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NUCLEAR REGULATORY COMMISSION

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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In the Matter of: PRIVATE FUEL STORAGE, LLC, (Independent Spent Fuel Storage Installation)

)) Docket No. 72-22) ASLBP No.) 97-732-02-ISFSI)

U. S. Nuclear Regulatory Commission Sheraton Hotel, Wasatch Room Salt Lake City, Utah 84114

On June 7, 2002 the above-entitled matter came on for hearing, pursuant to notice, before:

MICHAEL C. FARRAR, CHAIRMAN Administrative Judge Atomic Safety & Licensing Board Panel

DR. JERRY R. KLINE Administrative Judge Atomic Safety & Licensing Board Panel

DR. PETER S. LAM Administrative Judge Atomic Safety & Licensing Board Panel

(202) 234-4433

10259 APPEARANCES FOR THE STATE OF UTAH: Denise Chancellor, Esq. Connie Nakahara, Esq. ASSISTANT ATTORNEYS GENERAL Office of the Attorney General 160 East 300 South, 5th Floor P. O. Box 140873 Salt Lake City, Utah 84114 FOR PRIVATE FUEL STORAGE, LLC: Matias Travieso-Diaz, Esq. Paul Gaukler, Esq. SHAW PITTMAN Attorneys at Law 2300 N Street, N.W. Washington, D.C. 20037 FOR THE U.S. NUCLEAR REGULATORY COMMISSION: Sherwin E. Turk, Esq. Martin O'Neill, Esq. Catherine Marco, Esq. OFFICE OF THE GENERAL COUNSEL Mail Stop - 0-15 B18 U.S. Nuclear Regulatory Commission Washington, D.C. 20555 NEAL R. GROSS COURT REPORTERS AND TRANSCRIBERS 1323 RHODE ISLAND AVE., NW.

WASHINGTON, D.C. 20005-3701

10260

EXAMINATION

Witness Panel: Farhang Ostadan and Steven Bartlett Continued Cross Examination by Mr. Turk 10262 Redirect Examination by Ms. Chancellor 10285 Redirect by Ms. Chancellor, 10380 on previous testimony Cross Examination by Mr. Travieso-Diaz 10393 Recross Examination by Mr. Turk 10434 Redirect Examination by Ms. Chancellor 10469 Recross Examination by Mr. Travieso-Diaz 10472 Further Redirect by Ms. Nakahara 10510 Further Recross by Mr. Turk 10515 Further Recross by Mr. Travieso-Diaz 10518 Further Redirect by Ms. Nakahara 10522 Further Recross by Mr. Turk 10523 Further Recross by Mr. Travieso-Diaz 10525 Witneess: Dr. Robert Youngs Direct Examination by Mr. Travieso-Diaz 10478 Prefiled Testiomony Admitted 10479 Cross Examination by Ms. Nakahara 10481 Cross Examination by Mr. Turk 10499 Redirect Examination by Mr. Travieso-Diaz 10502 Recross Examination by Mr. Turk 10504 Further Recross by Ms. Nakahara 10505 Steven Bartlett - Rebuttal Witness Witness: Direct Examination by Ms. Chancellor 10530 EXHIBITS No. MRKD/ADMTD 210 Interoffice memorandum from 10292/10337 PJTrudeau Boston to SMMacie Denver 211 Interoffice memo your from 10333/10337 S. M. Macie to P. Trudeau/N. T. Georges dated April 2, 1997

