and kind of strains we
5 got. We said, well, maybe this is some problem; if it's
6 cementation, maybe what destroy even in the weighting.
7 And that's why when we doing our soil conservation test,
8 we add the water -- one of them -- some of them add
9 water, and we specific to check that cementation will
10 break down by saturation on that. And it didn't show
11 any change. Very, very slight change.

12 So based on that, because the soil is not
13 really break down, and we continual load the test, we
14 compare them. One is inundated and one is not
15 inundated. And there is very, very little difference.
16 So basic what we -- based on that, we said, well, this
17 soil, at least that cementation cannot be break down,
18 you know, just by changing the water content.

19 Q. At what shear strength level does the
20 cementation break down?

21 A. (Dr. Chang) I object to the question.

22 A. (Mr. Trudeau) We don't know.

23 Q. If you know.

24 A. (Mr. Trudeau) We didn't measure a breakdown
25 in cementation even with the -- well, with the stresses

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1 as high as eight tons per square foot in our
2 consolidation test, we saw no behavior that looked like
3 a breakdown in cementation.
4 Q. Is cementation likely to break down at large
5 strain?
6 A. (Dr. Chang) Well, you want to define
7 "large"? How large?
8 Q. One to two percent. One to two percent
9 shear strength.
10 A. (Dr. Chang) I don't -- the strength, you
11 talk about strength?
12 Q. Shear strength, yes.
13 A. (Dr. Chang) All right. Depends --
14 Q. Shear strain, beg your pardon. Shear
15 strain. One to two percent shear strain.
16 MR. TRAVIESO-DIAZ: Can I have that question
17 read back? I don't know what the question is.
18 Q. (By Ms. Chancellor) Let me try this. Is
19 cementation broken down at one to two percent of shear
20 strain?
21 A. (Dr. Chang) Well, from the test, the sample
22 we test, I don't believe -- we have to calculate what
23 the, you know, from the consolidation what the shear
24 strain -- you probably see the shear strain going to be.
25 At least we see that probably more relate to the no more

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1 MS. NAKAHARA: Can you repeat that page
2 again?
3 A. (Mr. Trudeau) It's close to the back of
4 Appendix 2A, Attachment 6. It's Appendix C of that
5 attachment. It's that page right there.
6 Q. Were these samples wetted in the cyclic
7 trial test on Attachment -- Attachment 6 to Appendix 2A
8 of the SAR?
9 A. (Dr. Chang) No, it's not saturated.
10 Q. Not saturated. Would you agree that these
11 samples are taken at approximately 23 to 24 feet depth?
12 A. (Dr. Chang) I think we have a wide test. I
13 think some of them may be shallower.
14 Q. Could you turn to the Appendix -- Attachment
15 6, Appendix C to Appendix 2A where it's got the cyclic
16 triaxial tests? Do you see that?
17 A. (Mr. Trudeau) Yes.
18 Q. The first sheet shows depth of 24.9 feet?
19 A. (Mr. Trudeau) Correct.
20 Q. Second one, the same depth?
21 A. (Mr. Trudeau) 23 feet.
22 Q. Oh, 23 feet. The next one, 8 feet?
23 A. (Mr. Trudeau) Correct.
24 Q. 9.6 feet?
25 A. (Mr. Trudeau) Correct. 6.3 feet.

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1 load. We should have said it, how high is that going
2 to, you know, even low, beyond that low, the cementation
3 will break down. But so far from the consolidation
4 test, we really haven't seen the cementation break down
5 due to the load, because we -- the sample we run and
6 partially saturate and was inundated basically is very
7 similar. There's not much difference.
8 Q. Do you know whether there were any cyclic
9 measurements for shear strain for suspended cemented
10 soils -- suspected cemented soils?
11 A. (Dr. Chang) You mean in published
12 literature, or --
13 Q. For the soils at the PFS site.
14 A. (Dr. Chang) Yes. We did some cyclic
15 triaxial tests.
16 Q. And at what levels of strain were those
17 cyclic measurements taken?
18 A. (Dr. Chang) We applied the stress level to
19 the design earthquake, and the strain, we come out I
20 think very, very small. It's probably about -- strain
21 is 1 percent?
22 A. (Mr. Trudeau) I'm looking at Attachment 6
23 of Appendix 2A of the SAR. The results for sample CTB
24 4, U-13D showed double amplitude strain of 1.23 percent
25 after 513 cycles.

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1 Q. I guess I don't have a question.
2 You mentioned you used the design earthquake
3 value. What value did you use?
4 A. (Dr. Chang) I think that's point --
5 A. (Mr. Trudeau) 67 G.
6 A. (Dr. Chang) -- .67? That's in --
7 A. (Mr. Trudeau) When we laid out these tests,
8 it was --
9 A. (Dr. Chang) -- in here.
10 A. (Mr. Trudeau) -- prior to the PSHA study.
11 So we hit these samples as hard as we could without
12 putting them into tension.
13 A. (Dr. Chang) In the requesting form.
14 A. (Mr. Trudeau) It's not in this. This SAR
15 is missing some pages. Can we look at yours?
16 MS. CHANCELLOR: Sure. We're glad to share.
17 A. (Mr. Trudeau) We have those in all of
18 these, but not this here.
19 Q. Is that our book you're taking about?
20 A. (Mr. Trudeau) No, no. It was found about
21 five pages ahead of where it belonged. So we found it.
22 I'm sorry.
23 There's a page that's labeled page 18.
24 We're in Appendix 2A of the SAR, Attachment 6. I'm
25 sorry to say I can't refer by page number. We're

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1 A. (Mr. Trudeau) Yes.
2 Q. I didn't copy this as part of this exhibit,
3 but on page 73 -- let me read you this statement, then
4 I'll give you page 73. Is it states, "Furthermore, the
5 pads will be constructed on and within soil cement which
6 will be strong enough to resist sliding of the pads
7 using only the passive resistance of the soil cement.
8 The soil cement will effectively lock the pads in their
9 respective locations so that they cannot move relative
10 to one another." That's at the very bottom --
11 A. (Mr. Trudeau) I see it.
12 Q. -- of page 73. Does the statement on page
13 73, does that imply that for the soil cement mat to be
14 effective in resisting sliding, it must act as an
15 integral unit with the pads and allow no differential
16 movement between the pads?
17 A. (Mr. Trudeau) It will effectively do that,
18 because its strength will be higher than the strength
19 necessary to resist movement of the pads.
20 Q. If you would look at Exhibit 38, the
21 excerpts from the SAR Figure 2.6-2.
22 A. (Mr. Trudeau) Yes, I have it.
23 Q. What are the approximate width and dimension
24 of the integral pad soil cement based on, as shown in
25 Figure 2.6-2?

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1 A. (Mr. Trudeau) What are the --
2 Q. Approximate width and dimension of the
3 integral pad soil cement based on.
4 A. (Mr. Trudeau) We're planning to use soil
5 cement between all of the rows of pads, so these pads
6 are spaced 30 feet on centers so that whole area will be
7 soil cement.
8 Q. If you look at Figure 2.6-2, there are four
9 grids or four --
10 A. (Mr. Trudeau) Four quadrants.
11 Q. Four quadrants. Would those four quadrants
12 all act as a single mat?
13 A. (Mr. Trudeau) That's the intent. The soil
14 cement in those areas also provides a firm foundation
15 for the transporter to travel, so you get added benefit
16 out of supporting the transporter as well in those
17 areas.
18 Q. Do you know what the tensile strength is of
19 the soil cement?
20 A. (Mr. Trudeau) Not yet. Hasn't been
21 designed yet.
22 Q. When will it be designed?
23 A. (Mr. Trudeau) We're -- well, we've -- we're
24 in the process of preparing the ESSOW for the lab
25 testing required for that right now, Engineering

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1 Services Scope of Work.
2 Q. In designing the soil cement mat, were the
3 effects of surface waves and non-horizontally propagated
4 waves considered?
5 A. (Mr. Trudeau) We looked only at the
6 strength required to resist the dynamic forces.
7 Q. In which direction?
8 A. (Mr. Trudeau) Horizontal direction.
9 Q. But you didn't consider the vertical
10 direction?
11 A. (Dr. Chang) The vertical direction is
12 not -- you have up and down, you're not going to slide.
13 Q. Were the bending and torsional stresses
14 imposed by the surface waves calculated over the four
15 quadrants of the pad area?
16 A. (Mr. Trudeau) No.
17 Q. Would bending stresses place the pad mat in
18 contention?
19 A. (Mr. Trudeau) I don't know.
20 Q. You stated that -- is the design complete
21 for the cement pad?
22 A. (Mr. Trudeau) For the --
23 Q. For the cement --
24 A. (Mr. Trudeau) For the concrete pad?
25 Q. Concrete pad mat -- I mean, soil cement mat.

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1 A. (Mr. Trudeau) No.
2 Q. Is it still in a conceptual stage?
3 A. (Mr. Trudeau) That's correct.
4 Q. When do you expect to reduce it from a
5 conceptual stage to a design stage?
6 A. (Mr. Trudeau) As I said, we're working on
7 getting the lab program to test the soils to see what
8 percentages cement are required to get the unconfined
9 compressive strengths and the durability requirements
10 done now.
11 Q. Do you plan to measure tensile strength?
12 A. (Mr. Trudeau) I had not planned to.
13 Q. Can you preclude that there won't be any
14 tensile stresses in the mat?
15 A. (Mr. Trudeau) No.
16 Q. Are you likely to change your mind about
17 whether you're going to consider tensile strength?
18 A. (Mr. Trudeau) We will look at that. Thank
19 you very much.
20 Q. Would you expect the soil cement and the mat
21 to act as an integrated unit with forces in the vertical
22 direction?
23 A. (Mr. Trudeau) There will not be a shear
24 connection on the edges of the pads, so whether they
25 move as an integral unit or not will depend on the

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1 magnitude of the stresses between them, whether the bond
2 strength between soil cement and the concrete pad will
3 be sufficient, and whether the pad underlying the -- I
4 mean, the mat, the soil cement layer underlying the pads
5 have sufficient shear strength to resist those forces.

6 Q. You testified that you're in the process of
7 going from a conceptual to a design phase of the soil
8 cement pad -- mat. When do you anticipate that you will
9 have completed the design?

10 A. (Mr. Trudeau) First quarter next year,
11 perhaps.

12 Q. In order to complete it, is there a lab test
13 that you need to run? Do you need to do any field work?

14 A. (Mr. Trudeau) We need to obtain samples of
15 the site soils for the lab testing program. So field
16 work in that inasmuch as you have to go to the field to
17 get the dirt.

18 Q. If you consider the pad and the soil cement
19 an integral unit, should you consider the seismic --
20 seismic load from soil cement in the sliding analysis?
21 Do you understand the question?