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| | 10261 |
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| 1 | June 7, 2002 9:05 a.m. |
| 2 | |
| 3 | PROCEEDINGS |
| 4 | |
| 5 | JUDGE FARRAR: All right. We're back on |
| б | the record, having been advised by the parties of |
| 7 | certain matters. |
| 8 | And then do the parties have any |
| 9 | preliminary matters? |
| 10 | MR. TURK: I would just note something |
| 11 | for the record, Your Honor. Before we started |
| 12 | today, I handed to the judges an abridged copy of |
| 13 | my cross-examination plan so as to focus on the |
| 14 | issues that I would like to cover today. |
| 15 | JUDGE FARRAR: Yes, thank you, Mr. Turk. |
| 16 | We appreciate that. |
| 17 | And, then, if there's nothing else, we |
| 18 | will continue with the Staff's cross-examination of |
| 19 | the Ostadan/Bartlett panel on Part D of the |
| 20 | contention. |
| 21 | Dr. Bartlett, Dr. Ostadan, welcome back. |
| 22 | You both were previously sworn, so if you'll |
| 23 | consider yourselves still under oath, please. |
| 24 | |
| 25 | |
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| | 10262 |
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| 1 | FARHANG OSTADAN |
| 2 | . and |
| 3 | STEVEN FLOYD BARTLETT, |
| 4 | having been previously sworn to tell the truth, |
| 5 | were examined and testified as follows: |
| б | |
| 7 | CROSS-EXAMINATION |
| 8 | BY MR. TURK: |
| 9 | Q. Good morning, gentlemen. |
| 10 | I don't have very much for you this |
| 11 | morning. In my opinion we can conclude in 10 or |
| 12 | 15 minutes, but, of course, it will depend whether |
| 13 | you share that view, whether you believe you need |
| 14 | to go into more explanations than I believe |
| 15 | necessary. But we'll see what develops. |
| 16 | First, I'd like to go back to the |
| 17 | transcript of May 9th. Do you have a copy of the |
| 18 | transcript of your testimony for that day? |
| 19 | DR. BARTLETT: I do not. |
| 20 | DR. OSTADAN: I do not. |
| 21 | Q. Well, I'm going to read a question that |
| 22 | appears at page 7813. In that discussion we were |
| 23 | talking about Section 3.7.1 of NUREG 0800, and, in |
| 24 | discussing that document, I asked you a question |
| 25 | about the use of multiple time histories. Do you |
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| | 10263 |
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| 1 | have a copy of 3.7.1 before you? |
| 2 | DR. OSTADAN: I don't. |
| 3 | DR. BARTLETT: I do not. |
| 4 | MR. TURK: May we go off the record for |
| 5 | a moment, Your Honor? |
| 6 | JUDGE FARRAR: Yes. |
| 7 | (A discussion was held off the record.) |
| 8 | JUDGE FARRAR: All right. Go ahead. |
| 9 | MR. TURK: While we were off the record, |
| 10 | counsel for the Applicant graciously lent us a copy |
| 11 | of Staff Exhibit DD for use by the witnesses. |
| 12 | Q. Gentlemen, you recognize this document? |
| 13 | DR. OSTADAN: Yes, I do. |
| 14 | DR. BARTLETT: Yes, I do. |
| 15 | Q. That is Section 3.7.1 of NUREG 0800? |
| 16 | DR. OSTADAN: That's right. |
| 17 | Q. If you would, turn to page 3.7.1-3. |
| 18 | DR. OSTADAN: Yes. |
| 19 | Q. Do you recall the last time we met I was |
| 20 | examining you on whether this document contains any |
| 21 | mandatory language which would require the use of |
| 22 | multiple time histories? Do you recall we had that |
| 23 | discussion? |
| 24 | DR. OSTADAN: Yeah, I recall we |
| 25 | discussed this and to ASCE 4-98. |
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| | 10264 |
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| 1 | Q. At page 7813 of the transcript from |
| 2 | May 9th, I asked a question which we never obtained |
| 3 | an answer to, and I'd just like to ask that |
| 4 | question again at this time. |
| 5 | Counsel, if you're following, it's at |
| 6 | the top of page 7813. |
| 7 | My question was is there whether |
| 8 | there's anything in this document, quote, that |
| 9 | indicates a mandatory requirement or guidance to |
| 10 | say that only a multiple time history can be used |
| 11 | if you're doing a nonlinear analysis. |
| 12 | And I was awaiting an answer, and I |
| 13 | believe we then had some interruptions. Can you |
| 14 | provide an answer to |
| 15 | MS. CHANCELLOR: Excuse me, Your Honor. |
| 16 | I would request that Mr. Turk not characterize my |
| 17 | objections as interruptions. |
| 18 | JUDGE FARRAR: I didn't know that he |
| 19 | was I assumed he meant like some other |
| 20 | interruption, but be that as it may, let's move on. |
| 21 | And let's not characterize each other's stuff, and |
| 22 | let's not be overly sensitive. |
| 23 | DR. OSTADAN: I can only read what's |
| 24 | said here and what I know of what's being practiced |
| 25 | in the industry. |
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| | 10265 |
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| 1 | Q. (By Mr. Turk) If you would |
| 2 | Dr. Ostadan, I believe if you can answer my |
| 3 | question yes or no, you can go on after that. But |
| 4 | my question is is there anything in this discussion |
| 5 | of options and in particular if you would look |
| 6 | at Option No. 2, multiple time histories. Is there |
| 7 | anything in this document that indicates that only |
| 8 | multiple time histories can be used when one is |
| 9 | doing a nonlinear analysis? |
| 10 | JUDGE FARRAR: Mr. Turk, while he's |
| 11 | thinking about that, could you give us that page |
| 12 | reference again? |
| 13 | MR. TURK: 7813 at the top of the page. |
| 14 | I'm sorry. Did you want the page |
| 15 | reference to the regulatory guide? |
| 16 | JUDGE FARRAR: No, to |
| 17 | MR. TURK: Okay. |
| 18 | JUDGE FARRAR: to the transcript. |
| 19 | Of what date? |
| 20 | MR. TURK: May 9th. |
| 21 | DR. OSTADAN: My interpretation of the |
| 22 | second part of an Option 2 is when it says may be |
| 23 | appropriate, to me, it's a requirement. |
| 24 | Q. (By Mr. Turk) Okay. That's your |
| 25 | interpretation? |
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| | 10266 |
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| 1 | DR. OSTADAN: That's right. |
| 2 | Q. I had asked another question at page |
| 3 | 7815 of the transcript, and this is this was a |
| 4 | discussion of page 3.7.1-7 of that regulatory |
| 5 | guide, Staff Exhibit DD. On page 7814 of the |
| 6 | transcript, you were reading a description of |
| 7 | multiple time histories, and you were reading from |
| 8 | the paragraph which begins, The review of the |
| 9 | real-time histories. Do you see that on page 3.7. |
| 10 | |
| 11 | DR. OSTADAN: Yes, I see it. |
| 12 | Q 1-7? |
| 13 | And I asked you in that section and |
| 14 | this was your reading of that paragraph whether |
| 15 | there's anything in that paragraph that states that |
| 16 | multiple time histories shall be used or must be |
| 17 | used. |
| 18 | And you indicated your answer to my |
| 19 | question was, quote, He he indicates I guess |
| 20 | that should be it indicates. He indicates it will |
| 21 | be reviewed on a case-by-case basis. |
| 22 | In making that answer, did you mean to |
| 23 | suggest that this section of the Regulatory Guide |
| 24 | requires the use of multiple time histories in a |
| 25 | non when conducting a nonlinear analysis? |
| | |
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| | 10267 |
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| 1 | DR. OSTADAN: Again, my interpretation |
| 2 | and my experience has been, yes, it's been the |
| 3 | requirement for nonlinear analysis to use multiple |
| 4 | time histories. And the statement here is how many |
| 5 | and what form and fashion, and that would be |
| 6 | reviewed on a case-by-case basis. |
| 7 | Q. But you would agree, however, that |
| 8 | there's nothing in the words of the guidance that |
| 9 | makes that a mandatory requirement? That's your |
| 10 | interpretation and experience of how things are |
| 11 | done, but the words of the regulatory guidance |
| 12 | don't state that; correct? |
| 13 | MS. CHANCELLOR: Your Honor, I'd object |
| 14 | to the form of the question. It appears that |
| 15 | Mr. Turk is asking for a legal interpretation of |
| 16 | the regulation. |
| 17 | DR. OSTADAN: Again, all I can say |
| 18 | JUDGE FARRAR: Wait, wait. |
| 19 | Mr. Turk? |
| 20 | MR. TURK: I believe that objection is |
| 21 | invalid, Your Honor. I'm asking him what the words |
| 22 | state. He's indicated his interpretation and |
| 23 | experience are one thing. I'm asking him to |
| 24 | confirm that the words don't appear. I'm not |
| 25 | asking for legal interpretations. |
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| | 10268 |
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| 1 | JUDGE FARRAR: Ms. Chancellor, I would |
| 2 | tend to agree with Mr. Turk that these questions |
| 3 | about |
| 4 | DR. OSTADAN: Could you repeat |
| 5 | JUDGE FARRAR: that we've there's |
| 6 | a thin line between what's a legal interpretation |
| 7 | and what does something mean technically, and we've |
| 8 | allowed some leeway here. So we'll overrule the |
| 9 | objection. |
| 10 | You may answer. Were you indicating you |
| 11 | wanted the question read back, Dr. Ostadan? |
| 12 | DR. OSTADAN: Yes. May I have the |
| 13 | question, please? |
| 14 | MR. TURK: Madame, reporter, if you |
| 15 | would. |
| 16 | (The question was read as follows: |
| 17 | "Question: But you would agree, |
| 18 | however, that there's nothing in the words of |
| 19 | the guidance that makes that a mandatory |
| 20 | requirement? That's your interpretation and |
| 21 | experience of how things are done, but the |
| 22 | words of the regulatory guidance don't state |
| 23 | that; correct?") |
| 24 | DR. OSTADAN: I certainly cannot use |
| 25 | cannot see the word "must" and "shall be" used. |
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| | 10269 |
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| 1 | However, I go back to page 3.7.1-3 and their Option |
| 2 | 2, second paragraph. It says, Multiple time |
| 3 | history analysis incorporating real earthquake time |
| 4 | histories are appropriate when such analysis are |
| 5 | proposed. It's referring to nonlinear analysis. |
| 6 | Q. (By Mr. Turk) You just read that in a |
| 7 | way that I don't see the words. Are you aware of |
| 8 | that, that you read something that doesn't appear? |
| 9 | DR. OSTADAN: You were asking whether |
| 10 | Q. I'm sorry. I strike that. I |
| 11 | understand what you're saying now. |
| 12 | In Answer 9 I'm sorry. If you would, |
| 13 | go to your prefiled testimony. |
| 14 | DR. OSTADAN: Yes. |
| 15 | Q. In the Answer 9 you provide in response |
| 16 | to the question, Please give an overview of the PFS |
| 17 | design, a summary of various features and aspects |
| 18 | of the PFS design and application. In that answer |
| 19 | you discuss the use of testing. |
| 20 | DR. OSTADAN: Which paragraph? |
| 21 | Q. In the very first paragraph of Answer 9, |
| 22 | about halfway down, a little past halfway down, you |
| 23 | discuss the cement-treated soil, and you state that |
| 24 | the amount of cement and the properties of the |
| 25 | treated soil are still undetermined because PFS |
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| | 10270 |
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| 1 | plans to delay the requisite testing to complete |
| 2 | the design until after it obtains a Part 72 license |
| 3 | from the NRC. |
| 4 | Dr. Ostadan, let me ask you a question |
| 5 | first. In your work with Bechtel are you familiar |
| 6 | with licensee or applicant's conduct of testing, |
| 7 | either of materials or components in a facility? |
| 8 | DR. OSTADAN: I can't recall any any |
| 9 | testing at this time. Again, but I have to qualify |
| 10 | that. Most of the design I have dealt with are |
| 11 | conventional nuclear facilities with the |
| 12 | understanding that if the specification are |
| 13 | prepared properly and the testing is done |
| 14 | correctly, then material will end up being better |
| 15 | than what we expect, whereas here we have a we |
| 16 | are walking a fine line with the soil cement. On |
| 17 | one hand, we don't want it to be too stiff. On the |
| 18 | other hand, we want it to be able to carry the |
| 19 | loads and perform its function. So this is this |
| 20 | conflicting recount that concerns me. |
| 21 | MR. TURK: Would you read back my |
| 22 | question, please? |
| 23 | (A discussion was held off the record.) |
| 24 | (The question was read as follows: |
| 25 | "Dr. Ostadan, let me ask you a question |
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| | 10271 |
|----|---|
| 1 | first. In your work with Bechtel are you |
| 2 | familiar with licensee or applicant's conduct |
| 3 | of testing, either of materials or components |
| 4 | in a facility?") |
| 5 | DR. OSTADAN: I think I answered that. |
| 6 | I said I don't recall any. |
| 7 | Q. (By Mr. Turk) So that's the answer to |
| 8 | the question I asked? |
| 9 | DR. OSTADAN: That's right. |
| 10 | Q. So you do not have familiarity with |
| 11 | whether that testing, which is done in connection |
| 12 | with facilities that Bechtel is involved with, |
| 13 | whether that testing is done either prelicensing or |
| 14 | post-licensing? |
| 15 | DR. OSTADAN: Certainly I don't recall |
| 16 | of any prelicensing, but I qualified my response to |
| 17 | you. These are being conventional design, whereas |
| 18 | here the requirement is different? |
| 19 | MR. TURK: I'm sorry. Could you read |
| 20 | back my last question again, please? |
| 21 | (The question was read as follows: |
| 22 | "Question: So you do not have |
| 23 | familiarity with whether that testing, which is |
| 24 | done in connection with facilities that Bechtel |
| 25 | is involved with, whether that testing is done |
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| | 10272 |
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| 1 | either prelicensing or post-licensing?") |
| 2 | DR. OSTADAN: I believe I answered that. |
| 3 | I don't recall any for prelicensing. |
| 4 | Q. (By Mr. Turk) Do you recall any for |
| 5 | post-licensing? |
| 6 | DR. OSTADAN: I don't recall that |
| 7 | either, no. |
| 8 | Q. You're not aware, then, of whether |
| 9 | testing is routinely conducted post-licensing with |
| 10 | respect to nuclear facilities? |
| 11 | DR. OSTADAN: It's not conducted |
| 12 | routinely for conventional designs. |
| 13 | JUDGE FARRAR: Dr. Ostadan, you've got |
| 14 | to speak up a little. We're not hearing. |
| 15 | DR. OSTADAN: I'm sorry. Yes, |
| 16 | Your Honor. |
| 17 | Q. (By Mr. Turk) You don't recall any |
| 18 | testing post-licensing? |
| 19 | A. I do not, yes. |
| 20 | Q. And that's the basis for your statement |
| 21 | that it's not routinely conducted? |
| 22 | DR. OSTADAN: That's correct. |
| 23 | Q. Dr. Bartlett, you're involved to some |
| 24 | extent with highway construction in the state of |
| 25 | Utah? |
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| | 10273 |
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| 1 | DR. BARTLETT: I had been involved in |
| 2 | highway construction back in the '80s. My current |
| 3 | more latest stint with UDOT was in design not |
| 4 | construction, but I think I'm familiar with both. |
| 5 | Q. You're aware, are you not, that in |
| 6 | construction of highways and bridges it's routine |
| 7 | to perform tests of concrete |
| 8 | DR. BARTLETT: That's quality |
| 9 | assurance/quality control testing. |
| 10 | Q. And that is, during the course of |
| 11 | construction, there's it's fairly routine to |
| 12 | conduct testing of concrete materials, correct? |
| 13 | DR. BARTLETT: Yes. |
| 14 | Q. Dr. Ostadan, are you familiar with the |
| 15 | acronym ITAAC? |
| 16 | DR. OSTADAN: Maybe you can help me to |
| 17 | remember. |
| 18 | Q. At this point you're not familiar with |
| 19 | that? |
| 20 | DR. OSTADAN: No. |
| 21 | Q. Inspections, testings and acceptance |
| 22 | criteria, are you familiar with that phrase? |
| 23 | DR. OSTADAN: Yes. |
| 24 | Q. And what is your understanding of that |
| 25 | phrase, how it's used in the nuclear industry, or |
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| | 10274 |
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| 1 | are you familiar with how it's used in the nuclear |
| 2 | industry? |
| 3 | DR. OSTADAN: I do not know the details, |
| 4 | no. |
| 5 | Q. So then you're not familiar with how the |
| 6 | Nuclear Regulatory Commission uses the term "ITAAC" |
| 7 | or what it means in regulatory parlance? |
| 8 | DR. OSTADAN: No, I do not. |
| 9 | Q. Also in Answer 9 of your testimony |
| 10 | and this appears on page 5 there's a paragraph |
| 11 | that begins, quote, There are also conflicting |
| 12 | requirements in PFS's design, close quote. |
| 13 | Do you see that paragraph? |
| 14 | DR. OSTADAN: Yes. The last paragraph, |
| 15 | yes. |
| 16 | Q. It's the paragraph that appears in the |
| 17 | middle of the page. It's the last paragraph of |
| 18 | Answer 9? |
| 19 | DR. OSTADAN: That's correct. |
| 20 | Q. You indicate in that paragraph I'm |
| 21 | going to paraphrase here, but you're welcome to add |
| 22 | to what I state if or change it if you feel |
| 23 | necessary. But you discuss the fact that the |
| 24 | cement-treated soil under the pads cannot be too |
| 25 | stiff; on the other hand, it must be stiff enough. |
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| | 10275 |
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| 1 | That's essentially a paraphrasing of what your |
| 2 | statement is there. Is there anything inherently |
| 3 | conflicting about that? |
| 4 | DR. OSTADAN: In my mind there is, yes. |
| 5 | Q. In your work at Bechtel, you're not |
| 6 | faced with that same requirement, that you have to |
| 7 | achieve a certain material property that's neither |
| 8 | too far to one side nor too far to the other? |
| 9 | DR. OSTADAN: No. I have never dealt |
| 10 | with this sort of conflicting requirements. |
| 11 | Q. Isn't it fairly common, Dr. Bartlett, |
| 12 | that in construction, for instance, the |
| 13 | construction of a building in a high seismic zone, |
| 14 | the building must be strong, yet it must be ductile |
| 15 | in order to withstand seismic forces? Is that not |
| 16 | a common sort of a problem that engineers face? |
| 17 | DR. BARTLETT: I'm not a structural |
| 18 | engineer, but when I talk with them, I do recall |
| 19 | that they discuss ideas of ductility and the |
| 20 | importance of having it in their structures. |
| 21 | Q. And it's probably true also with the |
| 22 | construction of bridges and highways, you want to |
| 23 | achieve a certain value but not go too far, |
| 24 | correct? For instance, you don't want to make a |
| 25 | bridge too brittle, and yet you want it to be |
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| | 10276 |
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| 1 | strong. |
| 2 | DR. BARTLETT: I I think we're |
| 3 | tending to confuse issues. The requirement that I |
| 4 | think Dr. Ostadan and I are referring to have to |
| 5 | deal with soil cement and how we deal and treat |
| 6 | with the soils. When we get into concrete, steel |
| 7 | and other materials used in construction, I guess I |
| 8 | would have to defer, I'm not sure. Obviously |
| 9 | there's a ductility requirements that the |
| 10 | structure instead of being excessively stiff, |
| 11 | would allow it to be ductile. But I'm not sure |
| 12 | that's the issue we're focusing on here so |
| 13 | Q. No, I understand, but we're focusing on |
| 14 | the question of conflicting requirements, not |
| 15 | necessarily with respect to cement-treated soil but |
| 16 | a material property or a construction element. |
| 17 | Let me ask you a question in a different |
| 18 | way. |
| 19 | DR. BARTLETT: Sure. |
| 20 | Q. If you're constructing a highway bridge, |
| 21 | you want it to be strong, correct, strong enough to |
| 22 | withstand all forces to which it may be subjected? |
| 23 | DR. BARTLETT: You'd want it to have the |
| 24 | capacity to carry the seismic load, yes. |
| 25 | Q. At the same time, you don't want to put |
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| 1 | too much mass into it. You don't want to make it |
| 2 | too heavy or you don't want to go too far in |
| 3 | your design, correct? |
| 4 | DR. BARTLETT: My understanding of |
| 5 | structural design is that you want ductility in the |
| 6 | structure. |
| 7 | Q. At the same time, you want strength and |
| 8 | stiffness to withstand |
| 9 | DR. BARTLETT: Capacity to carry a load |
| 10 | but still behave ductilely. |
| 11 | Q. That's correct, but you have that sort |
| 12 | of a conflicting |
| 13 | DR. BARTLETT: No. Those aren't |
| 14 | conflicting requirements. Those are harmonious |
| 15 | requirements. |
| 16 | Q. In designing a bridge let's use that |
| 17 | example to withstand seismic forces, is it |
| 18 | correct that if you put too much weight into the |
| 19 | bridge, the forces become greater during the |
| 20 | seismic event? |
| 21 | DR. BARTLETT: As the mass increases, |
| 22 | the forces increase because of the inertial |
| 23 | loadings. |
| 24 | Q. And, therefore, you don't want to |
| 25 | introduce too much mass, and yet correct? |
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| 1 | DR. BARTLETT: Some of the philosophy of |
| 2 | design is to use lighter weight materials that have |
| 3 | higher strength-to-mass ratios, yes. |
| 4 | Q. So, in effect, then, you have |
| 5 | requirements from two sides, and you try to find an |
| 6 | appropriate balance between those two different |
| 7 | requirements, correct? |
| 8 | DR. BARTLETT: No. |
| 9 | Q. What am I misunderstanding? |
| 10 | DR. BARTLETT: I don't see the |
| 11 | conflicting requirements. I just see a philosophy |
| 12 | to keep structures lightweight and ductile. |
| 13 | Q. So rather than describing those as |
| 14 | conflicting requirements, perhaps you would say the |
| 15 | requirement that should be strong enough to that |
| 16 | your construction be strong enough and yet |
| 17 | DR. BARTLETT: The ideal material would |
| 18 | be a material that's extremely strong, lightweight |
| 19 | and ductile. |
| 20 | Q. But, essentially, you have a bracket. |
| 21 | You don't want to go too far to one side nor too |
| 22 | far to the other with respect to how much mass you |
| 23 | introduce into the structure, correct? You have to |
| 24 | have enough mass but not too much. |
| 25 | DR. BARTLETT: You're stretching my |
| | |
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| 1 | understanding of structural engineering, but I see |
| 2 | Dr. Ostadan may want to jump in. |
| 3 | DR. OSTADAN: May I I may provide |
| 4 | some explanation here. |
| 5 | Q. Okay. Understanding that you also are |
| 6 | not a structural engineer, correct, Dr. Ostadan? |
| 7 | DR. OSTADAN: That's correct, yeah, but |
| 8 | let me tell you what's my understanding of |
| 9 | ductility is. Ductility has to do with the detail |
| 10 | design of the structural member, how the rebars are |
| 11 | set, how much confinement you have so that it can |
| 12 | absorb a large strain and perform. You could have |
| 13 | a huge column, massive column. You could have that |
| 14 | huge, massive column designed to be ductile or |
| 15 | designed not to be ductile. It depends how you do |
| 16 | the detail design. |
| 17 | Q. And in creating that design, would the |
| 18 | seismic forces at issue in a particular location be |
| 19 | taken into account? |
| 20 | DR. OSTADAN: Of course. |
| 21 | Q. And if you had a greater degree of |
| 22 | seismicity or greater seismic load possible |
| 23 | strike seismicity. Let's talk about the seismic |
| 24 | load then you would make your structure more |
| 25 | ductile? Is that how I understand what happens? |
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| 1 | DR. OSTADAN: It's preferred to make |
| 2 | it to put in as much ductility as you can, yes. |
| 3 | Q. But, at the same time, you require the |
| 4 | structure to be strong enough to withstand loads? |
| 5 | DR. OSTADAN: Exactly. |
| 6 | Q. And that's what structural engineers do |
| 7 | at firms like Bechtel and Stone & Webster, correct, |
| 8 | they try to achieve a design that comes somewhere |
| 9 | between those two that that blends those two |
| 10 | requirements, strong enough yet still ductile, if |
| 11 | necessary? |
| 12 | DR. OSTADAN: That is that is true, |
| 13 | but I don't see it conflicting. As I indicated, |
| 14 | you could have a big, massive column and be |
| 15 | ductile, depending on the detail design. |
| 16 | Q. And, in essence, that's what is going to |
| 17 | be required of the cement-treated soil underneath |
| 18 | the storage pads, is it not, it must be stiff |
| 19 | enough but not too stiff? |
| 20 | DR. OSTADAN: No. There's a big |
| 21 | difference here. There's nothing to really do a |
| 22 | detail design. All we do here is mix the cement |
| 23 | and soil, and that is the limit of what we can |
| 24 | exercise, really, in the mix. There is no the |
| 25 | analogy to the rebar will be how much rebar, what |
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10281 will be the overlap length, its confinement. 1 We 2 have those parameters to consider in a column. 3 Here it's simply how much soil and how much cement, how much water, and the laboratory tests will tell 4 5 us how much strength and stiffness we get out of the mix. 6 7 0. And you mentioned one word in your 8 answer just now that I'd like to focus on. You 9 mentioned water. The amount of water you add into the mix is important to determining what stiffness 10 11 you end up with, correct? 12 DR. OSTADAN: I would like to defer that 13 to Dr. Bartlett. 14 That's fine. 0. 15 Dr. Bartlett, that's correct, is it not? DR. BARTLETT: Well, when you design a 16 17 soil cement mix -- and this is just my 18 understanding of listening to Dr. Mitchell and 19 Dr. Wissa talk in their depositions, that you have 20 a target moisture content in the mix that you're 21 targeting. The soil may already -- because it has 22 some moisture in it, depending on how much cement you're adding, you may not even actually have to 23 24 add any water. There may be enough soil moisture 25 that you could mix in the cement without adding **NEAL R. GROSS** COURT REPORTERS AND TRANSCRIBERS 1323 RHODE ISLAND AVE , N.W

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| 1 | water. Might be if it's extremely wet that you |
| 2 | might actually dry the soil out. |
| 3 | So there's some target range that you're |
| 4 | trying to achieve with the combination of the soil |
| 5 | and its properties, the cement and its properties |
| 6 | and the amount of water that you may either have to |
| 7 | add or may already be present when you mix this. |
| 8 | Q. And the mix that you choose ultimately |
| 9 | affects the stiffness that results. |
| 10 | DR. BARTLETT: The strength and |
| 11 | stiffness properties are a function of the mix. |
| 12 | Q. Have either of you gentlemen seen the |
| 13 | Certificate of Compliance for the HI-STORM 100 |
| 14 | storage cask? |
| 15 | DR. OSTADAN: I believe I browsed |
| 16 | through that at one time. |
| 17 | DR. BARTLETT: I may have also, but it's |
| 18 | been a long time ago. |
| 19 | Q. Neither one of you are very familiar |
| 20 | with it? |
| 21 | DR. BARTLETT: I'm not very familiar |
| 22 | with it. |
| 23 | DR. OSTADAN: I'm not familiar. |
| 24 | Q. At the bottom of page 5 of your prefiled |
| 25 | testimony, continuing on to the top of page 6 |
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| | 10283 |
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| 1 | this is in Answer 10 there's a sentence that |
| 2 | begins, As Dr. Marvın Resnikoff explains in hıs |
| 3 | concurrently filed testimony, the bounding ground |
| 4 | motions in the Certificate of Compliance for the |
| 5 | HI-STORM cask for the purpose of determining the |
| 6 | maximum zero point acceleration that will not cause |
| 7 | incipient tipping are bounded by accelerations of |
| 8 | 0.445 g horizontal and 0.16 g vertical. |
| 9 | Do you see that statement? |
| 10 | DR. OSTADAN: Yes. |
| 11 | DR. BARTLETT: Yes, I do. |
| 12 | Q. In making that statement are you merely |
| 13 | referring to Dr. Resnikoff's testimony about the |
| 14 | CoC rather than making any conclusions of your own? |
| 15 | DR. OSTADAN: I think I saw that in the |
| 16 | Certificate of Compliance, I recall, this value of |
| 17 | accelerations. The accelerations values, I recall |
| 18 | I have seen that in the Certificate of Compliance. |
| 19 | Q. Dr. Ostadan, have you ever seen a |
| 20 | Certificate of Compliance other than the HI-STORM |
| 21 | 100 cask CoC? |
| 22 | DR. OSTADAN: No, I have not. |
| 23 | Q. Are you are you familiar with the |
| 24 | analyses that were done by Holtec in support of its |
| 25 | application for that CoC? |
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| | 10284 |
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| 1 | DR. OSTADAN: No, I am not familiar. |
| 2 | Q. Are you familiar with I take it I |
| 3 | take it since you're not familiar with the |
| 4 | analyses, you're not familiar with whether the |
| 5 | analyses indicate that tipping would occur if |
| 6 | accelerations of 0.445 g horizontal and 0.16 g |
| 7 | vertical are exceeded? |
| 8 | DR. OSTADAN: I would not know. |
| 9 | Q. You wouldn't know? |
| 10 | DR. OSTADAN: No. |
| 11 | DR. BARTLETT: May I ask, is this for |
| 12 | the general Certificate of Compliance. |
| 13 | Q. Yes. That's what this testimony |
| 14 | addresses in |
| 15 | DR. BARTLETT: Yes, that's the way I |
| 16 | responded to my questions. |
| 17 | Q. The same, Dr. Bartlett, you're not |
| 18 | familiar with the analyses in the CoC? |
| 19 | DR. BARTLETT: That support the general |
| 20 | Certificate of Compliance? No, I have not seen |
| 21 | those. |
| 22 | Q. And so you don't know if those analyses |
| 23 | indicate that tipping will occur if those |
| 24 | accelerations are exceeded? |
| 25 | DR. BARTLETT: That's correct. |
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| | 10285 |
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| 1 | Q. I take it also, then, that neither one |
| 2 | of you are aware of the extent to which |
| 3 | conservatisms may be included in the analyses |
| 4 | supporting the CoC application? |
| 5 | DR. OSTADAN: I do not know. |
| 6 | DR. BARTLETT: I don't either. |
| 7 | MR. TURK: I have nothing further, |
| 8 | Your Honor. |
| 9 | Thank you, gentlemen. |
| 10 | DR. OSTADAN: Thank you. |
| 11 | (The Board confers off the record.) |
| 12 | JUDGE FARRAR: The Board has no further |
| 13 | questions in addition to what we've asked before, |
| 14 | so, Ms. Chancellor, do you want redirect? |
| 15 | MS. CHANCELLOR: Yes, please, |
| 16 | Your Honor. |
| 17 | |
| 18 | REDIRECT EXAMINATION |
| 19 | BY MS. CHANCELLOR: |
| 20 | Q. Good morning. |
| 21 | I'll direct my questions at either of |
| 22 | you unless I direct one specifically to one |
| 23 | witness or the other, so feel free to decide who |
| 24 | wants to answer. |
| 25 | Could could you explain very |
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| 1 | succinctly why you believe that the PFS seismic |
| 2 | design is unprecedented? |
| 3 | DR. OSTADAN: I believe we discussed a |
| 4 | number of design features that is called for here |
| 5 | by PFS that I I certainly haven't seen it done |
| 6 | in the past. The fact that the design is based on |
| 7 | an isolation system with the cask sliding on the |
| 8 | pads and taking full credit for this phenomenon |
| 9 | without any supporting evidence based on experience |
| 10 | data or laboratory data is unprecedented. |
| 11 | The setting of the site is also quite |
| 12 | unique with respect to seismic setting and the |
| 13 | major faults near and at the site. And the site |
| 14 | soil properties perhaps Dr. Bartlett can expand |
| 15 | on that are quite soft, susceptible to movement |
| 16 | and settlement. And the predicted settlements are, |
| 17 | in my opinion, fairly large. So in that regard, |
| 18 | there are a number of unique features here called |
| 19 | for. |
| 20 | The fact that soil cement has been used |
| 21 | to resist seismic loading of foundation is also |
| 22 | unique. I haven't seen it anywhere else, |
| 23 | specifically for nuclear projects. |
| 24 | Do you have anything else to add, |
| 25 | Dr. Bartlett? |
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| | 10287 |
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| 1 | DR. BARTLETT: I think also important to |
| 2 | understand Dr. Ostadan talked about this idea of |
| 3 | using sliding as a mechanism to reduce the seismic |
| 4 | load. Certainly the philosophy of this design is |
| 5 | to allow sliding to occur at the casks and thereby |
| 6 | reduce the seismic loading that goes to the pad and |
| 7 | also to the foundation system. Full credit has |
| 8 | been taken in the design that sliding will occur |
| 9 | and using that mechanism to reduce the seismic |
| 10 | loads to the to the foundation system and soils. |
| 11 | Also, the site is in an area of high |
| 12 | seismicity where also the subsurface conditions are |
| 13 | somewhat marginal. The Bonneville clay is a |
| 14 | clayey/silt, sılty/clay that is somewhat weak and |
| 15 | compressible. It the philosophy of this design |
| 16 | is to transfer the seismic load from the casks and |
| 17 | the pads down to the Bonneville clay and use the |
| 18 | Bonneville clay to resist the sliding motion. |
| 19 | Quite often in design we tend to want to |
| 20 | bypass a weaker and more compressible zone and get |
| 21 | into deeper, stiffer, stronger soils. |
| 22 | Q. When you say bypass compressible zones, |
| 23 | what do you mean by that? |
| 24 | DR. BARTLETT: Well, there's a couple |
| 25 | ways. You could either go to a deeper foundation |
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| 1 | system, or, in some cases, if that's not possible |
| 2 | or it's deemed to be more cost effective, there are |
| 3 | methods of treating a soil, improving its |
| 4 | compressibility and strength characteristics. |
| 5 | Q. And is soil cement |
| 6 | A. Not not the way the Applicant's using |
| 7 | it in this case. They're just using soil excuse |
| 8 | me, not really soil cement but, in the case of the |
| 9 | pads, cement-treated soil to take the forces from |
| 10 | the base of the pads and transfer them to the |
| 11 | Bonneville clay, but the Bonneville clay itself is |
| 12 | being left untreated. So, no, they're not using it |
| 13 | in the sense that I'm talking about. When I'm |
| 14 | talking about bypassing a compressible layer, I'm |
| 15 | inferring going down deeper with the foundation |
| 16 | system or taking the compressible layer, in this |
| 17 | case which would be the Bonneville clay itself, and |
| 18 | treating it. |
| 19 | Q. So you would remove the Bonneville |
| 20 | you would either remove or add to the Bonneville |
| 21 | clay layer? |
| 22 | A. Well, you could remove it or you could |
| 23 | treat it in place or you could bypass it with |
| 24 | foundation elements that go beyond and deeper, into |
| 25 | deeper soils. |
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| 1 | Q. How would you treat the Bonneville clays |
| 2 | in place? |
| 3 | A. Soil mixing. We did that on the I-15 |
| 4 | project. There was a mechanically stabilized earth |
| 5 | wall that was being constructed to top the |
| 6 | Bonneville clays, and there were both |
| 7 | compressibility and strength issues with the wall. |
| 8 | And there was an in situ method where we simply |
| 9 | augered down in to a certain depth. In this case |
| 10 | we augered down to about a 25-meter depth. And |
| 11 | then you auger back out, and you mix in lime and |
| 12 | cement and create a stabilized soil in place |
| 13 | without actually having to remove it and mix it. |
| 14 | DR. OSTADAN: May I add to that this |
| 15 | soil cement mix is pretty common in the industry |
| 16 | for mixing soils. It's practiced all over. |
| 17 | Q. And, Dr. Ostadan, you talked about the |
| 18 | PFS site acting as an isolation system with the |
| 19 | pads sliding. Is the isolation system you refer |
| 20 | to for PFS, does that have any similarity to a base |
| 21 | isolation system that you've talked about before? |
| 22 | DR. OSTADAN: In concept, yes, they are |
| 23 | all the same. You rely on a mechanism to reduce |
| 24 | the seismic loads. In the case of PFS, it's |
| 25 | sliding. |
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| 1 | Q. But would a base isolation system be an |
| 2 | engineered mechanism to reduce the seismic loads? |
| 3 | DR. OSTADAN: Yes, it is. The |
| 4 | requirement for conventional it's becoming |
| 5 | conventional now. It's been a number of years it's |
| 6 | been used. For base isolation in the Uniform |
| 7 | Building Code is to have a test plan to start with, |
| 8 | a number of them, and often every one of them are |
| 9 | being tested in the laboratory. |
| 10 | But I think more importantly, I think |
| 11 | the community recognizes that we don't have |
| 12 | experience data with respect to performance of |
| 13 | these systems in real major earthquake, so the |
| 14 | Uniform Building Code does not allow designers to |
| 15 | take full credit for the isolation. I believe it |
| 16 | limits it to 20 percent or so. That's all all |
| 17 | the credit they can call for. |
| 18 | Q. And how much credit, if any, has PFS |
| 19 | taken for the isolation system in which it in |
| 20 | which during an earthquake the foundations would |
| 21 | slide or may slide? |
| 22 | DR. OSTADAN: Well, all these |
| 23 | calculation are done by Holtec in their nonlinear |
| 24 | analysis in which the casks are allowed to slide. |
| 25 | There is no limitation set in place there as to how |
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| l | much and if it can be taken. So I would say a |
| 2 | hundred percent. |
| 3 | Q. And under under the building code, if |
| 4 | it were if it were a normal building, a base |
| 5 | isolation system, then, the credit in terms would |
| 6 | be 20 percent what does this credit represent? |
| 7 | DR. OSTADAN: Well, what you as a |
| 8 | designer, what one needs to do is to calculate the |
| 9 | seismic load as if you don't have any isolation |
| 10 | system, obtain that number. Then you calculate the |
| 11 | seismic load with isolation system. But, of |
| 12 | course, this will be less. But then for design you |
| 13 | cannot use anything less than 80 percent of of |
| 14 | the case for which you did not have isolation. |
| 15 | Q. And Holtec, when it calculated the |
| 16 | seismic loads, did it calculate it both with and |
| 17 | without the casks sliding? |
| 18 | DR. OSTADAN: I have not seen any case |
| 19 | that Holtec has presented the sliding of the casks |
| 20 | or, other words, anchored the cask to the pad. |
| 21 | It's been always allowed to slide. |
| 22 | DR. BARTLETT: May I add? |
| 23 | Q. Certainly. |
| 24 | DR. BARTLETT: I think the if the |
| 25 | casks are anchored I think we alluded to this |
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| 1 | before, that 1f you do a case where you anchor the |
| 2 | casks, then the loadings to the foundation are |
| 3 | significantly increased, and the sliding, then, |
| 4 | potentially you can overturn and become a problem |
| 5 | with the foundation system. |
| 6 | Q. So if PFS were to anchor the casks, it |
| 7 | could not use the current |
| 8 | DR. BARTLETT: Shallow embedded pads |
| 9 | would not work then, if the casks were anchored, at |
| 10 | least in my opinion. |
| 11 | MS. CHANCELLOR: I'd like to have marked |
| 12 | State's Exhibit 210. |
| 13 | (STATE'S EXHIBIT-210 WAS MARKED.) |
| 14 | MS. CHANCELLOR: State's Exhibit 210 is |
| 15 | an interoffice memorandum from PJTrudeau Boston to |
| 16 | SMMacie Denver, I believe this is a Stone & |
| 17 | Webster document, dated April 3, 1997. |
| 18 | Q. Dr. Ostadan, have you seen this document |
| 19 | before? |
| 20 | DR. OSTADAN: I'm not sure I've seen it. |
| 21 | Q. If you look at paragraph 2? |
| 22 | And, Dr. Bartlett, you may take a look |
| 23 | at it too. |
| 24 | DR. BARTLETT: Yeah, I think I |
| 25 | understand the history here a little bit. When |
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10293 1 this facility was first proposed, there was cases 2 looked at where here anchored casks were going to 3 be placed -- well, I quess the cases that were reviewed were probably anchored casks were going to 4 -- atop the pads were going to be looked at atop a 5 6 frictional material. A frictional material 7 probably, in this case, meant some type of crushed gravel. 8 9 And when those cases were looked at, the combination of anchoring the casks obviously 10 increased the inertial loading, and obviously 11 too -- maybe less obviously to you. But, to me, if 12 you're using a frictional material, there's no 13 14 cohesion, and frictional materials derive their strength mainly from the normal forces that are 15 acting upon them. So the combination of anchoring 16 the casks and using a frictional material 17 introduced sliding problems into the design, or at 18 least there were some sliding issues in the design. 19 And are you looking at item No. 2 on 20 Q. State's Exhibit 210? 21 Right. I'm looking at 22 DR. BARTLETT: the first couple sentences here, Sliding resistance 23 requirements were originally adopted -- excuse me, 24 were originally developed assuming that the casks 25 NEAL R. GROSS COURT REPORTERS AND TRANSCRIBERS 1323 RHODE ISLAND AVE , NW WASHING FON, D.C. 20005-3701 www nealrgross com (202) 234-4433