22 A. (Mr. Trudeau) The soil cement will have
23 sufficient strength to exceed the Mononobe Okabe active
24 pressures that would be applicable for that case, I
25 believe.

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1 Q. If there are integral -- if the pad and the
2 soil cement are an integral unit, wouldn't they move
3 together?

4 A. (Mr. Trudeau) Yes.

5 Q. So where is the inertial load -- where is
6 the inertial load of the soil cement going?

7 A. (Mr. Trudeau) Where is it going? It would
8 be resisted by the bond between the soil cement mat and
9 the underlying silty clay layer.

10 Q. So should this be included in the sliding
11 analysis, the inertial load?

12 A. (Mr. Trudeau) I guess so.

13 Q. Has it been?

14 A. (Mr. Trudeau) No.

15 Q. Were potential weaknesses in the soil cement
16 mat considered due to cracking upon drying or other
17 environmental factors?

18 A. (Mr. Trudeau) Cracking would not impair the
19 compressive strength of the soil cement.

20 Q. Would it affect its tensile strength?

21 A. (Mr. Trudeau) Yes.

22 Q. Did you consider that, and how much effect
23 would it have?

24 A. (Mr. Trudeau) Can't tell you that. The
25 nature of soil cement, the way it's constructed in

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1 layers, would tend to minimize the propagation of cracks
2 throughout the whole mat of soil cement.

3 Q. Do you have data to support that, or is that
4 your opinion?

5 A. (Mr. Trudeau) That's my opinion.

6 Q. Could you look at Exhibit 39 on the last
7 page, page 84, and if you look at what's entitled
8 Figure 3.

9 A. (Mr. Trudeau) I have it.

10 Q. Would you agree that Figure 3 shows a
11 typical detail of a past soil cement interface?

12 A. (Mr. Trudeau) Correct.

13 Q. Do you agree that this typical detail
14 indicates that the soil cement mat will be three feet
15 thick outside the pad footprint and approximately one
16 foot thick underneath the pad?

17 A. (Mr. Trudeau) The figure indicates it will
18 be at least that, yes.

19 Q. Were calculations made to determine the
20 effect of the non-uniformity and thickness at this
21 point?

22 A. (Mr. Trudeau) Calculations of what?

23 Q. How this joint will respond to dynamic
24 torsional and bending stresses.

25 A. (Mr. Trudeau) No.

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1 Q. Do you know either from other projects or
2 review of literature whether soil cement has been used
3 to reduce dynamic sliding?

4 A. (Mr. Trudeau) No.

5 Q. Do you agree that there is five feet
6 longitudinal distance between the pads?

7 A. (Mr. Trudeau) Correct.

8 Q. Is passive resistance from one pad a driving
9 force for the other pad?

10 A. (Mr. Trudeau) The whole unit acts -- I
11 mean, the whole quadrant -- the whole pad emplacement
12 area will act as an integral unit.

13 Q. So does this mean that the sliding analysis
14 should be performed for the whole pad emplacement area?

15 A. (Mr. Trudeau) Correct.

16 Q. Are you familiar with Calculation G(B)13,
17 which is called Stability Analyses for the canister
18 transfer building Supported on a Mat Foundation?

19 A. (Mr. Trudeau) Yes.

20 Q. I'd like to have marked as Exhibit 46 --
21 (Exhibit 46 marked.)

22 Are you familiar with calculation G(B)13?

23 A. (Mr. Trudeau) Yes.

24 Q. If would you turn -- oh. If you would turn
25 the -- Exhibit 46 is an excerpt from G(B)13. If you

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1 need additional pages, let me know. I've got the entire
2 package here. If you would turn to the last page, which
3 is page 25. Were you responsible for this calculation
4 package?

5 A. (Mr. Trudeau) For Rev. 2 and 3, yes.

6 Q. And Dr. Chang, did you independently review
7 Rev. 2 and 3?

8 A. (Dr. Chang) Yes.

9 Q. And I, too, I guess -- I also?

10 A. (Dr. Chang) Yeah.

11 Q. In the middle of the last paragraph on page
12 25, it states, "It is likely, that should slippage occur
13 within the cohesionless soil underlying the building, it
14 would minimize the level of accelerations that would be
15 transmitted through the soil into the structure. In
16 this manner, the cohesionless soils would act as a
17 built-in base-shear isolation system. Any decrease in
18 these accelerations as a result of this would increase
19 the factor of safety against sliding, which would
20 decrease the estimated displacements as well."

21 Do you see that --

22 A. (Mr. Trudeau) Yes, I do.

23 Q. -- that I just read? If slippage, that is,
24 displacement, is required to reduce accelerations to the
25 canister transfer building, then how can reduced

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1 define failure of the soil?

2 A. (Mr. Trudeau) I guess it does for slippage
3 along that layer of the soil.

4 Q. What is the magnitude of the slippage?

5 A. (Mr. Trudeau) It would be less than what's
6 shown here for Newmark's calculation, assuming that
7 layer existed up at the base of the structure and
8 assuming that that material had no cohesive strength
9 associated with its cementation.

10 Q. Does Newmark analysis consider fault fling
11 and other near field earthquake effects?

12 A. (Mr. Trudeau) Newmark analysis is based on
13 the acceleration time histories. I'm not really
14 familiar with fling and --

15 Q. Do you know whether fling was considered?

16 A. (Mr. Trudeau) For this analysis, no.

17 Q. Did Newmark analysis consider the potential
18 degradation of shear modular and shear strength?

19 A. (Mr. Trudeau) No.

20 Q. Did it consider the potential for
21 asymmetrical sliding?

22 A. (Mr. Trudeau) What do you mean by
23 asymmetrical sliding?

24 Q. Sliding in one direction.

25 A. (Mr. Trudeau) This analysis looked at three

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1 accelerations resulting from that slippage reduce the
2 displacement that has already occurred?

3 A. (Mr. Trudeau) This statement is saying that
4 if the accelerations were so large that the soils could
5 not transmit them to the building, the building would
6 never see them.

7 Q. But in reducing that acceleration, slippage
8 has to occur, correct?

9 A. (Mr. Trudeau) At the depth of the
10 cohesionless layer.

11 Q. Can you explain why this argument isn't
12 circular?

13 MR. TRAVIESO-DIAZ: Object to the form of
14 the question. Arguing with the witness.

15 Q. (By Ms. Chancellor) You state that
16 displacements reduce slippage, yet slippage has already
17 occurred, correct?

18 A. (Mr. Trudeau) No. That's not the point I'm
19 trying to make. The point I'm trying to make is that
20 the earthquake coming up through the soil reaches a
21 cohesionless layer. If the magnitude of those waves are
22 so high that they exceed the strength of the soil to
23 resist them, the soil will not transmit them through the
24 soil into the upper overlying materials.

25 Q. Does that define failure -- does that not

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1 different cases with the earthquake components in
2 north/south and east/west and vertical directions.

3 Q. The charts from which you determined the
4 displacement, were they for symmetrical or asymmetrical
5 sliding?

6 A. (Mr. Trudeau) May I see the rest of the
7 calc? They were based on symmetrical resistance, as
8 indicated by Figure 2.6-26 of the SAR.

9 Q. 2.6 --

10 A. (Mr. Trudeau) 2.6-26. It's Figure 6 of
11 Calc G(B)13.

12 Q. Do you know whether fault fling would
13 produce asymmetrical sliding?

14 A. (Mr. Trudeau) No.

15 Q. You don't know?

16 A. (Mr. Trudeau) Correct.

17 MS. CHANCELLOR: Can we go off the record
18 for a moment?

19 (Recess from 5:20 to 5:33 p.m.)

20 EXAMINATION

21 BY MS. NAKAHARA:

22 Q. Let's go back on the record. Good evening,
23 gentlemen. For the record, my name is Connie Nakahara,
24 and I'd like to continue asking you questions. And
25 thank you for your endurance.

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1 Are you familiar with the location of faults
2 near the proposed PFS site?

3 A. (Mr. Trudeau) No. That -- at least on
4 Geomatrix's scope on this project. I mean, I have a
5 generic understanding that there are some faults nearby.
6 The Cedar Mountain Fault I think is one of the ones that
7 I've heard mentioned. But really the faulting study was
8 under Geomatrix's scope.

9 Q. If there was a major fault capable of
10 generating an alarming magnitude earthquake near the PFS
11 site, do you believe there could be near fault impacts?

12 MR. TRAVIESO-DIAZ: I'm going to object to
13 the question in that it calls for the witness to speak
14 out of the areas beyond his area of expertise. But if
15 he can answer the question, he can.

16 A. (Mr. Trudeau) I haven't really gotten into
17 the Geomatrix faulting study, so I don't feel
18 comfortable answering questions about that type of
19 information. They were hired to do that kind of work.
20 I understand they've done it. They developed the design
21 ground motion. The design ground motion has been used
22 in the soil structure interaction analyses, and the
23 loads have been provided for the stability analyses that
24 I needed to do.

25 Q. Are you familiar with the time histories

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1 I understand it. I had a standing objection this
2 morning, but since we are having a new set of questions,
3 I want to restate it for the record.

4 MS. NAKAHARA: And your objection is noted.

5 Q. (By Ms. Nakahara) Do you agree that
6 major -- that a major fault dips under the proposed PFS
7 site?

8 A. (Mr. Trudeau) I'm not familiar with the
9 faulting study that Geomatrix did.

10 Q. I ask you to look at Exhibit 38, which is
11 the Safety Analysis Report, page 2.6-3. Did you assist
12 in -- did you draft this page? Were you responsible for
13 drafting this page? In particular, the last paragraph
14 on the page.

15 A. (Mr. Trudeau) No.

16 Q. Who would have drafted this page, if you
17 know?

18 A. (Mr. Trudeau) My guess, I believe Richard
19 Gillespie may have been the author of that paragraph,
20 the geologist working for Stone & Webster back in 1996
21 when the SAR -- '97, when the SAR was originally filed.
22 Looking at the text, however, it might have come from
23 Geomatrix.

24 Q. Do you have an opinion if a major fault dips
25 under the proposed PFS site, as stated in Exhibit 38,

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1 that were prepared for PFS site?

2 A. (Mr. Trudeau) I know Geomatrix developed
3 artificial time histories for the site in Calculation
4 G(PO18)-3. But I haven't -- I have no real familiarity
5 with characteristics of that time history one way or the
6 other.

7 Q. Do you know who at Geomatrix was responsible
8 for developing the time histories?

9 A. (Mr. Trudeau) I would look at G(PO18)-3.
10 The cover page should indicate who prepared that
11 calculation. I could guess, but I don't think you want
12 guesses.

13 MR. TRAVIESO-DIAZ: No guesses, please.

14 Q. (By Ms. Nakahara) Do you have an opinion of
15 whether large pulses in ground motion should be
16 considered in time histories?

17 A. (Mr. Trudeau) It's outside my area of
18 expertise.

19 Q. Dr. Chang, do you have an opinion?

20 A. (Dr. Chang) No.

21 MR. TRAVIESO-DIAZ: Before you ask the next
22 question, I raised it this morning, but since we have a
23 new team, let me restate my general objection on the
24 record to having any questions on subjects such as time
25 history which are outside the scope of Contention L, as

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1 whether earthquake waves are likely to arrive at an
2 angle?

3 MR. TRAVIESO-DIAZ: Same objection as
4 before. It's outside his area of expertise. I'll let
5 him answer if he can.

6 A. (Mr. Trudeau) The basis of my answer would
7 be just my interpretation of reading this paragraph.
8 I'm not familiar with this part of the license
9 application.

10 Q. Just asking your opinion in general, if it
11 was true that the fault dipped under the PFS site.

12 MR. TRAVIESO-DIAZ: Same objection.

13 A. (Mr. Trudeau) My opinion of what would --

14 Q. (By Ms. Nakahara) Whether earthquake waves
15 are likely to arrive at an angle.

16 A. (Mr. Trudeau) That's not an area that I'm
17 familiar with.

18 Q. Do you have an opinion? If earthquake waves
19 arrived at an angle, could they cause additional rocking
20 and torsional motion of the structures above and beyond
21 the vibration caused by the vertically propagated waves
22 of the earthquake?

23 A. (Mr. Trudeau) No.

24 Q. And why not? You don't have --

25 A. (Mr. Trudeau) It's outside my area of

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1 expertise.
2 Q. I thought you meant no, it wouldn't.
3 A. (Mr. Trudeau) Oh, No, I don't have an
4 opinion.
5 Q. This is a document entitled Multi-Cask
6 Response at the PFS ISFSI from 2,000 Year Seismic Event,
7 dated 8/20/99, approved. Are you familiar with that
8 document?
9 A. (Mr. Trudeau) No.
10 Q. This document is Document 5996.02-SC-5,
11 entitled Seismic Analysis of canister transfer building.
12 Are you familiar with this document?
13 A. (Mr. Trudeau) I understand that that
14 document was prepared by members of our structural
15 mechanics department in our Cherry Hill office. I
16 haven't looked -- I haven't reviewed that document. I
17 have used some of the loads from I believe that document
18 in Calc G(B)13.
19 Q. This is Document 5996.02-SC-4, entitled
20 Development of Soil Impedence Functions for canister
21 transfer building. Are you familiar with this document?
22 A. (Mr. Trudeau) It's similar in that it was
23 prepared by our structural mechanics people in Cherry
24 Hill. I haven't reviewed those calculations, so I don't
25 really know what's in there.

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1 Q. Have you used anything from this document?
2 A. (Mr. Trudeau) I don't recall.
3 Q. Did you provide the soil properties for the
4 calculations in that document, SC-4?
5 A. (Mr. Trudeau) I don't know what properties
6 are used in that calculation. Perhaps I should take a
7 look.
8 These properties that are shown here on --
9 let me rephrase. Page 9 of this calculation, which I'll
10 refer to as SC-4, Rev. 1, indicates that the properties
11 will be taken from Table 1 of Reference 5, see
12 Attachment A. Attachment A presents -- page A-1
13 presents a table of dynamic soil properties that I
14 recognize as coming from Geomatrix's Calculation
15 G(P018)-2, and it says right on the page that that's
16 where those properties came from.
17 Q. This document is G(P017)-2 from -- completed
18 by the International Civil Engineering Consultants,
19 Incorporated. Are you familiar with this document?
20 A. (Mr. Trudeau) This is what I would refer to
21 as Calc G(P017)-2 prepared by CEC. I have not reviewed
22 this document either, although some of the loads from
23 this document were provided to me for my stability
24 analysis of the pads.
25 Q. Who provided you the loads?

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1 A. (Mr. Trudeau) We could take a look at Calc
2 UB-4. There may be correspondence in the attachment
3 that indicates where the loads came from. I don't
4 remember who it was that I got them from, but I suspect
5 it may have been the project engineer on the job or the
6 lead structural engineer on the job.
7 Q. Do you recall what form --
8 A. (Mr. Trudeau) G(B)4, the Pad Stability
9 Analysis. G(B)4. We were looking at it earlier. We
10 have an excerpt from it.
11 MR. TRAVIESO-DIAZ: It's Exhibit 39.
12 A. (Mr. Trudeau) But Exhibit 39 only has
13 excerpts. It won't have what we're looking for.
14 Page B-1 of Calc G(B)4, Rev. 6 has a Post-it
15 fax note near the center of the page that indicates to
16 me that I received this data as a fax from Jerry Cooper,
17 the assistant project manager, or project engineer at
18 the time, likely.
19 Q. Is it correct that Attachment B was given to
20 you in its entirety?
21 A. (Mr. Trudeau) That's my recollection. We
22 can confirm that. Yes. The entire appendix is
23 Attachment B of the calc.
24 Q. And what do those seismic loads represent?
25 A. (Mr. Trudeau) These are the dynamic

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1 loadings from the casks to the top of the pads. It
2 includes Table S-1, Maximum Vertical Displacements in
3 Soil Bearing Pressures Dead Load; Table S-2, Maximum
4 Vertical Displacements in Soil Bearing Pressures Live
5 Load; dynamic horizontal and vertical soil pressures;
6 total maximum horizontal soil reactions in the X
7 direction dynamic loads; total maximum horizontal soil
8 reactions in the Y direction dynamic load; summary of
9 total maximum horizontal soil reactions dynamic load;
10 maximum vertical soil bearing pressures dynamic load;
11 vertical soil bearing pressures in horizontal soil shear
12 stresses; and summary of vertical soil bearing
13 pressures.
14 Q. Based on these results, do you have an
15 opinion on whether the pad performs as a rigid mat or a
16 flexible mat?
17 A. (Mr. Trudeau) I haven't looked at these
18 results to determine whether or, you know, how to form
19 that opinion as to whether there's information here to
20 determine whether it's rigid or flexible.
21 Q. Did you use the pressure under the mat from
22 that data to calculate bearing capacity for your bearing
23 capacity analysis?
24 A. (Mr. Trudeau) I used the summary of
25 vertical soil bearing pressures in determining the

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1 bearing capacity, yes, for the dynamic bearing capacity
2 case for the two-cask, four-cask, and eight-cask loads
3 shown in page B-10 of Attachment B of this calc.

4 Q. If you'll look at page 214.
5 (Exhibit 47 marked.)

6 Exhibit 47 is page 214, Table 5.2.5-1 out of
7 the calculation package G(P017)-2. If you'll take a
8 moment and familiarize yourself with this table. Let me
9 ask that question: take a look at it.

10 Do you agree that this table shows the
11 vertical displacement of the pad varies by a factor
12 larger than 2.5 from one node to the other?

13 A. (Mr. Trudeau) That what varies by a
14 magnitude of 2.5?

15 Q. The vertical displacement of the pad varies
16 by a factor larger than 2.5 from one node to another.

17 MR. TRAVIESO-DIAZ: What column are you
18 referring the witness to?

19 MS. NAKAHARA: On column A.

20 MR. TRAVIESO-DIAZ: Which column A?

21 MS. NAKAHARA: On the lower-bound
22 properties.

23 A. (Mr. Trudeau) Is the question with respect
24 to these nodes being adjacent to one another?

25 Q. No, any two points on the mat.

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1 that at node 274, which is a point some almost 30 feet
2 away from point node 144, the displacement is greater.
3 So in the vertical direction, it appears the pad must be
4 bending.

5 Q. Dr. Chang, do you have an opinion or do you
6 agree?

7 A. (Dr. Chang) Based on the result, that means
8 that they are not the same. So basically not -- you
9 said still rigid, then everything should be the same.
10 So the pad is elastic.

11 A. (Mr. Trudeau) I suppose it could be tilted,
12 too.

13 Q. If the pad were bending, do you believe that
14 in calculating soil spring and damping you should assume
15 that the pads are rigid?

16 A. (Mr. Trudeau) That's, again, outside my
17 scope on this project. Geomatrix is responsible for
18 those soil springs and damping that were applied in the
19 soil structure interaction analyses.

20 Q. Do you have an opinion?

21 A. (Mr. Trudeau) No.

22 Q. Dr. Chang?

23 A. (Dr. Chang) No.

24 Q. Earlier I believe you testified that the
25 pads are only -- are five feet apart in longitudinal

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1 A. (Mr. Trudeau) Any two points on the mat.
2 Perhaps you can help me. Which nodes are we talking
3 about?

4 Q. 274. For example, 274 versus 144.

5 A. (Mr. Trudeau) 274 versus 144?

6 Q. Yes.

7 A. (Mr. Trudeau) And the question is the
8 difference between those?

9 Q. Do you agree the vertical displacement
10 between those two nodes varies by a factor larger than
11 2.5?

12 A. (Mr. Trudeau) The vertical displacement at
13 node 274 is listed as 0.046 feet, and the displacement
14 at node 144 is listed as 0.017 feet.

15 Q. In your opinion, would this indicate, the
16 difference between the two nodes indicate that the pad
17 is not rigid?

18 MR. TRAVIESO-DIAZ: Object to the question.
19 The witness may answer.

20 A. (Mr. Trudeau) I'm not familiar with this
21 calculation, so I don't know exactly what it is I'm
22 looking at. This is the displacements at the bottom of
23 the pads from CEC's analysis?

24 Q. Yes.

25 A. (Mr. Trudeau) So what this is telling us is

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1 direction. Is that correct?

2 A. (Mr. Trudeau) Correct.

3 Q. Because the 64-foot pads are only five feet
4 apart in longitudinal direction, did you consider the
5 effect of pad-to-pad interaction?

6 MR. TRAVIESO-DIAZ: For what?

7 MS. NAKAHARA: For seismic loads.

8 MR. TRAVIESO-DIAZ: Do you understand the
9 question?

10 A. (Mr. Trudeau) In the pad stability analyses
11 G(B)4? Is that what we're talking about?

12 Q. Yes.

13 A. (Mr. Trudeau) The stability analysis in
14 Calc G(B)4 took the dynamic loads on A single pad and
15 used those in the analysis of the pad, so it did not
16 combine pad after pad after pad in a row.

17 Q. Why not?

18 A. (Mr. Trudeau) Why?

19 Q. If the pads are only five feet apart, in
20 your opinion you wouldn't expect A pad-to-pad
21 interaction?

22 A. (Mr. Trudeau) I would expect that these are
23 the maximum loads that any one pad would see at any one
24 time. If you go far enough down the line, the loads are
25 going to be less on adjacent pads. So if one pad can

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1 stay in place for the maximum load that occurs at any
2 particular time during the earthquake, the pad next to
3 it will not see those same maximum loads. They'll be
4 reduced somewhat.