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| 1 | were to be rigidly attached to the pads so that |
| 2 | full inertial forces of the casks due to the |
| 3 | earthquake could be would be transmitted to the |
| 4 | pads. For that scenario, a frictional material at |
| 5 | the base of the pads would not be capable of |
| 6 | providing the necessary resistance to sliding. |
| 7 | So, then, it may be and we're now |
| 8 | just surmising because we've watched the design of |
| 9 | all without necessarily being involved with all the |
| 10 | inner communications in the design that were going |
| 11 | on, we saw a design evolve to where the casks were |
| 12 | unanchored, and then there was an attempt to use |
| 13 | the clays instead of a frictional material to |
| 14 | reduce the sliding because the clays are not |
| 15 | dependent upon this gravity or friction to provide |
| 16 | capacity. They use their cohesion. |
| 17 | So you saw unanchored casks introduced |
| 18 | into the design. You saw an attempt to go down and |
| 19 | use and mobilize the full strength of the clays and |
| 20 | their cohesive strength. |
| 21 | Q. And then and then and to continue |
| 22 | on with the evolution of the design |
| 23 | DR. BARTLETT: Soil cement to now be the |
| 24 | excuse me, cement-treated soil to be the |
| 25 | mechanism where we couple the foundation loads to |
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| 1 | the top of the clays. |
| 2 | Q. And the soil cement cement I've |
| 3 | got to get my terminology hat on. The |
| 4 | cement-treated soil, was that introduced at the |
| 5 | time that the ground motions at PFS increased based |
| 6 | on some additional seismic work that PFS did? |
| 7 | DR. BARTLETT: Not entirely correct. I |
| 8 | believe there was talk of use of soil cement |
| 9 | preceding that. The my understanding the |
| 10 | first time I saw soil cement being introduced in |
| 11 | the design was not really for seismic capacity at |
| 12 | all. There was some environmental concerns that |
| 13 | these eolian silts, to strip and remove these 2 |
| 14 | feet and haul them somewhere else could cause a lot |
| 15 | of environmental damage. So there was an idea that |
| 16 | maybe this soil cement could be used to stabilize |
| 17 | the eolian silts in place, so that you would not |
| 18 | have to remove them, and use them stabilized in |
| 19 | place to provide a stable platform for the canister |
| 20 | transport vehicle. |
| 21 | Then as the design was changing and the |
| 22 | earthquake ground motions were changing, we saw |
| 23 | more and more of the introduction of also using |
| 24 | soil cement as an engineered mechanism also to |
| 25 | reduce or to resist seismic loading. |
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10296 1 But it was an evolution. I'm -- I'm not 2 sure exactly, but I do recall there was, I believe, soil cement in the design even prior to the change 3 4 in the design basis ground motions that occurred in the spring of 2001. 5 MR. TRAVIESO-DIAZ: Mr. Chairman, in the 6 7 interest of time, I would like to observe that this testimony isn't really relevant to the issue before 8 9 us because whatever the proposed design in 1997 may 10 have been, it's not what is before the Board. Ι 11 have allowed the questions because they may have 12 some -- some interest and historical significance, 13 but I think if we are going to continue along on this line I'm going to object. 14 15 MS. CHANCELLOR: I'm going to the it up, 16 Mr. Travieso-Diaz. I'd like to move for introduction of 17 State's Exhibit 210. 18 MR. TRAVIESO-DIAZ: Again, I would have 19 to object to that for the reasons I just stated. 20 21 JUDGE FARRAR: Mr. Turk? 22 MR. TURK: May I ask if there's a purpose for the offer? Is it --23 JUDGE FARRAR: If -- if you hadn't 24 25 asked, we would have. NEAL R. GROSS COURT REPORTERS AND TRANSCRIBERS 1323 RHODE ISLAND AVE , NW. (202) 234-4433 WASHINGTON, D.C 20005-3701 www nealrgross com

| | 10297 |
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| 1 | So, Ms. Chancellor, could you tell us |
| 2 | MS. CHANCELLOR: Why don't I hold off, |
| 3 | then, on offering the exhibit to be bound into the |
| 4 | record. I think my next series of questions might |
| 5 | tie it up. |
| 6 | JUDGE FARRAR: All right. |
| 7 | Q. (By Ms. Chancellor) Dr. Ostadan, you |
| 8 | have mentioned that there's no redundancy in PFS's |
| 9 | design; is that correct? |
| 10 | DR. OSTADAN: That's correct, yes. |
| 11 | Q. Is part of the problem can you is |
| 12 | it because of the actual design itself, the unique |
| 13 | design, that there is no redundancy? In other |
| 14 | words, if the casks were anchored, for example, |
| 15 | would that introduce redundancy into the design? |
| 16 | DR. OSTADAN: Yes, indeed. I would make |
| 17 | a distinction. The design can be unique but still |
| 18 | have redundancy. In this case many of the elements |
| 19 | are unique and there is no redundancy. |
| 20 | Q. What would it what would you consider |
| 21 | to be some redundancies in a storage a design |
| 22 | for a storage for a storage system? |
| 23 | DR. OSTADAN: Well, with respect to the |
| 24 | foundation, you know, if the typical nuclear |
| 25 | facilities that rely on foundation, and they are |
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10298 typically have good amount of embedment. You know, 1 2 right away design has a notion that no matter what 3 happens, how high of a earthquake may or may not come, the foundation's not going to go anywhere, 4 you know. You have the assurance that this -- this 5 6 is embedded in the ground and it's not going to 7 puncture the ground and fly off, you know. This is redundancy in very -- in basic term. 8 9 Here the foundation are virtually at the surface, and if some underestimation of the seismic 10 loads or capacity or estimation of capacity have 11 taken place, then there would be sliding of the 12 foundation and there will be stability of the 13 foundations because we don't have any other 14 mechanism to rely on. 15 On another analysis would be pile. You 16 could have 8, 10 piles, some of which may break if 17 the loads exceed our design loads, but you still 18 have redundancy in the foundation to carry the 19 loads. 20 And with respect -- that's with respect 21 0. to the foundations. What about with respect to 22 23 casks? DR. OSTADAN: The same thing with 24 respect to the casks. In this case the design 25 NEAL R. GROSS COURT REPORTERS AND TRANSCRIBERS 1323 RHODE ISLAND AVE , N W WASHINGTON, D.C. 20005-3701 www.nealrgross.com (202) 234-4433

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10299 1 relies on this nonlinear analysis to predict the displacement of the casks. What if the sensitive 2 3 analysis was not as accurate as it expected to be? You know, what redundancy do we have? Are they 4 going to go to the edge of the pad and fall off? 5 6 There's nothing built in there. 7 Q. And you mentioned that PFS is relying on a nonlinear analysis. Is this the Holtec computer 8 9 analysis of the performance of the -- of the casks? 10 DR. OSTADAN: That's correct, yes. 11 Ο. Is there any test data that is used by 12 Holtec in its analysis of the performance of the 13 casks? 14 DR. OSTADAN: Certainly I'm not aware of 15 any test referred to. I do know, and we all 16 realize in the industry side, that such analysis 17 are very sensitive. Unfortunately, it's very difficult to rely on them for a fairly accurate 18 19 prediction of behavior because of the sensitivity 20 they offer. 21 Q. If this were a conventional building or 22 a bridge, would you have as many concerns with 23 respect to relying on a nonlinear computer analysis 24 for the performance of the structure? 25 DR. OSTADAN: Well, even there, you NEAL R. GROSS COURT REPORTERS AND TRANSCRIBERS 1323 RHODE ISLAND AVE., N W

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| 1 | know, nonlinear analysis are done for bridges and |
| 2 | columns under extreme loading. I'm sure |
| 3 | Dr. Bartlett might know some examples. I certainly |
| 4 | do. And that is also a never-ending discussion as |
| 5 | to how accurate the results and predictions are, |
| 6 | you know, how many time histories, how the |
| 7 | parameters were modeled, how the results could |
| 8 | could be changed. |
| 9 | DR. BARTLETT: May I jump in? |
| 10 | Q. Certainly. |
| 11 | DR. BARTLETT: Certainly, when we're |
| 12 | dealing with fabricated materials such as concrete |
| 13 | and steel whose properties are reasonably well |
| 14 | designed, we're dealing with boundary conditions in |
| 15 | design of bridges and structures that are |
| 16 | reasonably well defined, and at least my |
| 17 | structural engineering friends do use nonlinear |
| 18 | analysis. |
| 19 | I think also the issues here are even |
| 20 | more complex than that, particularly when we look |
| 21 | at the soils. The soils are not fabricated. They |
| 22 | are naturally deposited materials that are |
| 23 | heterogeneous and isotropic, have a very are |
| 24 | very quick to reach a yield in a nonlinear |
| 25 | behavior. They are affected by multiple mechanisms |
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that are very difficult to define.

2 We in geotechnical engineering have been 3 accused of being some somewhat naive and behind the 4 science of modeling because our friends in 5 structural engineering use reasonably sophisticated 6 codes. We kindly remind our friends in structural 7 engineering that we have huge uncertainties in our 8 properties that we deal with because they are 9 deposited and laid down by nature and there's 10 multiple processes that affect their strength and 11 compressibility, both with time and during the 12 earthquake.

13 So our practice, usually in geotechnical 14 engineering, is to rely on very simple models that 15 are based primarily on statics, limit equilibrium 16 force, equilibrium things, that most even 17 undergraduate civil engineers are trained in, and 18 then use experience and precedence to guide our 19 judgment. Much of what we do is judgment based so 20 that, once we design a foundation system according 21 to that applied method that's been recognized and 22 used for numerous years and also that we've looked 23 at that design and saw how it has actually 24 performed either during an earthquake or with some 25 time, we have some confidence because our models we