5 Q. What's the basis of that opinion, your
6 opinion?

7 A. (Mr. Trudeau) Just the nature of the
8 seismic loading. The seismic loading comes in waves, so
9 that it's impossible for the pad at the beginning of the
10 row to see and experience the same acceleration as the
11 pad at the end of the row.

12 Q. If the pads are all the same, would they
13 create resonance that would increase the seismic loads?

14 A. (Mr. Trudeau) I don't know.

15 Q. Is it correct you did not consider it, the
16 effect of resonance?

17 A. (Mr. Trudeau) Correct.

18 Q. If you'll look at, and I didn't make copies
19 of this, SAR page 2.6-59. Are you familiar with PFS's
20 analysis of overturning and sliding stability of the
21 pads?

22 A. (Mr. Trudeau) Correct, yes.

23 Q. Do you agree that the analysis of
24 overturning and sliding stability of the pads are based
25 on the maximum peak ground acceleration?

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1 calc at all. Before I could answer that, I would need
2 to know what the coordinate system is that's used in
3 this. This is referring to a Z direction at node 261.
4 I can only assume you have provided me with a vertical.

5 Q. Did you consider the natural frequency of
6 the soil pad system in the overturning analysis?

7 A. (Mr. Trudeau) No.

8 Q. And why not?

9 A. (Mr. Trudeau) I assumed the pad was rigid
10 in the horizontal direction.

11 Q. If you will look at the Safety Analysis
12 Report on page 2.6-59, Revision 13. Is the maximum peak
13 ground acceleration in the vertical direction in that
14 calculation?

15 A. (Mr. Trudeau) 0.533 G's.

16 Q. What is your basis for using .33 G's in that
17 calculation -- .533 G's?

18 A. (Mr. Trudeau) I was calculating the inertia
19 of the pad using the peak ground acceleration in a
20 vertical direction.

21 Q. Why did you use the peak ground
22 acceleration?

23 A. (Mr. Trudeau) Because I thought that was
24 the right value to use.

25 Q. Do you agree that the right acceleration is

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1 A. (Mr. Trudeau) It's not clear from this page
2 what was done in sliding analysis, but what I can see
3 for the overturning analysis is that the inertial force
4 of the pad was used based on the peak ground
5 acceleration.

6 Q. Do you agree that using maximum peak ground
7 acceleration -- strike that.

8 Do you agree that using maximum peak ground
9 acceleration to attain inertial load to analyze
10 overturning of the pads is only valid for rigid systems?

11 A. (Mr. Trudeau) The pad is a rigid system in
12 the horizontal direction. We're talking about
13 horizontal loads to overturn this pad.

14 Q. So you would agree that it is all developed
15 for a rigid system?

16 A. (Mr. Trudeau) Correct.

17 Q. This is from calculation package G(P017)-2,
18 page 177, which is a graph of amplitude and frequency.
19 Are you familiar with this graph?

20 A. (Mr. Trudeau) No.

21 Q. Based on looking at the graph, do you agree
22 that the vertical frequency of a cask/pad soil system
23 varies from below 5 cycles per second to above 8 cycles
24 per second depending on the soil properties considered?

25 A. (Mr. Trudeau) I'm not familiar with this

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1 the acceleration at the natural frequency of the soil
2 pad?

3 A. (Mr. Trudeau) I guess I would have to say
4 no, because if I thought that was the right one, that's
5 the one I would have used.

6 Q. Are you familiar with the vertical design
7 response spectrum?

8 MR. TRAVIESO-DIAZ: Sorry -- the vertical
9 design response spectrum of what?

10 MS. NAKAHARA: The design basis motion.

11 MR. TRAVIESO-DIAZ: Of what?

12 MS. NAKAHARA: Of the PFS facility.

13 MR. TRAVIESO-DIAZ: Do you understand the
14 question?

15 A. (Mr. Trudeau) That's an area that our
16 structural mechanics people would be involved with.

17 MS. NAKAHARA: Can we take a five-minute
18 break while we look for a document?

19 (Recess from 6:20 to 6:33 p.m.)

20 Q. (By Ms. Nakahara) Page 20 out of
21 Calculation Package 05996.02-G(P018)-3, dated 8/24/99,
22 Figure 7. Are you familiar with this document?

23 A. (Mr. Trudeau) I know what it is, but I've
24 never reviewed it. This is the generation of the
25 artificial time history, I believe.

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1 Q. Yes. On the right-hand graph is the
2 vertical response spectrum design, design response
3 spectrum. Based on this spectrum, would you -- in your
4 opinion, would you agree that .533 G's applies to a
5 foundation with natural periods at approximately .02
6 seconds?

7 MR. TRAVIESO-DIAZ: Excuse me, Counsel. Are
8 you asking the witness to read a part of the graph, or
9 what is it that you're asking him to do?

10 MS. NAKAHARA: He agreed that .33 G on this
11 graph -- .533 G's on this graph applies to a foundation
12 with natural periods at approximately 0.2 seconds.

13 A. (Mr. Trudeau) 0.02 seconds. That's what I
14 believe this is saying, yes.

15 Q. (By Ms. Nakahara) If the natural period of
16 the soil pad system in the vertical direction is in a
17 range on this graph between .1 to .3 seconds, do you
18 agree acceleration would be higher than 0.33 G's,
19 0.533 G's?

20 A. (Mr. Trudeau) Yes.

21 Q. Based on this response spectrum, would your
22 calculations on SAR page 2.6-59 for overturning of the
23 pads, were those calculations changed which used the
24 0.533 G's?

25 A. (Mr. Trudeau) I don't know.

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1 Q. You've already answered this, but is it
2 correct that you did not consider the natural frequency
3 of the soil pad system in your analysis of overturning
4 of the pads?

5 A. (Mr. Trudeau) Yes.

6 Q. Did you consider the natural frequency of
7 the soil pad system in your sliding analysis that you
8 calculated in G(B)04?

9 A. (Mr. Trudeau) No.

10 Q. And why not?

11 A. (Mr. Trudeau) I assume that the pad was
12 rigid in the horizontal direction because it is rigid in
13 the horizontal direction.

14 Q. Is it correct that the pad was supported by
15 30 feet of medium stiff to stiff soil?

16 A. (Mr. Trudeau) As well as a thin layer of
17 soil cement.

18 Q. Based on the fact that the pad is supported
19 by 30 feet of medium stiff and stiff soil, wouldn't that
20 indicate that the soil pad system is not rigid?

21 MR. TRAVIESO-DIAZ: I think he answered that
22 question twice already. He's assumed it was rigid.

23 A. (Mr. Trudeau) In the horizontal direction.

24 MR. TRAVIESO-DIAZ: In the horizontal
25 direction.

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1 A. (Mr. Trudeau) Which is the direction
2 applicable for sliding.

3 Q. (By Ms. Nakahara) In your assumption that
4 the pad is rigid in the horizontal direction, did you
5 only consider the concrete pad, or the concrete pad and
6 soil in combination?

7 A. (Mr. Trudeau) The concrete pad.

8 Q. Do you agree that the natural frequency in
9 the horizontal direction for the soil is different -- is
10 driven by soil dynamic, by dynamic soil properties --
11 strike that. Let me start over and try this again.

12 Would you agree that the natural -- just a
13 minute. Let me try this again.

14 Would you agree that the natural frequency
15 in the horizontal direction is driven by dynamic soil
16 properties?

17 A. (Mr. Trudeau) I don't know.

18 Q. What information -- what type of information
19 would allow you to assess whether the natural frequency
20 in the horizontal direction is driven by dynamic soil
21 properties?

22 A. (Mr. Trudeau) I don't know.

23 Q. This is Document G(P018)-1. Did I ask you
24 about this document before? This is Soil and Foundation
25 Parameters for Dynamic Soil Structure Interaction

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1 Analysis, dated -- reviewed 8/26/99, Revision 1. Are
2 you familiar with this document?

3 A. (Mr. Trudeau) Yes.

4 Q. What is your familiarity?

5 A. (Mr. Trudeau) I understand that this is a
6 calculation that was prepared by Geomatrix to develop
7 the strain compatible soil properties for use by our
8 structural mechanics people in their soil structure
9 interaction analyses for the 1,000-year return period
10 earthquake.

11 Q. The one thousand?

12 A. (Mr. Trudeau) Yes, ma'am.

13 Q. Did you use any of the calculations from
14 this document in any of your subsequent calculations?

15 A. (Mr. Trudeau) I don't think so. I mean,
16 I've reported these results in the geotech design
17 criteria. Geomatrix had the scope to produce those
18 dynamic soil properties, and I added them to our geotech
19 design criteria for use by our structural mechanics
20 people and Holtec and CEC.

21 For the record, this calc is supplemented or
22 superseded by G(P018)-2, which is applicable for the
23 2,000-year return period earthquake. This calculation
24 supplements (P018)-2 inasmuch as the soil profile
25 background information is developed in this calculation.

1 As opposed to reiterating it in (P018)-2, Geomatrix just
2 referred back to this one in their subsequent calc.
3 Q. Do you know whether in this document it
4 states that below 45 feet the soil properties are not
5 well defined?
6 A. (Mr. Trudeau) I don't recall.
7 Q. Dr. Chang, are you familiar with this
8 document?
9 A. (Dr. Chang) No.
10 Q. Are you familiar with the effects of
11 concrete cracking under seismic loads?
12 A. (Mr. Trudeau) No.
13 MS. CHANCELLOR: I'd just like to say if the
14 witnesses get tired, please let us know and we can
15 continue this in the morning.
16 Q. (By Ms. Nakahara) Do you know if the
17 foundation stability analysis from -- strike that.
18 Do you know if the seismic loads for
19 foundation stability analysis were obtained from dynamic
20 analysis of the building, for the canister transfer
21 building?
22 A. (Mr. Trudeau) The dynamic loads applied in
23 the Calc G(B)13 did come from the soil structure
24 interaction analysis.
25 Q. Were the seismic loads obtained from the

1 acceleration response from the dynamic analysis?
2 A. (Mr. Trudeau) Yes.
3 Q. Did the canister transfer building analysis
4 consider the effect of rotational mass moment of
5 inertia?
6 A. (Mr. Trudeau) I don't know. I took the
7 loads that were provided me in this Table 2. This Table
8 2 I believe was based on one of the SC calcs. I'd have
9 to look there to find that answer, I think.
10 Yes, page 41 of this calc says that "the
11 dynamic bearing capacity was analyzed using dynamic
12 loads for the building that were developed in
13 Calculation 05996.02-SC-5."
14 Q. Did you use the loads from SC-5 or
15 acceleration response?
16 A. (Mr. Trudeau) I used the masses and the
17 accelerations provided by SC-5.
18 Q. Why didn't you include mass moment of
19 inertia calculation in your calculation?
20 A. (Mr. Trudeau) I didn't, you know -- I
21 didn't think I needed to.
22 Q. Based on --
23 A. (Mr. Trudeau) Well, I thought that the
24 correct way to calculate the dynamic load was to take
25 the masses that were provided to me with the peak

1 soil structure interaction analysis?
2 A. (Mr. Trudeau) Yes.
3 Q. This is calculation package 5996.02-G(B)13,
4 entitled Stability Analysis of the canister transfer
5 building Supported on a Mat Foundation, Rev. 2. Are you
6 familiar with this document?
7 A. (Mr. Trudeau) Rev. 3.
8 Q. Rev. 3.
9 A. (Mr. Trudeau) Yes.
10 Q. Is it correct that you are the preparer of
11 this document?
12 A. (Mr. Trudeau) Of Rev. 2 and 3, yes.
13 Q. Is it correct that Dr. Chang is the
14 independent reviewer and reviewer?
15 A. (Dr. Chang) Yes.
16 MR. TRAVIESO-DIAZ: I'd just like to state
17 for the record that went through all this with respect
18 to this document, which is Exhibit 46, in the prior
19 examination by Ms. Chancellor.
20 MS. NAKAHARA: And I apologize. It's been a
21 long day, which doesn't help you.
22 Q. (By Ms. Nakahara) Is it correct that the
23 canister transfer building stability analysis in this
24 document, that the seismic loads are obtained by
25 multiplying the mass at each elevation by the

1 acceleration values that were provided me to come up
2 with a force. Those are the forces I used.
3 Q. Do you agree that the mass moment of inertia
4 creates additional overturning?
5 A. (Mr. Trudeau) I don't know, nor do I know
6 that those aren't already included in these
7 accelerations that are shown here.
8 Q. If the mass moment of inertia is not
9 included in the Table 2 of Calculation SC-5, would you
10 agree that estimating seismic load by multiplying mass
11 times acceleration ignores the coupling from the two
12 horizontal directions?
13 A. (Mr. Trudeau) I don't know. This table
14 included the two different horizontal directions by
15 combining them in accordance with the 14040 Rule that
16 comes from ASCE 4 now dash 98, but we're using 4-86, and
17 also the SRP, I believe -- I don't remember the number.
18 But it's an acceptable way of combining these horizontal
19 components in this analysis. So I don't know if what
20 you're suggesting results in different values, but the
21 horizontal components were combined in this manner in
22 this analysis.
23 Q. Do you have an opinion, Dr. Chang?
24 A. (Dr. Chang) No. I think what happened,
25 it's whatever the structural mechanics give us a load,

1 and we use their load in all our analysis.

2 Q. Same document I just took from you, G(B)13
3 on page 15, look at that. Do you agree that PFS used a
4 shear key one foot deep around the canister transfer
5 building to improve the shear resistance against
6 sliding?

7 A. (Mr. Trudeau) Yes.

8 Q. Do you agree that this document -- this
9 calculation document estimates a factor of safety as low
10 as 1.1?

11 MR. TRAVIESO-DIAZ: Where in the exhibit are
12 you asking the witness to look?

13 A. (Mr. Trudeau) Yes.

14 Q. (By Ms. Nakahara) Do you agree that this
15 factor of safety calculation lies on the passive
16 resistance behind the one-foot shear key to develop the
17 resisting forces against sliding?

18 MR. TRAVIESO-DIAZ: I object to the
19 question. You can answer if you can.

20 A. (Mr. Trudeau) I'm sorry. Could you repeat
21 the question again, please?

22 MS. NAKAHARA: Would you read that back?
23 (The pending question was read.)

24 A. (Mr. Trudeau) Yes.

25 Q. This is calculation package G(P018)-2,

1 Q. Are you aware of the shear strength value
2 used in calculation package (P018)-2?

3 A. (Mr. Trudeau) The shear strength values
4 used for (P018)-2?

5 Q. Strike that. Are you aware of the shear
6 strength value used in calculation package G(B)13?

7 A. (Mr. Trudeau) For sliding?

8 Q. For stability analysis.

9 A. (Mr. Trudeau) I did the analysis. I don't
10 remember the numbers. I'll find them.

11 Undrained strength used for dynamic bearing
12 capacity analysis was 2.2 ksf, but it was modified based
13 on the cone penetration test results to -- the 2.2 ksf
14 was measured for what we were earlier calling layer 2.
15 All of the boring data and the cone penetration data
16 indicate that what we were calling layer 4 and layer 3
17 are stronger than the layer 2. And for bearing capacity
18 analyses of the entire upper layer, it's appropriate to
19 use an average strength to resist bearing failure. So
20 we adjusted the 2.2 values in a relative increase as
21 measured in the cone penetration test data. So the
22 resulting average shear strength for the dynamic bearing
23 capacity was 3.18 ksf.

24 Q. Did that shear strength value of 2.2 kips
25 per square feet account for mobilized shear strength due

1 titled Soil and Foundation Parameters for Dynamic Soil
2 Structure Interaction Analysis, 2,000-Year Return
3 Period, Design Ground Motions, last reviewed 8/10/99.
4 Are you familiar with this document?

5 A. (Mr. Trudeau) Yes.

6 Q. And what is your familiarity?

7 A. (Mr. Trudeau) This is the current strain
8 compatible soil property development calculation that
9 Geomatrix prepared for the 2,000-year return period
10 earthquake, the current design ground motion.

11 Q. Did you use any of this data in any of your
12 calculations?

13 A. (Mr. Trudeau) It's the same answer that I
14 provided to the -- you know, I thought I was answering
15 that question on this calc before. You know, I do not
16 believe that I used any of these results in geotechnical
17 calcs, but I understand that these were used in the soil
18 structure interaction analysis. They do appear in
19 geotech design criteria for that purpose.

20 Q. Do you know if in calculation package
21 (P018)-2 if part of the shear strength has already been
22 mobilized due to the free field wave propagation and the
23 full soil shear strength is not available to resist the
24 inertial load of the structure?

25 A. (Mr. Trudeau) I don't know.

1 to free field wave propagation?

2 A. (Mr. Trudeau) No.

3 Q. Why not?

4 A. (Mr. Trudeau) I didn't think it needed to.

5 Q. Based on what assumption?

6 A. (Mr. Trudeau) No assumption necessary. I
7 just didn't --

8 Q. Does free field propagation impose loading
9 on the soil?

10 A. (Mr. Trudeau) I don't know.

11 Q. Is it correct this morning that you
12 testified you estimated free field shear stresses to
13 plan the triaxial -- cyclic triaxial tests?

14 A. (Mr. Trudeau) Yes.

15 Q. Would that imply there is free field
16 propagation loading on the soil?

17 A. (Mr. Trudeau) I didn't understand the --

18 Q. Does that mean -- strike that last question.
19 Does that mean that loading from free field -- from free
20 field wave propagation would be imposed on the soil?

21 A. (Mr. Trudeau) I guess so, yes. I didn't
22 understand the way the question was presented that
23 that's the stresses that we're talking about.

24 Q. Okay. If those are the stresses we're
25 talking about -- strike the last part of that. If you

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1 use free field shear stresses to plan the triaxial, the
2 cyclic triaxial tests, why didn't you consider the free
3 field wave propagation in the stability analysis?

4 MR. TRAVIESO-DIAZ: The witness just
5 testified he didn't think he needed to.

6 MS. NAKAHARA: But I thought he said he
7 didn't understand the stresses that --

8 I guess maybe I don't understand. He didn't
9 understand my question, and then I didn't understand his
10 response.

11 A. (Mr. Trudeau) It didn't occur to me that we
12 needed to be including the free field shear stresses in
13 the soil, in the sliding stability analysis.

14 Q. Would you change your opinion now?

15 A. (Mr. Trudeau) I don't know. I would want
16 to think about it.

17 Q. Dr. Chang, do you have an opinion?

18 A. (Dr. Chang) I think that's two different
19 things. One is the free field. That's typical, that's
20 a normal seismic measure to calculate what the strain of
21 the soil is going to be due to wave propagation. And
22 during that one, if you have a soil -- you have a
23 structure on the top, typical the low, the stress is
24 still not going to change that much. The structure on
25 the top have some effect, but overall you have to go

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1 with the soil structure interaction analysis, and that
2 stress is based on a sealed beam analysis, one
3 dimension. And when you have a structure on the top,
4 typical the structure will have inertial force, and for
5 this bearing capacity we only include that inertial
6 force and apply on the soil. And the stress we apply
7 through the propagation may not be the same time as the
8 inertial force and also may not be in the same
9 direction.

10 So when you do an analysis, if you pursue to
11 that, you have to be really careful because we really
12 don't know what we deal with. So basic for the bearing
13 capacity analysis, we only consider inertial force of
14 the structure.

15 Q. In your stability analysis, did you use
16 passive soil pressure on one side of the key, on one
17 side of the shear key?

18 MR. TRAVIESO-DIAZ: Which stability
19 analysis?

20 MS. NAKAHARA: The canister transfer
21 building.

22 A. (Mr. Trudeau) I already indicated we did
23 that on the analysis that follows the page 15 you
24 pointed me to before. That, I'd like to add, is a
25 hypothetical analysis of sliding on a potential deeper

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1 lying soil that maybe doesn't have cementation, and it
2 used the passive resistance on the potentially sliding
3 block to show that it would stay in place. Before that
4 block could move, we need to exceed the passive
5 resistance of that soil.

6 Q. (By Ms. Nakahara) Did you consider the
7 static and seismic soil pressure on the other side of
8 the shear key in your stability analysis?

9 A. (Mr. Trudeau) This, again, is that
10 deep-seated failure plane we're talking about, or the
11 other analysis of the building?

12 Q. In the calculation that you used passive
13 pressure from the shear key.

14 A. (Mr. Trudeau) I'm looking at page 13 of
15 this calc that does the sliding stability analysis of
16 the canister transfer building founded on the in situ
17 silty clay soils. And I see that we used half of the
18 passive resistance on the side of the building down to
19 the bottom of the perimeter key, a six-foot height.

20 Q. So is it correct you did not consider the
21 static and seismic soil pressure on the other side of
22 the key?

23 A. (Mr. Trudeau) I haven't gotten that far
24 yet.

25 Q. I'm sorry.

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1 A. (Mr. Trudeau) We included half of the
2 passive resistance.

3 It appears we did not include it.

4 Q. Why not?

5 A. (Mr. Trudeau) I don't see any mention of it
6 in this calculation. I believe the fact that they're
7 not included is just an oversight. The numbers that
8 we're talking about are for very lightweight materials.
9 They're going to be very small numbers that would be I
10 suspect less than the half of the passive resistance
11 that we didn't include.

12 MS. NAKAHARA: Can you want to read back his
13 answer?

14 (The last answer was read back.)

15 Q. (By Ms. Nakahara) Do you mean an oversight
16 in not putting it in the document, or an oversight that
17 you did not consider the static and seismic soil
18 pressure on the other side of the shear key?