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| | 10302 |
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| 1 | may be using are less sophisticated but backed by |
| 2 | years of judgment and precedence. |
| 3 | So that's my perspective on this issue. |
| 4 | I would be very hesitant to model the nonlinear |
| 5 | behavior of a soil underneath a foundation system |
| 6 | using these codes because of our uncertainties that |
| 7 | are involved in the natural soils and their very |
| 8 | complex behavior. |
| 9 | Q. And in seismic design or seismic |
| 10 | analysis, do you look at both the capacity are |
| 11 | there two sides of the analysis, capacity and |
| 12 | demand? Is that correct? |
| 13 | DR. BARTLETT: Correct. |
| 14 | Q. And, Dr. Bartlett, you were mentioning |
| 15 | soils. Is that on the capacity side of the |
| 16 | analysis? |
| 17 | DR. BARTLETT: Generally I've been |
| 18 | focusing on the capacity side in modeling, at what |
| 19 | point do the soils reach a failure point and yield, |
| 20 | and what is their post-yield behavior, but |
| 21 | certainly on the demand side |
| 22 | Q. Before you go on to demand, could you |
| 23 | just describe the capacity side? Is it is it |
| 24 | just the capacity of the soils? Does it involve |
| 25 | what else does the capacity side involve? |
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| 1 | DR. BARTLETT: For this particular |
| 2 | design? |
| 3 | Q. For the PFS design, that's correct. |
| 4 | DR. BARTLETT: The capacity would be not |
| 5 | only the soils but the cement-treated soils and how |
| 6 | they behave seismically. |
| 7 | Q. Dr. Ostadan, is there anything in your |
| 8 | area that you look at on the capacity side? |
| 9 | DR. OSTADAN: Yes, certainly. The |
| 10 | capacity, really ability to carry the seismic |
| 11 | loads, and as it plays the role into the demand |
| 12 | side, the capacity of the foundation. In this case |
| 13 | the radiation damping of the pads at the canister |
| 14 | transfer building is another capacity that the soil |
| 15 | medium offers to reduce the seismic loads. |
| 16 | Q. And would the cask's performance be on |
| 17 | the capacity side? |
| 18 | DR. OSTADAN: Well, the cask now is |
| 19 | playing more on the demand side because that is the |
| 20 | component that is the mass that is experiencing the |
| 21 | accelerations and generating the seismic loads. |
| 22 | Q. So what is on the demand side? |
| 23 | DR. OSTADAN: Well, seismic input |
| 24 | motion, to start with, and then we have the inertia |
| 25 | of the cask casks and the pad and also some of |
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| | 10304 |
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| 1 | soil cement, the mass of soil cement. |
| 2 | Q. Do you have resonance frequency? |
| 3 | DR. OSTADAN: Yes, you could have, |
| 4 | depending on the natural frequency of the system |
| 5 | and the fact that how many of these systems you |
| 6 | have lined up next to each other. In this case, |
| 7 | with respect to the casks and the pad, dynamically |
| 8 | speaking we have virtually similar systems, so we |
| 9 | are replicating the same natural frequency of the |
| 10 | foundations over and over, 500 times |
| 11 | Q. Could you describe what resonance |
| 12 | could you describe the concept of resonance |
| 13 | frequency in simple terms? |
| 14 | DR. OSTADAN: Okay. I'll try. There |
| 15 | are actually two parts to it here as it relates to |
| 16 | PFS design. One is once we have a pad and a cask |
| 17 | and a soil medium under it, apart from seismic load |
| 18 | and design motion, this system, by definition, has |
| 19 | a natural frequency. Like this building has its |
| 20 | own natural frequency no matter what earthquake |
| 21 | will come in the future. It's just a function of |
| 22 | the mass and the stiffness of the building and the |
| 23 | soll and the foundation. And that can be obtained. |
| 24 | In the case of pads, from what I have |
| 25 | seen in this calculation, it ranges between 5 to |
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| 1 | 10, 11 hertz, depending on the properties they have |
| 2 | used, upper bound and best estimate and lower |
| 3 | bound. |
| 4 | Now, if these frequencies turn out to |
| 5 | line up with where the major energy is in the |
| 6 | design motion, then you have some component of |
| 7 | resonance taking place, you see. You have a system |
| 8 | whose that's very sensitive to a specific |
| 9 | frequency. And it just so happened that Mother |
| 10 | Nature is delivering energy at the same frequency, |
| 11 | and that would excite the systems the most. |
| 12 | An example of it, Mexico City earthquake |
| 13 | where a lot of high-rises collapsed. You have a |
| 14 | in fact, they have a clay deposit there too, soft |
| 15 | clay, and the natural frequency of the building |
| 16 | lined up with the foundation system. And it turned |
| 17 | out that the earthquake was a distant event, so |
| 18 | that frequency also lined up. And there was a lot |
| 19 | of damage and collapse of the buildings. |
| 20 | So that is resonance one aspect of |
| 21 | resonance. |
| 22 | Then then if it just so happened you |
| 23 | have identical systems, which is the case here, |
| 24 | having the same natural frequency obviously, as |
| 25 | they vibrate, you know, they change the seismic |
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| 1 | wave field under them in the soil medium. For |
| 2 | example, if it is stated to 5 hertz, there are a |
| 3 | lot of 5-hertz waves are pumping into the ground. |
| 4 | And that is another component of resonance. |
| 5 | MR. TRAVIESO-DIAZ: Mr. Chairman, I'm |
| 6 | sorry. I hate to be rude, but I move to strike the |
| 7 | last portion of the witness' answer that deals with |
| 8 | the issue of the effects of having a number of pads |
| 9 | vibrating at the same vibrational frequency. We |
| 10 | went through this in the in limine motions, and |
| 11 | this issue was kept out. |
| 12 | As I say, I apologize for doing this, |
| 13 | but I really don't want to have this in the record. |
| 14 | MS. CHANCELLOR: It was just a general |
| 15 | description of resonance frequencies as it relates |
| 16 | to PFS. I promise not to use it in the findings. |
| 17 | JUDGE FARRAR: To the extent that |
| 18 | it's was just intended as an answer to the |
| 19 | question, we will consider it. To the extent, |
| 20 | Mr. Travieso-Diaz, that it introduces elements of |
| 21 | the forbidden subjects, you are correct, and we |
| 22 | certainly would not consider it on that basis. |
| 23 | MR. TURK: And, Your Honor, just for |
| 24 | clarification, this is the cause that was outside |
| 25 | the scope of the contention? |
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| 1 | JUDGE FARRAR: Right. But to the extent |
| 2 | it's an explanation of the term that he was |
| 3 | requested to define in layman's language, you know, |
| 4 | we'll consider it for that basis. |
| 5 | MR. TRAVIESO-DIAZ: If it was intended |
| 6 | as a tutorial to explain possible phenomena, I |
| 7 | don't object to that, but, again, I don't expect to |
| 8 | see that used any other way. |
| 9 | MS. CHANCELLOR: You won't, |
| 10 | Mr. Travieso-Diaz. |
| 11 | MR. TRAVIESO-DIAZ: Thank you. |
| 12 | Q. (By Ms. Chancellor) Had you completed |
| 13 | the description, Dr. Ostadan? |
| 14 | DR. OSTADAN: Yes, I have. |
| 15 | Q. Okay. And soil structure interaction, |
| 16 | is that also on the demand side? |
| 17 | DR. OSTADAN: Actually, it is on both |
| 18 | sides. As it relates to defining the parameters |
| 19 | that in this case, say, spring and dash pots, it |
| 20 | really calls on capacity side and what those |
| 21 | properties are and how much stiffness and radiation |
| 22 | capacity they have, but then it integrates on the |
| 23 | demand side to direct faults. |
| 24 | Q. First of all, basics on soil structure |
| 25 | interaction, could you give us just a general |
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| 1 | description of soil structure interaction? |
| 2 | . MR. TURK: May I inquire, Your Honor, is |
| 3 | this redirect or cross? Was there some question |
| 4 | raised in cross as to to the witness, either the |
| 5 | the term "soil structure interaction" or what it |
| 6 | means or why why are we why are we doing |
| 7 | this as redirect? |
| 8 | MS. CHANCELLOR: We were doing it |
| 9 | we're doing it as redirect because there have been |
| 10 | a number of questions about soil structure |
| 11 | interaction, and this is a prelude so that we |
| 12 | have left the subject a week or two ago. |
| 13 | Everybody's cold. I think that we need to redefine |
| 14 | terms so that we can have a sensible discussion on |
| 15 | the record of the issues that are raised by the |
| 16 | by the State and that were raised during |
| 17 | cross-examination. |
| 18 | MR. TRAVIESO-DIAZ: If I could comment? |
| 19 | If you recall, at the very beginning of these |
| 20 | witness's testimony some time ago, there was an |
| 21 | offer to provide a tutorial, which the board |
| 22 | declined to take. I have no problem if we have |
| 23 | some questions that form the foundation for |
| 24 | specific testimony. But second, I didn't ask |
| 25 | either of these witnesses, I don't recall, to give |
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| 1 | me an explanation what soil structure interaction |
| 2 | was. And I think if we're going to go through |
| 3 | every potential aspect of the fundamental physics |
| 4 | that underlie this contention, we're going to be |
| 5 | here a very long time. So I am only raising it as |
| 6 | a question of not only being beyond the scope of |
| 7 | the cross-examination but being, perhaps, not an |
| 8 | effective use of time. |
| 9 | MS. CHANCELLOR: I might object to the |
| 10 | not effective use of time. I didn't complain when |
| 11 | I thought other people didn't use time effectively. |
| 12 | With respect to whether this was brought |
| 13 | up in cross-examination, there have been there |
| 14 | has been a considerable amount of discussion about |
| 15 | soil structure interaction. I'm just asking this |
| 16 | witness, Dr. Ostadan, to give us a layperson's |
| 17 | description of soil structure interaction so that |
| 18 | the rest of the redirect can be framed by that |
| 19 | that layperson's understanding of the term. |
| 20 | MR. TRAVIESO-DIAZ: Perhaps I could |
| 21 | focus my comment a little better. My concern here |
| 22 | is that we have been going for the last 15 minutes |
| 23 | or so talking about what's the demand side, what is |
| 24 | supply side, what are the components, and so on. |
| 25 | All those things are already on the record to a |
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| 1 | considerable extent, as a matter of fact, both in |
| 2 | the prefiled testimony and that was the first |
| 3 | set of questions that I asked these witnesses when |
| 4 | I examined them very recently. I wanted to |
| 5 | understand what they were talking about. I think |
| 6 | that we're being also duplicative in talking about |
| 7 | things that are already were explained. |
| 8 | And I didn't mean to although I tried |
| 9 | to be effective on my use of time, I didn't mean to |
| 10 | to imply that you were not. I just think in the |
| 11 | overall scheme of things, given that we want to |
| 12 | finish with this portion of Contention Q L/QQ in |
| 13 | the next two days, I would urge everybody to try to |
| 14 | be economical in what they ask. That's all. |
| 15 | MS. CHANCELLOR: Mr. Travieso-Diaz, I |
| 16 | went out of my way yesterday to copy exhibits for |
| 17 | Dr. Arabasz. I tried to be as efficient as |
| 18 | possible, and I will try to do the same today. |
| 19 | JUDGE FARRAR: Wait, wait. I think he |
| 20 | was saying that he was not accusing you of not |
| 21 | being that, so |
| 22 | MR. TRAVIESO-DIAZ: I'm emphatically not |
| 23 | accusing you of anything. |
| 24 | JUDGE FARRAR: Right. Let me do this. |
| 25 | We were faced with this problem, that the direct |
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| 1 | testimony was nearly a month ago, so was some of |
| 2 | the cross, and making fine rulings on what was |
| 3 | within the extent of the cross is a little |
| 4 | difficult at this point. We then get into the |
| 5 | question of bringing witnesses back later on |
| 6 | rebuttal or surrebuttal, and so I think we're |
| 7 | inclined to leave a little bit of leeway here for |
| 8 | State's counsel in the interest of overall |
| 9 | efficiency. |
| 10 | But, Ms. Chancellor, we do want to make |
| 11 | sure we're not being unnecessarily duplicative, so |
| 12 | if you'll just bear all that in mind as you |
| 13 | proceed. |
| 14 | MR. TURK: May I note one thing also, |
| 15 | Your Honor? I I raised the question initially |
| 16 | because I didn't see this as being directed to |
| 17 | something in the cross-examination that she needed |
| 18 | to address. It seems to be a supplementation of |
| 19 | the direct testimony. |
| 20 | I would note that Dr. Stamatakos is here |
| 21 | with me today. We intent to present rebuttal |
| 22 | testimony directed to some of the things that Dr. |
| 23 | Arabasz brought out. We're short on time. We have |
| 24 | today and tomorrow, being Saturday. I want to make |
| 25 | sure that we can finish things without extending, |
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| 1 | and I want to ask that if something is not a proper |
| 2 | part of the redirect that we move on past it. I |
| 3 | certainly understand your ruling on this one, |
| 4 | Your Honor, but I I would note that I would |
| 5 | raise the same problem again if I see it because we |
| 6 | are short of time and I think we should limit |
| 7 | ourselves to proper redirect. |
| 8 | JUDGE FARRAR: All right. So far we're |
| 9 | not prepared to say we're outside those bounds, but |
| 10 | we will bear everyone's thoughts in mind. |
| 11 | Go ahead, Ms. Chancellor. |
| 12 | Q. (By Ms. Chancellor) Dr. Ostadan, could |
| 13 | you give us a very brief description of soil |
| 14 | structure interaction? |
| 15 | DR. OSTADAN: I think the best way to |
| 16 | view soil structure interaction is to draw an |
| 17 | analogy as to what it would be if you didn't have |
| 18 | soil structure interaction, and that is simply |
| 19 | assuming your building, your structure, is on a |
| 20 | very stiff medium, such as rock, it doesn't deform, |
| 21 | it's rigidly connected, there is virtually no |
| 22 | interaction. Soil structure interaction is is |
| 23 | really the process and the calculation that takes |
| 24 | into account the formation of the soil, additional |
| 25 | amplification of the motion that could have been |
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| 1 | caused by the soil, taking credit for the radiation |
| 2 | damping in the soil, recognizing that the soil |
| 3 | medium may change the natural frequency of the |
| 4 | system and then to try to be as realistic as |
| 5 | possible in predicting the seismic loads and |
| 6 | seismic response of the building. For that matter, |
| 7 | it is required, both by NRC and by DOE, for nuclear |
| 8 | facilities that are on soil foundation, to be taken |
| 9 | into account. |
| 10 | Q. Thank you for that brief response. |
| 11 | Finally, with respect to getting terms |
| 12 | defined and out of the way, can you describe |
| 13 | factors of safety versus safety with respect to the |
| 14 | design of the PFS facility? Are there certain |
| 15 | factors of safety that PFS must meet? |
| 16 | DR. OSTADAN: Yes. I think with respect |
| 17 | to the foundation that's where my emphasis has |
| 18 | been the requirement is for stability of the |
| 19 | foundation a factor of safety of 1.1 needs to be |
| 20 | , met. |
| 21 | DR. BARTLETT: That is found, I believe, |
| 22 | in NUREG 0800, Section 3.8.5. |
| 23 | Also, I may add in regards to the |
| 24 | sliding of the casks, they're also in NUREG 1536, |
| 25 | and its requirements discuss sliding and tipping. |
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| | 10314 |
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| 1 | Q. (By Ms. Chancellor) And these are |
| 2 | requirements that the design must meet, is that |
| 3 | correct, without regard to whether there's going to |
| 4 | be any radiation release? |
| 5 | DR. OSTADAN: Yes. This is independent |
| 6 | of the consequence of, let's say, failure. |
| 7 | DR. BARTLETT: Ms. Chancellor, I may |
| 8 | have to amend my previous answer because the NUREG |
| 9 | 0800, Section 3.8.5 is for nuclear power plants, |
| 10 | not explicitly for ISFSIs, but we agree with what |
| 11 | PFS's point that it's a requirement that they're |
| 12 | attempting to meet. |
| 13 | Q. Thank you. |
| 14 | MR. TRAVIESO-DIAZ: Ms. Chancellor, I |
| 15 | don't want to interrupt your train of thought, but |
| 16 | could this be a good place for a break? |
| 17 | MS. CHANCELLOR: It would be an |
| 18 | excellent place for a break. |
| 19 | JUDGE FARRAR: Okay. Off the record. |
| 20 | (A discussion was held off the record.) |
| 21 | JUDGE FARRAR: Then let's take a |
| 22 | let's take a break till quarter of. |
| 23 | (A recess was taken.) |
| 24 | JUDGE FARRAR: Ms. Chancellor, you were |
| 25 | going to tell us after the break how long you |
| | |
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| | 10315 |
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| 1 | thought you might need, just for planning purposes. |
| 2 | MS. CHANCELLOR: Well, I promise to be |
| 3 | efficient. I don't know if I'll get through by |
| 4 | lunch or not. |
| 5 | JUDGE FARRAR: Okay. Well, let's start |
| 6 | right in, then. |
| 7 | MS. CHANCELLOR: Depends how it goes, |
| 8 | Your Honor. |
| 9 | Q. It's correct, isn't it, that I'd like |
| 10 | to focus now on PFS's seismic analysis and |
| 11 | questions that were brought up with respect to the |
| 12 | seismic analysis. Is it what did Geomatrix do |
| 13 | with respect to the seismic analysis? Did they |
| 14 | develop the ground motions and soil properties? |
| 15 | DR. OSTADAN: Yes. Their primary input |
| 16 | was to come up with the design motion and the time |
| 17 | histories. They also performed what they call |
| 18 | freefield analysis to obtain the soil properties |
| 19 | that are compatible with the limit of earthquake |
| 20 | shaking. |
| 21 | Q. And the ground motions that Geomatrix |
| 22 | developed, they were in the freefield; is that |
| 23 | correct? |
| 24 | DR. OSTADAN: That is correct. |
| 25 | Q. And could you does that mean that |
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| 10316 |
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| there were no buildings or anything |
| A. That's right. Freefield means actually |
| it is free from presence of any buildings, so |
| that's how it's typically designed. |
| Q. And then Holtec used the ground motions |
| and soil properties that Geomatrix developed; is |
| that correct? |
| DR. OSTADAN: Yes. The ground motion, |
| they used the time histories that Geomatrix |
| developed. However, the soil properties, they took |
| the properties that was provided by Geomatrix, and |
| then they they calculated the soil springs and |
| damping. And then they used those parameters in |
| their model. |
| Q. And during your cross-examination you |
| got a number of questions about the Holtec cask |
| performance calculation. Could and the cask |
| could you explain how Holtec modeled the cask |
| sliding or cask performance and how the soil |
| springs and damping relate to this calculation? |
| DR. OSTADAN: Okay. This is a fairly |
| complex model. Part of this model has to do with |
| modeling of the casks and interaction with the pad |
| and the interface conditions. They use certain |
| springs between the cask and the pad, and that part |
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| 1 | of it, I believe, was the subject that Altran |
| 2 | Dr. Khan, looked at it fairly closely. |
| 3 | Then the other part of their model is |
| 4 | is the pad and the soil, and the way that it has |
| 5 | been represented in their model is based on what |
| 6 | they call lumped parameters. It's basically a soil |
| 7 | spring a set of soil springs and dash pots. And |
| 8 | to obtain those values they had to make certain |
| 9 | assumptions, one of which I have a main concern |
| 10 | in with is pad where I assume to be rigid. |
| 11 | Q. And what is the problem with assuming |
| 12 | the pad is rigid? |
| 13 | DR. OSTADAN: Okay. Now, that goes back |
| 14 | to how you obtain that spring and dash pot. And |
| 15 | how this is derived and there are different ways |
| 16 | of doing this is you need to first make |
| 17 | assumptions whether the pad is acting in a rigid |
| 18 | manner, that there is no deformation within the pad |
| 19 | itself, or it actually deforms. And the way it |
| 20 | would impact your parameters would be mostly on the |
| 21 | damping part of it. If the pad were to be rigid, |
| 22 | the damping would be less, and if the damping is |
| 23 | less, the seismic loads coming out of the analysis |
| 24 | would be higher. And if they're assumed to be |
| 25 | rigid, which was the case, the damping would be |
| 1 | 1 |