19 A. (Mr. Trudeau) I don't understand the
20 difference in the question.

21 Q. Did you actually consider the static and
22 seismic soil pressure on the other side of the shear
23 key, or did you just not put in the fact that you
24 considered it in this document?

25 A. (Mr. Trudeau) It appears that we didn't

Deposition of: Paul Trudeau and Thomas Y. Chang
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1 consider it.
2 Q. Okay, thank you. Do you agree -- do you
3 need to look some more?
4 A. (Mr. Trudeau) Yes. Could I have just a
5 couple minutes, please?
6 Q. Sure. Take as much time as you need.
7 A. (Mr. Trudeau) It's not like me to not
8 include that kind of thing, so I want to make sure it's
9 not here.
10 Q. Would you like to take a break so we're not
11 all staring at you?
12 A. (Mr. Trudeau) That would be fine. I just
13 need about five minutes.
14 (Recess from 7:29 to 7:40 p.m.)
15 A. (Mr. Trudeau) I can't see it in this calc.
16 I'm afraid to say I think it was just an oversight that
17 it wasn't included. I believe it's going to be a very
18 small number. We have the same calc in the calc -- I
19 mean, the pad stability analysis. We can see there that
20 it's a very small number. It's going -- I would assume
21 be less than the passive resistance. Looks like it was
22 just an oversight.
23 Q. (By Ms. Nakahara) Do you agree that the
24 soil behind the face of the mat has low overburden
25 pressure; the passive resistance will actually develop

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1 behind the shear key on the inner side of the mat where
2 the overburden of the building confines the soil?
3 A. (Mr. Trudeau) I believe the passive
4 resistance will build on both places.
5 Q. Do you have an opinion on which location
6 would have a higher passive resistance?
7 A. (Mr. Trudeau) The material behind the key
8 will provide more of the resistance.
9 Q. Will the overburden of the building
10 contribute to the passive resistance?
11 A. (Mr. Trudeau) Yes.
12 Q. Do you agree that the passive resistance
13 under the mat mobilizes the passive zone and develops
14 vertical loads acting locally under the mat?
15 A. (Mr. Trudeau) I don't think -- I don't
16 understand the question. Could you say it again,
17 please? Let me hear it again.
18 (The pending question was read.)
19 A. (Mr. Trudeau) There clearly are vertical
20 loads under the mat. What effect the passive resistance
21 behind the key has, I don't know.
22 Q. Would the passive soil on the inner side of
23 the mat put a vertical load on the mat?
24 A. (Mr. Trudeau) The mat overlying the soil is
25 holding it in place, so one acts against the other. I

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1 guess the answer would be yes.
2 Q. Did you consider the passive soil and its
3 reaction under the mat in the stability analysis of the
4 canister transfer building and design of the mat?
5 A. (Mr. Trudeau) The analysis assumes that the
6 block of clay encompassed by the perimeter key is held
7 in place by the perimeter key so that the resistance to
8 motion is provided on the base of the plane defined by
9 the bottom of the key.
10 Q. Would that imply there's no passive zone
11 under the mat?
12 A. (Mr. Trudeau) It doesn't take credit to
13 that passive resistance. It assumes that all of the
14 strength is provided by shearing across the plain at the
15 bottom of the key.
16 Q. The passive load, passive zone -- strike
17 that. If a passive zone develops under the mat, would
18 it put a vertical load on the mat?
19 A. (Mr. Trudeau) I'm not sure you would have a
20 passive failure in that location. I think the soil is
21 shearing below the plain defined by the perimeter key.
22 And shearing at that point, it wouldn't get the vertical
23 load that you're looking for, in my opinion.
24 Q. Dr. Chang, do you agree with Mr. Trudeau?
25 A. (Dr. Chang) There shouldn't be large amount

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1 of what they call load, because you have to consider the
2 rigidity of the mat and the shear key. Basic they all
3 move together, and the passive inside going to develop
4 if the key moves against the soil, and the soil on the
5 low core move up, and then you can develop the vertical
6 load. But in this condition everything move together,
7 you shouldn't have.
8 Q. Is the mass of the soil inside the shear key
9 circle considered in calculating a load?
10 A. (Mr. Trudeau) I don't recall. I don't
11 think it was.
12 Q. Why not?
13 A. (Mr. Trudeau) I don't know why not.
14 Q. Earlier we -- earlier I asked you questions
15 with respect to your overturning analysis in G(B)13. Do
16 you agree that in calculating the resisting moment for
17 the overturning -- in the overturning analysis that you
18 assume the mass center of the building is at the center
19 of the mat?
20 A. (Mr. Trudeau) The resisting moment is
21 calculated as the width of the building times the
22 distance from one edge of the mat to the center of the
23 mat.
24 Q. By making that assumption, did you account
25 for the mass eccentricity at various elevations and

Deposition of: Paul Trudeau and Thomas Y. Chang
DATE TAKEN: November 15, 2000

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1 underestimating the overturning moment?
2 A. (Mr. Trudeau) I don't know.
3 Q. Did you consider that at each elevation the
4 mass is not centered at the center of the mat?
5 A. (Mr. Trudeau) No.
6 Q. Why not?
7 A. (Mr. Trudeau) I didn't know that they
8 weren't centered.
9 MS. NAKAHARA: Can you read my last
10 question?
11 (The record was read: "Q. Did you consider that at
12 each elevation the mass is not centered at the center of
13 the mat?")
14 Q. (By Ms. Nakahara) If the mass is not
15 centered at the center of the mat for each elevation,
16 would that change your overturning analysis calculation?
17 A. (Mr. Trudeau) It could.
18 Q. In Calculation Package SC-5, which you
19 already testified you weren't familiar with, it
20 describes the -- in Attachment A, the building masses.
21 And it gives the masses -- the masses, centroid and
22 masses and mass moment of inertia at each elevation
23 using the Stone & Webster computer program M-A-S-S. And
24 although you're not familiar with that document
25 specifically, have you seen any of the data in that

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1 document?
2 MR. TRAVIESO-DIAZ: Objection. The witness
3 testified that he's not familiar with the document.
4 MS. NAKAHARA: With the specific document,
5 but I mean the data.
6 A. (Mr. Trudeau) Well, I believe this is the
7 document that the masses and accelerations that I show
8 in my Table 2 of G(B)13 came from, but I don't know
9 where in this calc it came from. And I'm not familiar
10 with this page that you're referencing as Attachment A.
11 Q. Can you clarify what processes are in place
12 to ensure that you were provided with all applicable
13 information for your calculation, for example, to ensure
14 that you were given all applicable building mass
15 information from this document, SC-5?
16 MR. TRAVIESO-DIAZ: Objection. The question
17 was asked to this morning, and he testified at length
18 how the design process and the sharing of information
19 among disciplines and all the things that went on. We
20 talked about that for at least 15 minutes. It's asked
21 and answered.
22 Q. (By Ms. Nakahara) Doesn't that show there
23 are gaps in the process if you're not sure what
24 information from various calculation packages you've
25 incorporated into subsequent calculation packages?

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1 MR. TRAVIESO-DIAZ: Objection. That's not
2 what he testified. He testified where he got
3 information from.
4 A. (Mr. Trudeau) I thought I had all the
5 information I needed.
6 Q. Is the information -- is it correct that --
7 strike that.
8 Who would identify what information from
9 calculation package SC-5 goes into the design document
10 that you obtained your information from?
11 A. (Mr. Trudeau) Who would do what?
12 Q. Who would identify what information in
13 Calculation SC-5 would go into the overall design
14 document that everyone else gets their information from?
15 A. (Mr. Trudeau) I would guess the structural
16 mechanics people that prepared that calc would provide
17 that information.
18 Q. And are they familiar with the type of
19 information that you and other teams would need for the
20 various different calculations?
21 A. (Mr. Trudeau) I believe so, yes.
22 Q. And how would they become familiar with the
23 type of information necessary for other teams'
24 calculations?
25 A. (Mr. Trudeau) I would have requested the

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1 dynamic loads for use in an overturning and sliding
2 analysis, and he would have provided them.
3 Now, the fact that I haven't included an
4 eccentricity on the different elevations may mean that
5 that's not significant. I don't know. I haven't seen
6 that information. It needs to be checked, having
7 brought up this issue. I thought that it was a
8 symmetrically designed building and that it didn't need
9 to be included in my analyses, because that information
10 hadn't been provided when I asked for the loads.
11 Q. When you indicate the type of information
12 that you need for various calculations, do you also
13 provide the type of parameters such as identifying
14 whether the mass centers are the same at each elevation?
15 A. (Mr. Trudeau) I did not specifically ask
16 for that information.
17 Q. In general, would you identify various
18 parameters for the type of information? Strike that.
19 If you thought that eccentricity was
20 important, when you asked for information from other
21 disciplines or from other teams, would you have
22 specified that you wanted to know whether the mass
23 centers were different at different elevations?
24 A. (Mr. Trudeau) Obviously.
25 Q. Okay. So for similar types of information

Deposition of: Paul Trudeau and Thomas Y. Chang
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1 that you requested, you would -- if you felt it was
2 important, you would identify the type of parameters;
3 you would define the parameters of information you
4 wanted. Is that correct?

5 A. (Mr. Trudeau) Correct.

6 Q. Do you believe any oversight in considering
7 eccentricity would underestimate the overturning moment?

8 A. (Mr. Trudeau) I can agree that it might,
9 but I suspect that the differences aren't that great. I
10 will have to review the centers of gravity of these
11 masses and see just how much it does affect these
12 analyses.

13 Q. Dr. Chang, do you agree?

14 A. (Dr. Chang) I think what we have to know,
15 exact what the structural mechanics provide to us. They
16 provide to us the vertical load and also the moment, and
17 some of the eccentricity probably already included in
18 their analysis. So whatever the load, they give it to
19 us, give it to the center of the foundation. Center of
20 the foundation. And it include the moment. So those
21 moment of shear force are probably already considered on
22 the whole structure of eccentricity. So we really don't
23 know. We have to check it out.

24 Q. Did you obtain the seismic loads directly
25 from the seismic -- or the structural group, or did you

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1 obtain the accelerations and calculate the loads?

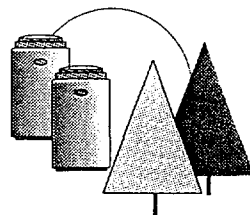
2 A. (Mr. Trudeau) We obtained the accelerations
3 and the masses.

4 MS. NAKAHARA: I think we're finally done,
5 gentlemen. Thank you.

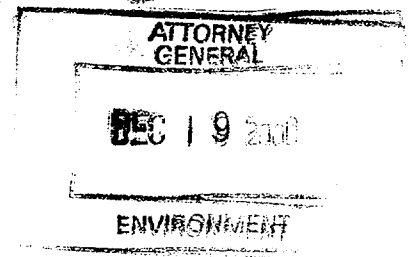
6 (Deposition was concluded at 8:06 p.m.)

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Private Fuel Storage, LLC



P.O. Box C4010, La Crosse, WI 54602-4010

John D. Parkyn, Chairman of the Board

December 11, 2000

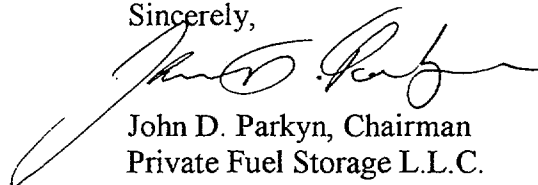
Mr. Mark Delligatti
Senior Project Manager
Spent Fuel Project Office
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

GEOTECHNICAL CHARACTERIZATION OF PFSF SITE
DOCKET NO. 72-22/TAC NO. L22462
PRIVATE FUEL STORAGE FACILITY
PRIVATE FUEL STORAGE L.L.C.

Recent evaluations of test data previously collected for the Private Fuel Storage Facility (PFSF) site suggest that some of the data may not have been fully integrated into the geotechnical assessment of the site. We are currently assessing the implications that this might have with respect to design basis ground motion, soil/structure interactions, stability analyses, and other related issues. PFS anticipates completing this assessment by December 22, 2000. If we determine from this assessment that there is an impact on our licensing basis, we will provide at that time a timetable of the actions necessary to update our License Application. We do not believe that this assessment has any implications with respect to our analysis of the seismicity of the site or the choice of the appropriate return period used to select the seismic design response spectra.

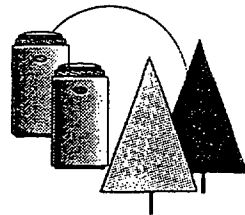
If you have any questions please contact me at 608-787-1236 or Mr. J. L. Donnell, Project Director, at 303-741-7009.

Sincerely,



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

Mark Delligatti
John Donnell
Jay Silberg
Sherwin Turk
Asadul Chowdhury
Murray Wade
Scott Northard
Denise Chancellor
Richard E. Condit
John Paul Kennedy
Joro Walker



Private Fuel Storage, LLC

P.O. Box C4010, La Crosse, WI 54602-4010

John D. Parkyn, Chairman of the Board

December 22, 2000

Mr. Mark Delligatti
Senior Project Manager
Spent Fuel Project Office
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

GEOTECHNICAL CHARACTERIZATION OF PFSF SITE
DOCKET NO. 72-22 / TAC NO. L22462
PRIVATE FUEL STORAGE FACILITY
PRIVATE FUEL STORAGE L.L.C.

Reference: PFS Letter, Parkyn to Delligatti, Geotechnical Characterization of PFSF Site, dated December 11, 2000

PFS has completed the initial assessment of the implications of revisions to the geotechnical characterization of the PFSF site resulting from the inclusion of data not previously incorporated. We have determined that there will be an impact to the project licensing basis. An amendment to the License Application will be prepared to reflect the required changes in the PFSF design basis ground motion and dynamic stability analyses based on new shear and pressure wave velocity profiles being developed for the site. This amendment will update the following chapters/sections of the PFSF License Application:

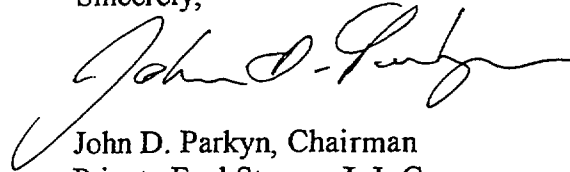
1. Section 2.6.2.1 of the SAR, "Engineering Properties of Materials for Seismic Wave Propagation and Soil-Structure Interaction", will be revised to incorporate any changes that are made to the velocity profiles and resulting changes to the site response analyses and idealized soil profiles for use in soil-structure interaction analyses. Section 2.6.1.12 of the SAR, "Stability of Foundations for Structures and Embankments" will be updated, as necessary, to revise discussions of the results of dynamic stability analyses of the storage pads and the Canister Transfer Building resulting from changes to the PFSF site design basis ground motion. SAR Section 2.6.4.9, "Design Basis Ground Motion", will be updated, as necessary, to identify the

new design basis ground motions. Changes to maintain consistency will also be made to other subsections of Section 2.6 of the SAR.

2. Section 3.2.10.1.1 of the SAR, "Design Response Spectra", will be revised to reflect the site-specific horizontal and vertical response spectra curves associated with the new design basis ground motion. Changes to maintain consistency will also be made to other subsections of Section 3.2.10 of the SAR.
3. Section 4.2.1.5.1(H) of the SAR, which evaluates the structural design of the storage cask under seismic conditions, will be updated to reflect the results of the HI-STORM storage cask stability analyses based on the new seismic response spectra. SAR Section 4.2.3.5.1, "Storage Pad Analysis", will be revised to reflect the dynamic analyses of the storage pads for the new design basis ground motion. SAR Sections 4.7.1, "Canister Transfer Building", and 4.7.2, "Canister Transfer Cranes", will be updated as necessary to incorporate changes resulting from the new seismic loads.
4. SAR Section 8.2.1, "Earthquake", will be revised to reflect the new design basis ground motion and the results of the HI-STORM storage cask stability analyses based on the new seismic response spectra. In addition, the discussion of the stability of a loaded cask transporter under seismic conditions (Section 8.2.6.2) will be updated for the new design basis ground motion.
5. Section 2.6 of the PFSF Environmental Report, which includes a summary of the geotechnical and seismic information in Chapter 2 of the SAR, will also be updated so that it is consistent with the information presented in the SAR. Section 2.6.5 of the ER, "Engineering Characteristics of Site Materials", will be revised to incorporate any changes that are made to the velocity profiles and resulting changes to the site response analyses and idealized soil profiles that were used in the soil-structure interaction analyses. ER Section 2.6.8, "Design Basis Ground Motions", will be updated, as necessary, to identify the new design basis ground motions. Changes to maintain consistency will also be made to other subsections of Section 2.6 of the ER. PFS does not anticipate that changes will be needed in the NRC's Environmental Impact Statement (EIS), since Section 4.1 of the Draft EIS, "Geology and Soils", states that "The adequacy of the proposed PFSF design to withstand earthquakes will be addressed in the NRC's final SER and is not addressed in this DEIS."

Several calculations, analyses, and reports must be revised to support the license amendment and will also be submitted to the NRC. The current target date for submittal of Amendment #20 to the License Application is March 2, 2001. If you have any questions regarding this response, please contact me at 608-787-1236 or Mr. John Donnell, Project Director, at 303-741-7009.

Sincerely,

A handwritten signature in cursive script, appearing to read "John D. Parkyn".

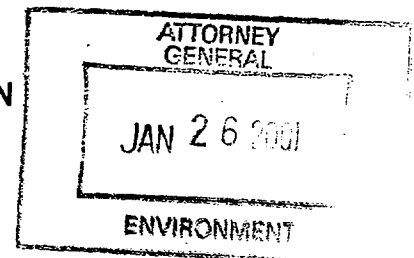
John D. Parkyn, Chairman
Private Fuel Storage L.L.C.

cc:

John Donnell
Jay Silberg
Sherwin Turk
Asadul Chowdhury
Scott Northard
Denise Chancellor
Richard E. Condit
John Paul Kennedy
Joro Walker



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001



January 19, 2001

Mr. John D. Parkyn
Chairman of the Board
Private Fuel Storage, L.L.C.
P.O. Box C4010
La Crosse, WI 54602-4010

SUBJECT: YOUR DECEMBER 11, AND DECEMBER 22, 2000, LETTERS

Dear Mr. Parkyn:

I am responding to your December 11, and December 22, 2000, letters to Mr. Mark Delligatti. In those letters you inform the U.S. Nuclear Regulatory Commission (NRC) staff that Private Fuel Storage, LLC (PFS) plans to submit amendments to its Safety Analysis Report (SAR) and the Environmental Report (ER) for the license application for the proposed Private Fuel Storage Facility (PFSF), concerning certain geotechnical matters. Your second letter details the specific sections of the SAR and ER that you anticipate will be affected. I note that subsequent to your two letters, the NRC staff determined that new information concerning aircraft crash hazards was contained in the PFS motion to the Atomic Safety and Licensing Board for summary disposition of Utah Contention K and Confederated Tribes Contention B, "Inadequate Consideration of Credible Accidents." Mr. John Donnell, of your staff, has indicated that this new information will also be included in amendments to the SAR to be submitted in late January 2001.

As you know, the NRC staff completed its Safety Evaluation Report (SER) for the proposed PFSF on September 29, 2000. The NRC staff, the Department of Interior's Bureau of Land Management and Bureau of Indian Affairs, and the Surface Transportation Board [which are cooperating with the NRC staff in the development of the PFS Final Environmental Impact Statement (FEIS)] had planned to issue the FEIS (including responses to the extensive comments received on the Draft EIS) on February 28, 2001. To this end, many Federal employees and contractors have been diligently working during the preceding period to meet this schedule, and publication of the FEIS has remained on target for February 28, 2001.

You have now informed us of additional analyses being performed related to the geophysical characterization of the proposed PFSF site. You indicated that the resulting amendments to the SAR and ER will not be submitted to the NRC until early March 2001. PFS has indicated that the design basis ground motion and dynamic stability analyses could be affected, based on new shear and pressure wave velocity profiles being developed for the site; that structural design analyses could be affected; and that the SAR and ER will both be affected. You have also indicated that the new aircraft crash data and accident analysis revision, reflecting your motion for summary disposition, will be submitted as an amendment to the SAR later this month. This SAR amendment regarding credible accidents will account for new data that PFS received from the U.S. Air Force regarding F-16 aircraft, along with PFS analysis of this and other data, and reconsideration of previously submitted data and analyses.

In your letter of December 22, you state that "PFS does not anticipate that changes will be needed" in the staff's EIS, since section 4.1 of the Draft EIS states that "[t]he adequacy of the proposed PFSF design to withstand earthquakes will be addressed in the Staff's final SER and is not addressed in this DEIS." While you correctly cite this statement, we believe you overlook the fact that in the same section of the DEIS, the staff committed to provide a summary in the FEIS of its evaluation findings concerning geologic and seismic considerations (DEIS at 1-12); also, other DEIS conclusions concerning the impacts of the facility were reached on a preliminary basis, prior to completion of the SER (see, e.g., DEIS at 4-48).

We anticipate that portions of the staff's SER published in September 2000, may need to be revised to reflect our review of your motion for summary disposition and your upcoming SAR amendment(s). If the staff determines that the bases for any safety conclusions reached in its SER have changed, a supplement to the SER will have to be developed; and even if the SER bases and conclusions remain unchanged, this would have to be documented.