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| higher or the highest it could be, and, therefore, the seismic load would be less. MR. TURK: Your Honor, I did not interrupt the question or answer, but I don't see that this is redirect. It's part of the witness's direct testimony. What what they're doing now is they're supplementing their direct testimony. The only function for redirect, the only proper function, is to go back over questions that were asked in the cross and try to repair the damage, either verify what was meant or to address the testimony given in cross. |
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| 2 the seismic load would be less. 3 MR. TURK: Your Honor, I did not 4 interrupt the question or answer, but I don't see 5 that this is redirect. It's part of the witness's 6 direct testimony. What what they're doing now 7 is they're supplementing their direct testimony. 8 The only function for redirect, the only proper 9 function, is to go back over questions that were 10 asked in the cross and try to repair the damage, 11 either verify what was meant or to address the 12 testimony given in cross. |
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| 10 asked in the cross and try to repair the damage, 11 either verify what was meant or to address the 12 testimony given in cross. |
| <pre>11 either verify what was meant or to address the 12 testimony given in cross.</pre> |
| 12 testimony given in cross. |
| |
| 13 I was I've been careful in my |
| 14 cross-examination to limit it to what was presente |
| 15 in direct. The the same requirement applies to |
| 16 redirect. They have to address the |
| 17 cross-examination. I don't see Ms. Chancellor |
| 18 doing that. |
| 19 MR. TRAVIESO-DIAZ: If I may, I think |
| 20 the best practice, in fact, is to cite where in th |
| 21 transcript the question was asked and then |
| 22 providing the page number, but short of that, ther |
| 23 should be, I believe, some better tie-in of the |
| 24 questions being asked to the specific areas or |
| 25 issues that were raised in the cross-examination. |
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| | 10319 |
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| 1 | I think that we're having I'm |
| 2 | listening to it, and it sounds to me that we're |
| 3 | having an extended tutorial again. I'm not |
| 4 | objecting as long as it's kept limited, but I think |
| 5 | that Mr. Turk has a point. |
| 6 | MS. CHANCELLOR: Your Honor, there has |
| 7 | been a number of days of testimony there have |
| 8 | been a couple of days of testimony of Dr. Bartlett |
| 9 | and Dr. Ostadan. What I tried to do was group |
| 10 | items together. In some instances I have |
| 11 | transcript page numbers, in other instances, I do |
| 12 | not. |
| 13 | And it's a very difficult subject to |
| 14 | cross-examine on when the people who usually assist |
| 15 | me are sitting on the witness stand. So I'm |
| 16 | proceeding as best I can, and I don't believe any |
| 17 | of the other redirect examination cited transcript |
| 18 | page numbers when they wanted to ask about a |
| 19 | particular area. |
| 20 | And I was very, very liberal yesterday |
| 21 | in not objecting to certain wide-ranging |
| 22 | recross-examination, and I expect the same latitude |
| 23 | here. |
| 24 | JUDGE FARRAR: Let me ask a question. |
| 25 | When we get into rebuttal, rebuttal witnesses, a |
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| 1 | problem brought about by the simultaneous filing of |
| 2 | prefiled direct, you could end up bringing these |
| 3 | witnesses back on rebuttal. Am I mistaken or am I |
| 4 | correct? |
| 5 | MS. CHANCELLOR: That's correct. |
| 6 | JUDGE FARRAR: Counsel? |
| 7 | MR. TRAVIESO-DIAZ: Yes. |
| 8 | JUDGE FARRAR: All right. Then in the |
| 9 | interests of efficiency, why do we need to draw a |
| 10 | bright line between in the interest of |
| 11 | efficiency and the fact that we're a month after |
| 12 | the fact from the direct and it's hard to make |
| 13 | rulings, in the interest of efficiency, why do we |
| 14 | need to draw a bright line between what's redirect, |
| 15 | responding to your previous cross, and what might |
| 16 | stray into into rebuttal? Does it really |
| 17 | matter. |
| 18 | MR. TRAVIESO-DIAZ: Well, it does |
| 19 | matter, because if, in the under the guise of |
| 20 | redirect, we have initial and new direct testimony |
| 21 | that has not been addressed by anybody. That means |
| 22 | that, for example, that the rebuttal that I'm going |
| 23 | to present to you in a few hours is going to be |
| 24 | woefully incomplete, and it's really going to have |
| 25 | to be difficult to defend with a reasonable |
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| 1 | fairness, that this direct testimony will have been |
| 2 | heard for the first time an hour before the witness |
| 3 | has to address it. So the testimony does matter. |
| 4 | And I don't I'm not accusing |
| 5 | Ms. Chancellor of re-redirecting, but I certainly |
| 6 | will oppose creating that situation here because |
| 7 | that would, in fact, require extending the rebuttal |
| 8 | far beyond where I expect we would need to go. So |
| 9 | in that respect, it does matter. |
| 10 | JUDGE FARRAR: If then, |
| 11 | Ms. Chancellor will have the right, of course, |
| 12 | later to bring these witnesses back on rebuttal. |
| 13 | MR. TRAVIESO-DIAZ: I believe that's |
| 14 | that's correct. |
| 15 | MR. TURK: That's not correct, |
| 16 | Your Honor. There is no right to bring rebuttal |
| 17 | testimony. There has to be a request to submit it |
| 18 | or to present it, and you would rule on that, if |
| 19 | I'm not mistaken. |
| 20 | JUDGE FARRAR: I assume that's |
| 21 | technically true, but we've all been sitting here, |
| 22 | assuming, for example, Applicant is going to have |
| 23 | rebuttal testimony thank, and no one has it's |
| 24 | been a foregone conclusion that, given the way the |
| 25 | case unfolds, that they have the right that |
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that's the way to go, whether you call it a right or not.

3 MR. TURK: What -- what rebuttal 4 testimony would address is something that came up 5 in examination of another witness sponsored by 6 another party. It's not a chance to supplement the 7 party's direct testimony and say, Oh, I should have 8 made myself more clear or I should have expanded 9 upon what I presented. That's not a permissible 10 matter for either cross -- either redirect or rebuttal examination. 11

And, I'm sorry, Your Honor. 12 I think 13 there is a reason why procedural requirements such 14 as limiting redirect to the scope of cross have 15 been abided by the courts and by the Commission for 16 decades, if not centuries in the case of the 17 That is the well-recognized way in which courts. 18 examination of witnesses and presentation of testimony is to be conducted. And it's improper to 19 20 say to a party, Well, at some point you'll be able 21 to present testimony anyway so we'll just let you do it now under the guise of whatever we're calling 22 23 it. It would open the door to more cross-examination for us on matters that were not 24 25 the subject or were not presented in direct, and,

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| 1 | as Mr. Travieso-Diaz says, then there's a question, |
| 2 | Well, how do we address that in rebuttal. |
| 3 | The scope of the proceeding has been |
| 4 | defined by the direct testimony. We're limited by |
| 5 | that. Cross must stick within the direct, redirect |
| 6 | must stick within the cross. |
| 7 | MR. TRAVIESO-DIAZ: I'd like to make |
| 8 | just two observations. First, the position of |
| 9 | Mr. Turk with respect to not having a right of |
| 10 | rebuttal technically is correct, except for the |
| 11 | Applicant. Applicant, having burden of proof, has |
| 12 | the right to ask as much rebuttal as it needs until |
| 13 | it feels it has addressed the issues that have been |
| 14 | addressed by the other parties. |
| 15 | Having said that, I have been working |
| 16 | under the assertion and in a case as complex as |
| 17 | this, the parties will continue to provide narrower |
| 18 | and narrower and more focused and more, can I say |
| 19 | responsive rebuttal or redirect, or whatever their |
| 20 | testimony may be, as warranted and as necessary. |
| 21 | Certainly, I don't expect that we're going to have |
| 22 | a cone, that is, instead of going toward a narrow |
| 23 | end of the cone, we're going to go back to the wide |
| 24 | end, if you understand the analogy I'm trying to |
| 25 | make. |
| | |

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10324 1 So I'm operating on the assumption that when Ms. Chancellor finishes and I ask questions of 2 3 the witnesses and Mr. Turk asks questions of the witnesses and they get excused, I provide such 4 5 rebuttal as I need. She may ask questions of them 6 and so on. If she needs to bring her witnesses 7 back to provide further rebuttal, that's okay. But 8 the process has to come to an end, and we have to 9 converge. 10 MR. TURK: And I have one more point, Your Honor, if I may. The reason why we're a 11 12 month -- we're sitting here a month later now 13 concluding the cross-examination and doing the redirect is because of the witnesses' own 14 15 scheduling problems. On May 9th Dr. Ostadan --16 JUDGE FARRAR: Let's not waste any time 17 with why we're here. This has been a very complex 18 proceeding to manage. The parties have done their

19 best. The witnesses -- if we were going to point 20 fingers, I will be happy to point fingers at all of you for suggesting that this was a four-week case. 21 22 So -- and I think what we're struggling with is the 23 fact that you and the witnesses planned for a 24 four-week proceeding, and now we're all struggling 25 to get them back here at the appropriate time. So.

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| 1 | MR. TURK: I'm not pointing fingers. I |
| 2 | was only commenting on Ms. Chancellor's remark that |
| 3 | it's been a month since the cross-examination that |
| 4 | preceded this, and she's seeking to take credit for |
| 5 | the need to to perhaps be broader than she would |
| 6 | have been if she had gone the next day. But that's |
| 7 | we extended ourselves to this point as a matter |
| 8 | of convenience to the State and its witness, and I |
| 9 | don't think she should say, "Well, it's been so |
| 10 | long, I need more latitude." |
| 11 | JUDGE FARRAR: Well, the one thing |
| 12 | that's emerged not the one thing. One thing |
| 13 | that's emerged is, Ms. Chancellor, any help you can |
| 14 | give us with references to prior cross would be |
| 15 | helpful. Again, because of the lapse of time, the |
| 16 | cross is not as fresh in our minds as it would |
| 17 | ordinarily be, so if you can assist well, I've |
| 18 | heard several times from both of the other parties, |
| 19 | and why don't you |
| 20 | MS. CHANCELLOR: I'd like to make a |
| 21 | general comment about the scope of what are we |
| 22 | up to? redirect. During the cross, both PFS and |
| 23 | the Staff tried to minimize the issues that the |
| 24 | Staff had raised the State, I beg your pardon |
| 25 | I certainly don't want to get confused with the |
| | |