With regard to the FEIS and the responses to comments on the DEIS, it cannot be determined with certainty, in advance of our receipt and review of your submittals, whether the conclusions which resulted from the staff's review of the currently docketed information are appropriate or require revision. Accordingly, in light of PFS' recent submittal of new information and its determination to amend its license application, we do not believe it would be appropriate or prudent to publish the FEIS until the staff has reviewed the new information and the upcoming license application amendments. When the staff has reviewed the new information and SAR and ER amendments, we will be able to determine the impact that the submittal of the new information and amendments may have on the schedule for completion and release of the FEIS.

Finally, PFS should consider that the Final SAR (FSAR) for the proposed PFSF must be submitted to the NRC staff under oath and affirmation. It is important, therefore, that PFS review the entire document and determine it to be complete and accurate at the time of its submittal, particularly after fully taking into consideration any impacts that may result from any new information and analyses. In addition, as Mr. Delligatti has previously indicated to Mr. Donnell, we expect all of the commitment letters associated with the safety evaluation to be included as an appendix to the FSAR.

If you have any questions regarding this letter, please contact Mr. Delligatti at (301) 415-8518.

Sincerely,



E. William Brach, Director
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No.: 72-22
cc: Service Lists

CONDENSED TRANSCRIPT

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	Docket No. 72-22
	)	ASLPB No. 97-732-02-ISFSI
PRIVATE FUEL STORAGE)	
L.L.C.)	
	)	DEPOSITION OF:
(Private Fuel Storage)	
Facility)	)	<u>WALTER J. ARABASZ</u>
)	

CONFIDENTIAL AND PROPRIETARY

Wednesday, October 18, 2000 - 9:30 a.m.

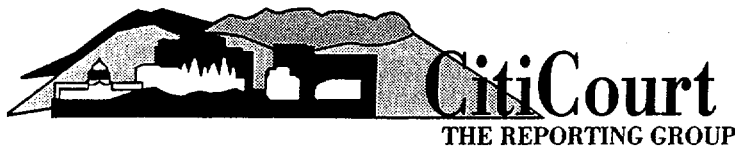
Location: Parsons, Behle & Latimer

201 S. Main, #1800

Salt Lake City, Utah

Reporter: Vicky McDaniel

Notary Public in and for the State of Utah



50 South Main, Suite 920
Salt Lake City, Utah 84144

801.532.3441

TOLL FREE 877.532.3441

FAX 801.532.3414

Date Taken: October 18, 2000

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1 study, being judged to be not directly significant.

2 Q. And you would agree with that judgment, that
3 it's not directly significant, volcanic hazard?

4 A. I am not familiar with the history of
5 volcanic activity in this general area, and I would be
6 reluctant to offer an opinion.

7 Q. Just to clarify: apart from the volcanic
8 activity, then, they did cover everything else in
9 Appendix D?

10 A. Down to the next to the last bullet, the
11 effects of human activities, I don't recall relevant
12 investigations. I would infer a judgment that they were
13 basically not material.

14 Q. And would you agree with that judgment or
15 disagree?

16 A. I'm not familiar with any history of
17 withdrawal of fluids in that basin. In general I would
18 agree, but I don't have that direct familiarity.

19 Q. Then those are the only two potential
20 exceptions that you see with respect to Appendix D?

21 A. In terms of acknowledging that appropriate
22 studies were undertaken, yes.

23 MR. GAUKLER: I'd like to have marked as
24 Exhibit 3 Utah Contention L.
25 (Exhibit 3 marked.)

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1 A. Yes.

2 Q. Then basis 4, soil stability and foundation
3 loading. It's on page 92. Do you see that?

4 A. Yes, I do.

5 Q. Of those four bases, which ones do you have
6 specific knowledge about in terms of your professional
7 ability and expertise?

8 A. Primarily basis 2, ground motion. The
9 surface faulting, I have expertise relevant to active
10 faulting and surface faulting. In advising the state, I
11 defer it to another state expert, notably Dr. Lee
12 Allison.

13 Q. But you do have expertise in that area?

14 A. Correct, yes.

15 Q. And basis 3 and 4 would be beyond your areas
16 of expertise, then?

17 A. Yes, they would be.

18 Q. What is your understanding of basis 1 as
19 it's set forth in the contention?

20 A. In general, that -- excuse me. My general
21 understanding is that there had been inadequate
22 characterization. I would need to take time to read it
23 in detail again, because I did not consider this an area
24 that I would directly have to be involved in defending,
25 that my familiarity is cursory.

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1 Q. Dr. Arabasz, what I've handed to you is an
2 excerpt from the State of Utah's original contentions
3 filed with respect to the licensing of the Private Fuel
4 Storage matter that contains Utah Contention L. Are you
5 familiar with this document?

6 A. Yes, I am.

7 Q. And have you reviewed it previously?

8 A. I have read it, yes.

9 Q. The document, for the record, is dated
10 November 23, 1997. Did you have a role in preparing
11 this document?

12 A. No, I did not.

13 Q. When did you first read this document,
14 approximately?

15 A. In early 1999 at about the time of the
16 informal discovery.

17 Q. When you look at the document, on page 80 of
18 the excerpt the top of the page it says "L,
19 Geotechnical," and then it has the basic contention, and
20 under that has basis. Basis 1 on page 80 is surface
21 faulting; basis 2 on page 82 is ground motion. Do you
22 see that?

23 A. Yes, I do.

24 Q. Basis 3 on page 83 is characterization of
25 subsurface soils.

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1 Q. Do you understand it to be an adequate
2 characterization of the site?

3 A. In general, yes.

4 Q. And what do you understand basis 2 to be?

5 A. Insofar as the seismic sources had not been
6 completely characterized, then of course the ground
7 motion characterization on which that rests would have
8 been indeterminate, and that some features of ground
9 motion relating to proximity to active faults, notably
10 near surface -- excuse me, near source effects, had not
11 been adequately accounted for.

12 Q. And in particular the basis refers to a
13 particular approach or a journal article by a
14 Dr. Somerville?

15 A. Correct.

16 Q. And what is that -- are you familiar with
17 that journal article?

18 A. I'm familiar with a follow-up article that
19 Dr. Somerville wrote in 1998 that I'm more familiar
20 with. But it basically was I believe a restatement in
21 another venue of the same methodology.

22 Q. And that's your understanding, then, of
23 basis 2 of the contention, correct?

24 A. Correct.

25 Q. Now, the bases 1 and 2 of the contention --

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Date Taken: October 18, 2000

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1 So that now required -- or having identified
2 the East and the West Faults at depth virtually beneath
3 the site, that makes moot the need to import the random
4 earthquake underneath the site.

5 Q. So in other words, if you have new
6 information, your concern with respect to the random
7 earthquake is no longer really a concern with respect to
8 the PFS site. Am I understanding you correctly?

9 A. Correct, in terms of what the outcome would
10 be from input in a hazard analysis.

11 Q. Because you really have an earthquake that
12 you're -- concerning your analysis of the same size or
13 bigger size?

14 A. Correct.

15 Q. Okay. Any other minor details that you
16 looked at with respect to the Geomatrix report as
17 referred to in Exhibit 4?

18 A. Under the subheading of "Hazard
19 Characterization," no, I don't recall and carry with me
20 any issues that I think are material.

21 Q. Outside of the area of hazard
22 characterization, do you have any minor details you'd
23 quibble with or other concerns?

24 A. Yes.

25 Q. And what are those?

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1 Q. Where are you reading from, again? I'm
2 sorry.

3 A. The second -- Exhibit 5 summary, the second
4 paragraph.

5 Q. Oh, I see it.

6 A. And given this concern, questions were put
7 directly to NRC's staff. And I need help.

8 MS. CHANCELLOR: He'd like to look at a
9 discovery document that we submitted to NRC.

10 Q. (BY MR. GAUKLER) To refresh your
11 recollection?

12 A. Well, to call to your attention what NRC's
13 staff admitted in response to a question asking whether
14 the approach used by Geomatrix both in the 1997 SAR and
15 in the updated PSHA as a deterministic analysis, whether
16 the approach would meet the requirements of 10 CFR 100,
17 Appendix A, and the staff ultimately responded.

18 MS. CHANCELLOR: Do you need to refresh your
19 recollection -- it's the Staff's Objections and
20 Responses to the State of Utah's Sixth Set of Discovery
21 Requests Directed to NRC Staff, Utah Contention I, dated
22 February 14, 2000. And it's both the staff's response
23 to admission No. 1 and admission No. 2, and the response
24 is the same.

25 A. Shall I read the request for admission and

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1 A. These have become part of the record and
2 entangled in the guidelines for a design-basis
3 earthquake, notably the deterministic versus a
4 probabilistic and what is relevant in this process for
5 decision making.

6 Q. Could you explain -- I don't understand.

7 A. Okay, sure.

8 Q. Are you getting into stuff that might go to
9 the probabilistic method? Are you talking about a
10 return period or something like that? Explain so I
11 understand. If it concerns probabilistic method, that
12 isn't part of this contention; we won't continue. But
13 if it doesn't, then we will continue. What do you mean?

14 A. Okay. Can we return to the original
15 question?

16 MR. GAUKLER: Yeah. Could you restate the
17 original question, please?

18 (The record was read.)

19 Q. Do you understand the question?

20 A. Yes. And in Exhibit 5, under the summary,
21 the second paragraph here, in April 1999 we state that
22 "One recurring point we comment on is the uncertain
23 regulatory acceptability of the hybrid 'deterministic'
24 approach, used both in the 1997 SAR and in an updated
25 assessment provided to NRC in April 1999."

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1 response? The gist of it is that it asked both whether
2 the DSHA, the deterministic seismic -- the deterministic
3 seismic hazard analysis performed by Geomatrix in
4 Appendix 2d of 1997 deviated from established precedent.

5 Well, I guess I'll read the whole thing.

6 "Do you admit that the deterministic seismic hazard
7 analysis (DSHA) performed by Geomatrix Consultants,
8 Incorporated, and reported in Appendix 2d of the 1997
9 SAR deviated from established precedent in meeting
10 requirements of 10 CFR 72.102(f)(1) and 10 CFR 100
11 Appendix A for assessing the maximum vibratory ground
12 motion at the PFS site by incorporating uncertainty in
13 the maximum magnitude, minimum source to site distance,
14 and choice of ground motion attenuation relationship in
15 establishing the 84 percentile ground motions?"

16 I should look at the bottom line and see if
17 this was the right one.

18 Okay, this is correct. And the staff
19 response, "The staff objects to this request on the
20 grounds that it is vague and ambiguous. Notwithstanding
21 this objection, the staff states that the Geomatrix DSHA
22 did not meet the deterministic requirements in 10 CFR
23 part 100, Appendix A." And similarly asked whether in
24 the updated DSHA whether there was a deviation from
25 established precedent. Similarly, the staff responds,

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