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| 1 | Staff that the State had raised. And I think |
| 2 | it's critical for us to present our case to |
| 3 | reiterate to describe the issues that we believe |
| 4 | are important based on having to respond to both |
| 5 | the Applicant and the Staff who at times asked |
| 6 | overlapping and duplicative questions. I mean if |
| 7 | we wanted to move this process along, we would |
| 8 | restrict the Staff to those questions that the |
| 9 | Applicant had not raised in its initial cross. |
| 10 | But that aside, I think that because of |
| 11 | these honed questions that the Applicant, in |
| 12 | particular, used to try and minimize the issues |
| 13 | that the State raised, that I am taking a broader |
| 14 | swath approach of having the witnesses rebut that |
| 15 | attempt to minimize the State's issues by |
| 16 | describing why those issues are important. And I |
| 17 | think that it shouldn't take too long, and if I can |
| 18 | get through in a few hours, I don't believe that |
| 19 | that is dragging out the process, given the amount |
| 20 | of time we've spent on other witnesses. |
| 21 | JUDGE FARRAR: Well, I'm less concerned |
| 22 | about time than subject matter. |
| 23 | MS. CHANCELLOR: Oh, okay. I understand |
| 24 | your point. |
| 25 | JUDGE FARRAR: In other words, it's not |
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| 1 | a matter of the time, but are we |
| 2 | MS. CHANCELLOR: Opening the door to |
| 3 | more rebuttal? |
| 4 | JUDGE FARRAR: Right. |
| 5 | MS. CHANCELLOR: I don't I don't |
| 6 | believe so, Your Honor. |
| 7 | JUDGE FARRAR: Let me consult with my |
| 8 | colleagues for a minute. |
| 9 | (The Board confers off the record.) |
| 10 | JUDGE FARRAR: Let us do this in all the |
| 11 | circumstances. |
| 12 | Ms. Chancellor, number one, we do need |
| 13 | to have a convergence. |
| 14 | Number two, we don't need just a |
| 15 | repetition of what's been said before or said on |
| 16 | the direct. We tend to get things the first time, |
| 17 | and if we don't get them, we we have not been |
| 18 | embarrassed to ask for help. |
| 19 | Number three, given the lapse of time |
| 20 | and the fact that Ms. Chancellor's advisors are now |
| 21 | on the stand, let's do this with the Applicant's |
| 22 | and the Staff's concern that something would be |
| 23 | said here that they weren't prepared to meet on |
| 24 | rebuttal, let's do this with that: Let me hear you |
| 25 | when you think there's something serious of that |
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| 1 | nature. In other words, the fact that it you |
| 2 | all are very well prepared for this case and your |
| 3 | rebuttal witnesses are very well prepared. And |
| 4 | there are some areas where even if it's straight |
| 5 | and impermissible beyond redirect areas, your |
| 6 | people are ready. |
| 7 | So I'll give you a few chips to cash in |
| 8 | when you think it would really reach the point of |
| 9 | unfairness. Otherwise, we'll spend the rest of the |
| 10 | day arguing about whether it's in or not. So let |
| 11 | me hear you when you I'm not saying your points |
| 12 | are not valid, but in the interest of moving the |
| 13 | proceeding along, let me hear you when you think |
| 14 | this is something you are genuinely surprised by |
| 15 | and not ready to meet. |
| 16 | MR. TRAVIESO-DIAZ: Thank you, you |
| 17 | honor. |
| 18 | Could I have I'm sorry. Because of |
| 19 | the lapse of time, I forgot what the last question |
| 20 | and answer was. |
| 21 | JUDGE FARRAR: If there is one. Is |
| 22 | there one pending or was that |
| 23 | MR. TRAVIESO-DIAZ: Could I have read |
| 24 | whatever the last Q and A were? |
| 25 | (The question was read as follows: |
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| 1 | "Question: And what is the problem with |
| 2 | assuming the pad is rigid? |
| 3 | "DR. OSTADAN: Now, that goes back to |
| 4 | how you obtain that spring and dash pot. And |
| 5 | how this is derived and there are different |
| 6 | ways of doing this is you need to first make |
| 7 | assumptions whether the pad is acting in a |
| 8 | rigid manner, that there is no deformation |
| 9 | within the pad itself or it actually deforms. |
| 10 | And the way it would impact your parameters |
| 11 | would be mostly on the damping part of it. If |
| 12 | the pad were to be rigid, the damping would be |
| 13 | less, and if the damping is less, the seismic |
| 14 | loads coming out of the analysis would be |
| 15 | higher. And if they're assumed to be rigid, |
| 16 | which was the case, the damping would be higher |
| 17 | or the highest it could be, and, therefore, the |
| 18 | seismic load would be less.") |
| 19 | MR. TRAVIESO-DIAZ: Thank you. |
| 20 | Q. (By Ms. Chancellor) I believe that I |
| 21 | believe at transcript page 7517 was a discussion |
| 22 | about shortcomings in the Holtec analysis. Dr. |
| 23 | Ostadan, in the Holtec cask performance analysis, |
| 24 | has there been any quantification of soil |
| 25 | interaction effects? |
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| 1 | DR. OSTADAN: No. Unfortunately, that |
| 2 | is not what I view to be a typical soil structure |
| 3 | interaction report. It has a very brief |
| 4 | description of the model and simply shows the |
| 5 | results in terms of cask displacement. It does not |
| 6 | entertain discussion or description of |
| 7 | interactions, the change of frequencies, |
| 8 | amplification of motion, the response of the pad |
| 9 | and the cask in terms of acceleration, how it |
| 10 | compares to freefield and, in summary, really, it |
| 11 | is not a typical SSI report. |
| 12 | Q. And I believe there was some discussion |
| 13 | about soil properties and changes of soil |
| 14 | properties from lower bound to best estimate to |
| 15 | upper bound let me ask this question: If you |
| 16 | change the soil properties from lower bound to |
| 17 | best from lower bound to best estimate to upper |
| 18 | bound, is there any rocking or torsional response |
| 19 | on the pad? |
| 20 | MR. TURK: Objection, Your Honor. I'm |
| 21 | sorry to do this. I don't want to interrupt |
| 22 | MS. CHANCELLOR: Oh, Your Honor |
| 23 | Your Honor, can we take a break? |
| 24 | JUDGE FARRAR: No, no. Let |
| 25 | MR. TURK: Let me me state the |
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| 1 | Objection, if I may. |
| 2 | JUDGE FARRAR: Yes, let's hear the |
| 3 | objection. |
| 4 | MR. TURK: Counsel, was nice enough to |
| 5 | refer us to page 7517 of the testimony. This is |
| 6 | May 8th. |
| 7 | MS. CHANCELLOR: Your Honor, I can't |
| 8 | continue. |
| 9 | JUDGE FARRAR: Let's take a break. |
| 10 | MS. CHANCELLOR: Thank you. |
| 11 | (A recess was taken.) |
| 12 | JUDGE FARRAR: There's been a suggestion |
| 13 | we take an early lunch break. It's now 11:25. |
| 14 | Let's come back at 12:45. |
| 15 | (Lunch recess was taken.) |
| 16 | JUDGE FARRAR: All right. We're back |
| 17 | from lunch and ready to resume. Why don't we start |
| 18 | with a new question, unless there are any |
| 19 | preliminary matters or suggestions. |
| 20 | MS. CHANCELLOR: No, your Honor, I'm |
| 21 | ready to start with some new questions. |
| 22 | JUDGE FARRAR: Okay, go ahead. |
| 23 | Q. (By Ms. Chancellor) I would like to |
| 24 | turn to pad settlement. Both counsel asked you |
| 25 | numerous questions concerning settlement of the |
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| 1 | pad. In particular, Mr. Turk asked questions |
| 2 | relating to differential settlement, and that's at |
| 3 | transcript pages 7764 through 7773. And either of |
| 4 | you may answer this. Was settlement of the pad |
| 5 | considered by PFS in the design of the pads, do you |
| 6 | know? |
| 7 | DR. BARTLETT: I don't believe it was |
| 8 | considered in the structural design of the pads. |
| 9 | Neither was it considered in the cask sliding |
| 10 | stability analysis done by Holtec. |
| 11 | Q. And was the effect of neighboring pads |
| 12 | considered by PFS in its design? |
| 13 | DR. BARTLETT: When you say defect of |
| 14 | neighboring pads, the loading sequences and how |
| 15 | they may impact settlement? |
| 16 | Q. That's correct. |
| 17 | DR. BARTLETT: No. To my knowledge, it |
| 18 | was not. |
| 19 · | Q. And what is the effect of settlement and |
| 20 | how it relates to prediction of cask movement? |
| 21 | DR. BARTLETT: If there's settlement of |
| 22 | the pads then there could be, we've talked about it |
| 23 | before, a dishing effect or maybe some slight |
| 24 | tilting of the pads that would occur due to |
| 25 | differential settlement. And of course the |
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| 1 | analysis that Holtec did assumed a perfectly planer |
| 2 | surface, horizontal planer surface. So it would |
| 3 | impact those assumptions. |
| 4 | MS. CHANCELLOR: I would like to hand |
| 5 | out State's and have marked State's Exhibit 210? |
| 6 | 211, I beg your pardon. |
| 7 | (STATE EXHIBIT-211 MARKED.) |
| 8 | Q. (By Ms. Chancellor) This is an |
| 9 | interoffice memo your from S. M. Macie to P. |
| 10 | Trudeau/N. T. Georges dated April 2, 1997. I |
| 11 | believe it's a Stone & Webster document. Item 5 of |
| 12 | this interoffice memorandum states, "Settlements |
| 13 | are a problem." Dr. Bartlett, have you seen this |
| 14 | document before? |
| 15 | DR. BARTLETT: No, I haven't. |
| 16 | Q. Are you sure you haven't? |
| 17 | DR. BARTLETT: Well, I guess I must |
| 18 | have. To qualify, if you meant have you showed it |
| 19 | to me today, yes, I've seen it today. |
| 20 | Q. Yes. |
| 21 | DR. BARTLETT: You've shown it though me |
| 22 | today, yes. |
| 23 | Q. That's what I mean. |
| 24 | DR. BARTLETT: Before we came to |
| 25 | testimony, yes, this was given to me this morning. |
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| | 10334 |
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| 1 | JUDGE FARRAR: That was a trick |
| 2 | question. |
| 3 | DR. BARTLETT: Okay. Yes, I have seen |
| 4 | this earlier today. |
| 5 | Q. (By Ms. Chancellor) But before today |
| 6 | you hadn't seen it? |
| 7 | DR. BARTLETT: Well, again, the project |
| 8 | has been long, there has been several documents |
| 9 | through discovery. I don't recall focusing in on |
| 10 | this at any time earlier. |
| 11 | Q. And on item 5 it states, "The total |
| 12 | storage pad settlement of 5 inches in one month |
| 13 | under full load will certainly cause differential |
| 14 | settlements. Differential settlements are cause |
| 15 | for concern in the NRC review and can require |
| 16 | extensive additional structural analysis to prove |
| 17 | the pad is adequate, " and it continues on. |
| 18 | What does this memorandum suggest to |
| 19 | you, given that it's dated in 1997? |
| 20 | DR. BARTLETT: Well, I think to be fair |
| 21 | we must realize, again, it is a historical |
| 22 | document. Obviously, sometime during the project |
| 23 | settlements of up to 5 inches were calculated. |
| 24 | This raised some issues about the structural |
| 25 | adequacy of the pads, and in this there was a |
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| 1 | recommendation that maybe preloading and what |
| 2 | preloading simply means is to apply some fill, a |
| 3 | certain amount of fill to try to take the |
| 4 | settlement out before the pads would be |
| 5 | constructed. |
| 6 | So I guess looking at it, the estimates |
| 7 | of total settlement have changed. There are still |
| 8 | concerns about settlement. They're not as large as |
| 9 | what's being estimated in this memo. And I have |
| 10 | not seen any well, I know there's no plan to do |
| 11 | any preloading in the current PFS program. |
| 12 | Q. Is it fair to say that PFS recognized |
| 13 | that differential settlement would cause a problem |
| 14 | at the PFS site? |
| 15 | DR. BARTLETT: I think so. Just looking |
| 16 | at this again, it's a historical document that |
| 17 | somebody along the design route calculated some |
| 18 | relatively large settlements and kind of run a |
| 19 | flag, if you will, a yellow flag maybe up the mast |
| 20 | and said, "We may have an issue here." |
| 21 | Q. So do you think that PFS can run a green |
| 22 | flag up the flag pole? Do you think that the |
| 23 | problem of differential settlement has been |
| 24 | resolved? |
| 25 | DR. BARTLETT: No, not completely. |
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| 1 | MS. CHANCELLOR: I would move to admit |
| 2 | State's Exhibit 211. |
| 3 | JUDGE FARRAR: Any objection? |
| 4 | MR. TRAVIESO-DIAZ: Your Honor, I hate |
| 5 | to do this, but I have the same objection to 211 |
| 6 | that I had to 210. They are historical documents. |
| 7 | The design, Dr. Bartlett just told us that the |
| 8 | settlement will be 5 inches. He has indicated, I |
| 9 | believe, the settlement problems exist and that's |
| 10 | adequate testimony. This Exhibit, I think is |
| 11 | irrelevant because it deals with things that are no |
| 12 | longer before us. 210 and 211 have the same |
| 13 | problem. |
| 14 | JUDGE FARRAR: Mr. Turk? |
| 15 | MR. TURK: Well, your Honor, with |
| 16 | respect to 210 I asked the question on what the |
| 17 | purpose of the offer is. I would ask the same. I |
| 18 | have no problem with the admission of the document |
| 19 | if it's to show that historically PFS or its |
| 20 | contractors considered these issues and PFS, of |
| 21 | course, can address whether or not they've |
| 22 | addressed it satisfactory. |
| 23 | JUDGE FARRAR: I would think that we |
| 24 | think that they are of some historical value, that |
| 25 | they can be admitted for that purpose and their |
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| 1 | increase in how much weight they have remains to be |
| 2 | seen. Perhaps, if anything, they demonstrate that |
| 3 | someone was alert to problems and thought about |
| 4 | them. So we will admit them. |
| 5 | MS. CHANCELLOR: "Them" being? |
| 6 | JUDGE FARRAR: Wait, I'm sorry. You |
| 7 | had only moved 211. |
| 8 | MS. CHANCELLOR: I'll try 210 too, your |
| 9 | Honor. |
| 10 | JUDGE FARRAR: You'll probably do pretty |
| 11 | well. Over the same objections, we'll admit 210 |
| 12 | also. |
| 13 | MS. CHANCELLOR: Thank you, your Honor. |
| 14 | MR. TURK: And, again, for the same |
| 15 | purpose, your Honor? |
| 16 | JUDGE FARRAR: Yes. |
| 17 | (EXHIBITS-210 AND 211 WERE ADMITTED.) |
| 18 | Q. (By Ms. Chancellor) At transcript pages |
| 19 | 7531 and 32 there is some questioning about I |
| 20 | don't want to be too specific because I don't want |
| 21 | to get an objection because I have the wrong page |
| 22 | number but I'm referring to some questioning |
| 23 | that came up on 7531 and 32. Are the seismic loads |
| 24 | used in the PFS analysis of the pad of pad |
| 25 | stability sufficient, Dr. Ostadan? |
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10338 1 DR. OSTADAN: I believe you are 2 referring to the stability analysis performed by 3 Stone & Webster. There are two components as 4 seismic loads are concerned. One has to do with the stability of seismic load for the cask. 5 The other is the estimate of seismic load or inertial 6 7 load of the pad. 8 Let me start with the pad itself. That 9 has been a puzzle in my mind. This is a very key parameter. Especially when it comes to the 10 stability analysis of the pad, one has to know how 11 12 much inertial load is there, and that requires 13 knowledge of acceleration of the pad. That information should have come from Holtec from 14 15 dynamic analysis of the pad and the cask. No where in Holtec report I was able to find any mention or 16

the pad is.

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So what has happened in the Stone & Webster calculation, they simply assumed a number based on design input motion, which is around about .7 G. And the same assumption, by the way, applies to the structural design of the pad by ICC, they had to assume a number and move on to design the pad. To this date I still don't know why this

description of what the acceleration response of

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critical response has not been presented and discussed.

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3 The only -- the only response that came 4 close to that was the report prepared by Dr. Luk in 5 which he discusses the acceleration responses and 6 he reports acceleration of the pad, and that turn 7 out to be significantly higher than .7 G. Ι believe it was closer to 3 G. So that, to me, is a 8 9 mystery. I have to assume that .7 G is not 10 sufficient, and to answer your question, as a 11 result of that seismic load is deficient. 12 And why is this one of the key input Q. 13 parameters in the design of the pad? 14 DR. OSTADAN: Well, I believe you 15 referred to the stability of the pad because it's a 16 very simple equation for stability of the pad. You 17 have the capacity, which is the cohesion times the 18 area of the pad. That's 2.1 ksf times the area. 19 And then on the demand side you have the cask and 20 the pad. So those numbers ought to be adequate sufficiently backed up and if you're off on any one 21 22 of them with this margin of 15 to 20 percent, the 23 balance will change quickly. So it's very 24 important to have this number correct.

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And it's the slim margins of PFS that

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Q.

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| 1 | cause you more concern than otherwise not having |
| 2 | these accelerations readily apparent? |
| 3 | DR. OSTADAN: Yes. I think the sliding |
| 4 | of the foundations is a major concern of mine. And |
| 5 | that's not really coming from necessarily these |
| 6 | numbers and thinking of these numbers. I mean, |
| 7 | it's such a basic physics involved here when you |
| 8 | have a mass experience in such large accelerations |
| 9 | such as 2,000-year motion. Expecting the |
| 10 | foundation to remain stable under sliding is very |
| 11 | optimistic expectation, to say the least. |
| 12 | Q. Now, I don't recall what page number of |
| 13 | the testimony this was, but I remember Mr. |
| 14 | Travieso-Diaz saying he was appalled at you not |
| 15 | having carefully analyzed the Luk report and making |
| 16 | giving opinions in your testimony with respect |
| 17 | to Figure 17 and I believe it was also Figures 22. |
| 18 | Dr. Ostadan, Figure 17 of the Luk report, it is |
| 19 | time histories of accelerations. In your practice, |
| 20 | do you review time histories of accelerations? |
| 21 | DR. OSTADAN: Yes. It's typically |
| 22 | reported in typical in SSI reports and what |
| 23 | their responses are. |
| 24 | Q. And how many of these time histories |
| 25 | would you have seen in your career? |
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| 1 | DR. OSTADAN: Oh, well, I would say any |
| 2 | typical SSI report talks about acceleration |
| 3 | responses of the structure foundation and compares |
| 4 | it with the free-field, how it increases, |
| 5 | decreases, describes them. So many, many times. |
| 6 | JUDGE FARRAR: Wait a minute, Ms. |
| 7 | Chancellor. Help us with many, many. We don't |
| 8 | know if that means 10 or 1,000. |
| 9 | DR. OSTADAN: Your Honor, I am not that |
| 10 | old. I would say in the 50, 60 maybe. |
| 11 | Q. (By Ms. Chancellor) I lost my train of |
| 12 | thought. At I believe Figure you also referred |
| 13 | to Figure 20 is it 21 or 22 in the Luk report? |
| 14 | 20. |
| 15 | DR. OSTADAN: Yeah, sure. |
| 16 | Q. And Figure 20. And Figure 20 is a Soil |
| 17 | Structure Interaction Comparison, Best Estimate |
| 18 | Soil Profile Data. Are these graphs on Figures 20a |
| 19 | and b, are these something that you use in your |
| 20 | normal course of business, that you come across in |
| 21 | your normal course of practice? |
| 22 | DR. OSTADAN: And these are also sort of |
| 23 | typical practice to try to characterize the |
| 24 | foundation motion and compare it to the free-field. |
| 25 | You can report it in terms of acceleration time |
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| 1 | history and you can also report it in terms of |
| 2 | acceleration response spectra or both, which is the |
| 3 | case here. And what we are looking at in Figure 20 |
| 4 | is the acceleration response spectra. |
| 5 | Q. And you testified that you had not |
| 6 | reviewed the Luk report in minute detail; isn't |
| 7 | that correct? |
| 8 | DR. OSTADAN: At the time, yes. But |
| 9 | I've had the opportunity now to look at it |
| 10 | carefully and I understand better what has been |
| 11 | done here. |
| 12 | Q. And is it correct that Dr. Luk omitted |
| 13 | proportional damping in his report? |
| 14 | DR. OSTADAN: Yes. He discusses here |
| 15 | the damping he has used. I think, as I recall, the |
| 16 | notion in the last testimony I was present was |
| 17 | because of the nature of the damping he had used, |
| 18 | and that's associated with the requirement of |
| 19 | nonlinear time history analysis, it tends to |
| 20 | overpredict a high frequency response. |
| 21 | And I think in the event of Figure 17, |
| 22 | the peak of acceleration which is closer to 2.5 to |
| 23 | 3 g was noted to be associated with high frequency, |
| 24 | and that is something that this kind of damping |
| 25 | cannot overcome. That is generally true. However, |
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| 1 | I think if one look at Figure 20b now, and even if |
| 2 | you are willing to accept that the very high |
| 3 | frequency response exceeds the charts here, they go |
| 4 | beyond 10 g, look at for example, .2 g, |
| 5 | acceleration response spectra I'm sorry, .2 |
| 6 | seconds, which is 5 hertz, now you are reading |
| 7 | numbers like 6, 7 hertz. So these are still very, |
| 8 | very high acceleration values. And I don't think |
| 9 | that damping 5 hertz is that high of a frequency. |
| 10 | Q. And Dr. Luk used a finite element model, |
| 11 | correct? |
| 12 | DR. OSTADAN: Yes, he did. |
| 13 | Q. And these points represent just one |
| 14 | node; is that correct? |
| 15 | DR. OSTADAN: Yes. Typically, you know, |
| 16 | you have to pick a node to get the response from, |
| 17 | yes. |
| 18 | Q. And does the fact that Dr. Luk omitted |
| 19 | proportional damping and that this Figure 20 and |
| 20 | Figure 17 only apply to one node, does that change |
| 21 | the opinion in your testimony with respect to what |
| 22 | you can glean from the Luk report with respect to |
| 23 | accelerations, acceleration response of the pad? |
| 24 | DR. OSTADAN: No. I still think Dr. Luk |
| 25 | has predicted fairly high acceleration responses |
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| <pre>1 for the pads. We can debate whether it 2 g, but it's very high. And with respect 3 notion of this is one node, I don't quit 4 with that I think a pad moving horizon</pre> | s 2 g or 3 t to the te agree ntally in d be it or some |
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| 2 g, but it's very high. And with respect 3 notion of this is one node, I don't quit 4 with that I think a pad moving horizon | to the agree ntally in be t or some |
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| 4 with that I think a pad moving horizon | ntally in 1 be it or some |
| | l be it or some |
| 5 plane is fairly rigid. In fact, I would | it or some |
| 6 surprised if I pick out a node next to : | |
| 7 distance away and I found acceleration | to be too |
| 8 different from this particular node. I | can't see |
| 9 why it should be different, frankly, in | the |
| 10 opposite direction. | |
| 11 Q. Dr. Bartlett, you were presen | nt for Dr. |
| 12 Luk's testimony, correct? | |
| 13 DR. BARTLETT: Yes, I was pro | esent for |
| 14 his testimony. | |
| 15 Q. And you were also present at | his |
| 16 deposition? | |
| DR. BARTLETT: Yes. | |
| 18 Q. Do you consider, from what yo | ou've |
| 19 learned in the deposition and in the ter | stimony, and |
| 20 also, you have reviewed the report too, | correct? |
| 21 DR. BARTLETT: Yes, I have re | eviewed the |
| 22 report. | |
| 23 Q. Based on the deposition, the | testimony |
| 24 and the report, do you have any concerns | s with Dr. |
| 25 Luk's report with respect to whether it | 's specific |
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| 1 | to the PFS site? |
| 2 | MR. TURK: Objection. This goes beyond |
| 3 | direct or cross. |
| 4 | JUDGE FARRAR: Let me hear the question |
| 5 | again. |
| 6 | (Pending question read back as follows:) |
| 7 | "Q Based on the deposition, the |
| 8 | testimony and the report, do you have |
| 9 | any concerns with Dr. Luk's report with |
| 10 | respect to whether it's specific to |
| 11 | the PFS site?") |
| 12 | JUDGE FARRAR: Complete the objection, |
| 13 | Mr. Turk, please. |
| 14 | MR. TURK: The question does not relate |
| 15 | to anything that was asked previously. This is an |
| 16 | attempt by the State to supplement and expand upon |
| 17 | its original testimony based on new analyses which |
| 18 | the witnesses may have conducted or new thoughts |
| 19 | that have occurred to them after the submission of |
| 20 | their original testimony. |
| 21 | MS. CHANCELLOR: I can rephrase the |
| 22 | question, your Honor, if there's a problem. |
| 23 | JUDGE FARRAR: Well, I don't know that |
| 24 | there's a problem. How does this differ from the |
| 25 | Applicant's aircraft testimony? |
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| 1 | MR. TURK: I'm not sure what you mean. |
| 2 | JUDGE FARRAR: We had a few weeks ago |
| 3 | the Applicant which had originally relied on a |
| 4 | certain number of aircraft reports, came back and |
| 5 | said they've now analyzed some more reports in |
| 6 | response to a question by Judge Lam. So they said |
| 7 | here, this is assertedly in response to a question |
| 8 | by Mr. Diaz. |
| 9 | MR. GAUKLER: I think the only question |
| 10 | might be where there's redirect or rebuttal, and to |
| 11 | me it doesn't make that much difference whether we |
| 12 | here it now as opposed to rebuttal. |
| 13 | MR. TRAVIESO-DIAZ: Technically the |
| 14 | State could put Dr. Ostadan and Dr. Bartlett on |
| 15 | later to provide rebuttal testimony to the |
| 16 | testimony of Dr. Luk. But frankly, in the interest |
| 17 | of expedience I will hear it whenever it's |
| 18 | proferred. But I do agree with Mr. Turk that this |
| 19 | doesn't relate to the examination that was |
| 20 | conducted by us or by him or the witnesses. |
| 21 | JUDGE FARRAR: Do you all recall, and |
| 22 | forgive me, it's been a long time, did the |
| 23 | Applicant's aircraft additional reports come in on |
| 24 | redirect or on rebuttal? |
| 25 | MR. GAUKLER: We submitted that |
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| 1 | testimony on rebuttal. |
| 2 | JUDGE FARRAR: On rebuttal. |
| 3 | MR. GAUKLER: Yeah. But like I say |
| 4 | here, I agree with Mr. Diaz, that it would be most |
| 5 | efficient if we discussed the topic. |
| 6 | JUDGE FARRAR: Thank you. Then on that |
| 7 | basis we'll overrule the objections and proceed. |
| 8 | Go ahead, you may answer. |
| 9 | DR. BARTLETT: When I looked at the |
| 10 | report, my review is usually restricted to looking |
| 11 | at the properties that are used in the analysis to |
| 12 | see if they represent what is at the PFS site. My |
| 13 | understanding of what Dr. Luk was doing, he was |
| 14 | first modeling general problems of casks and pads. |
| 15 | At some point in his study he was redirected to do |
| 16 | more of a site-specific analysis which included the |
| 17 | properties at the Private Fuel Storage site. And |
| 18 | my understanding is that Table 8 of the Luk report |
| 19 | summarizes the interface conditions that he used in |
| 20 | his modeling. |
| 21 | Q. (By Ms. Chancellor) And what page is |
| 22 | that on, Dr. Bartlett? |
| 23 | DR. BARTLETT: It's on page 30. |
| 24 | Q. And this is Staff's Exhibit P, right? |
| 25 | DR. BARTLETT: That, I'm not aware of. |
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| 1 | equal to 1.0 in the first case and on that first |
| 2 | line that represents the first case for soil type |
| 3 | 1. We see a Mu 2 of 1.0. |
| 4 | Q. Yes, I see it. |
| 5 | DR. BARTLETT: Okay. I'm just making |
| 6 | sure everybody is with me. What this essentially |
| 7 | means is this interface is being modeled as a |
| 8 | sliding interface. And a Mu 1 means the |
| 9 | coefficient of friction is equal to what I would |
| 10 | say 45 degree angle of feet. In geotechnical |
| 11 | engineering we don't use interfacial coefficients |
| 12 | of friction as often as we use what is called a phi |
| 13 | angle. And simply what a phi angle is, to get the |
| 14 | coefficient of friction of 1, that would imply that |
| 15 | we would take a block, place it on a surface, |
| 16 | incline it until it reached a 45 degree angle and |
| 17 | then it would initiate it sliding. So in soil |
| 18 | mechanics terms, 1 is equal to a phi angle of 45 |
| 19 | degrees. |
| 20 | Looking at the other cases, cases 2 and |
| 21 | 3 for the best estimate model type 1 we see a Mu 2 |
| 22 | of .31 degrees and then we see a Mu 2 again in the |
| 23 | last case or the third case again of 1.0. |
| 24 | So what this is really modeling in |
| 25 | simple terms is really a sliding on a granular |
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| 1 | material. |
| 2 | Q. Such as a sand? |
| 3 | DR. BARTLETT: Such as a sand or gravel |
| 4 | where there is no cohesion present. So it's |
| 5 | relying on this sliding friction to resist sliding. |
| 6 | That's not consistent with the PFS design intent. |
| 7 | My understanding, at least for the design basis |
| 8 | earthquake that PFS is proposing, that there will |
| 9 | be no sliding at these interfaces. In fact, they |
| 10 | intend to use soil cement with a high cohesion |
| 11 | which will bond itself to the bottom of the pads |
| 12 | and also be able to have enough strength that it |
| 13 | will bond itself to the clays so there cannot be |
| 14 | sliding at these interfaces. |
| 15 | So one criticism I would have of these |
| 16 | cases that were modeled is that there cannot be |
| 17 | allowed sliding at the Mu 2 interfaces in the |
| 18 | model. More importantly, I think also that to |
| 19 | realize that we cannot really model these |
| 20 | - interfaces at granular materials. The way that the |
| 21 | design is put forth is that these are soil cement |
| 22 | with a high cohesion and also the clays that have |
| 23 | derived their strength from cohesion, not from |
| 24 ' | internal angle of friction. And so those would |
| 25 | have to be adjusted. |

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| 1 | Now, to see the impact of these values |
| 2 | they would have to be changed in the model. And by |
| 3 | the way, these Mu 2 values tend to overemphasize |
| 4 | sliding. In other words, sliding would occur more |
| 5 | quickly with these Mu 2 values than it would if we |
| 6 | assigned the proper cohesion values to these. So |
| 7 | my general instincts are that this model with these |
| 8 | parameters in tends to overemphasize sliding. |
| 9 | Sliding would occur much more quickly than what |
| 10 | would happen if we really used the proper strengths |
| 11 | at these interfaces. |
| 12 | Q. So by failing to take cohesion from the |
| 13 | cement treated soil into account, did Dr. Luk |
| 14 | conduct a adequate soil structure interaction |
| 15 | analysis for the PFS site? |
| 16 | DR. BARTLETT: Well, I hesitate to say |
| 17 | did he conduct an adequate because I'm not an |
| 18 | expert in soil structure interaction. I would just |
| 19 | simply say that the properties in these interfaces |
| 20 | that he assigned are incorrect and they don't |
| 21 | properly represent what the strengths are at these |
| 22 | interfaces. And this tendency to put in these |
| 23 | sliding elements at these interfaces tends to |
| 24 | overemphasize sliding the model, which may tend to |
| 25 | dampen out the motion that's delivered to the |
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| 1 | casks. |
| 2 | Q. And did Dr. Luk take into account any |
| 3 | constraints that Holtec put on conditions at the |
| 4 | site? |
| 5 | DR. BARTLETT: Yes. There's one other |
| 6 | constraint that's placed on the design. We can |
| 7 | look at that. I'm going to Table 5 of the report. |
| 8 | Q. And what page is that on, Dr. Bartlett? |
| 9 | DR. BARTLETT: Page 11. I've changed my |
| 10 | mind. It's probably better to look at Table 2. |
| 11 | Q. On page 10? |
| 12 | DR. BARTLETT: And that's on page 10. |
| 13 | The design, as we understand it thus far, is to |
| 14 | limit the Young's Modulus of the cement treated |
| 15 | soil under the pads to 75,000 psi. And when we |
| 16 | look at what Dr. Luk has used in his report, the |
| 17 | soil cement underneath the pads has been assigned |
| 18 | 270,000 psi, which overestimates what the design |
| 19 | requirements that PFS has put on the soil cement. |
| 20 | Excuse me, cement treated soil. |
| 21 | Q. So, Doctor, you used a Young's Modulus |
| 22 | of 270,000? |
| 23 | DR. BARTLETT: Psi, yes, underneath the |
| 24 | pads. |
| 25 | MR. TURK: Your Honor, I would like to |
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make a comment. You have been quite liberal in the interest of expediting the proceeding. Sometimes liberality causes delay. If the State had given us notice that they wished to contest something about Dr. Luk's report, we could have had him here with us today to hear these criticisms. He is not here with us.

8 In the interest of allowing the State to 9 proceed, to expedite the proceeding, we now have a 10 situation where I'm not sure I can conduct cross on 11 this piece without Dr. Luk's advice. So we have 12 caused delay. I would ask that in the future if 13 something is not part of the cross-examination, we 14 should not have to sit here and be surprised by new 15 testimony in the guise of redirect that is actually 16 rebuttal. I should have an expert here with me to 17 hear this testimony and because of the Board's 18 ruling I do not, and I believe that's unfair. And 19 if Ms. Chancellor wishes to ask any other questions 20 along this line I would again object or at least 21 note my standing objection.

MR. TRAVIESO-DIAZ: If I could add one point, I think when Dr. Luk was here and gave testimony none of these questions were asked of him and they could have been asked at the time. So

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10354 1 that is a concern that I have. When the person who 2 . have addressed these issue was on the stand none of 3 these questions were raised with him, and I think that's quite unfair to raise them after the fact 4 5 when there is an opportunity to provide testimony that explains, rebuts, controverts at least what 6 7 they are saying. So I do have a problem with that. Dr. Luk, if he were here, would have a different 8 9 story. MR. TURK: Your Honor, for this 10 11 reason --JUDGE FARRAR: We've just heard you. 12 13 MS. CHANCELLOR: Your Honor, I think part of the problem comes from having to compress 14 everything relating to Dr. Luk. He was deposed on 15 Saturday, we got the transcript on Monday of the 16 17 deposition. He testified on Monday. Dr. Bartlett and Dr. Ostadan testified on Tuesday. That is not 18 your usual course of business. So I think that all 19 of this is feeding on itself. 20 And not pointing fingers at anybody, but 21 I think that given these circumstances it was 22 difficult to analyze anything that came out of Dr. 23 Luk's deposition and testimony given that it was at 24 the last minute. 25 NEAL R. GROSS

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| 1 | JUDGE FARRAR: All three of you are |
| 2 | correct. |
| 3 | MR. TURK: And there is one other point |
| 4 | to consider which goes to the fairness. |
| 5 | JUDGE FARRAR: I heard you on fairness. |
| 6 | All three of you are correct. Our ruling a few |
| 7 | minutes ago was in large part motivated by the |
| 8 | Applicant's position. It's the Applicant that has |
| 9 | the burden of proof in this case and they |
| 10 | represented they were willing to go ahead in the |
| 11 | interest of efficiency. |
| 12 | Mr. Turk, you have now raised a question |
| 13 | that goes beyond efficiency into fairness, and I've |
| 14 | indicated you were, like what all three of you have |
| 15 | said is correct, and now your fairness argument |
| 16 | does raise an efficiency problem. Go ahead. You |
| 17 | were going to add to your fairness argument. |
| 18 | MR. TURK: Yes, your Honor. Until I |
| 19 | heard this testimony orally at this moment I was |
| 20 | not aware that the State intended to present |
| 21 | rebuttal of Dr. Luk. There's a surprise element |
| 22 | there. I would ask that the testimony from the |
| 23 | point that I had objected be stricken at this time. |
| 24 | If the State wishes to present it as rebuttal, let |
| 25 | them file it. We can determine at that time, do we |
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| 1 | need Dr. Luk with us or not, we can determine how |
| 2 | to cross-examine him on it. I think that would |
| 3 | achieve the objective of fairness and it would also |
| 4 | allow the State, if they wish to present rebuttal |
| 5 | to present it, but in the proper manner. |
| 6 | JUDGE FARRAR: Ms. Chancellor, you're |
| 7 | correct, and thank you for reminding us of the |
| 8 | lateness with which the Luk matter arose. And so |
| 9 | we have here a problem of created by |
| 10 | circumstances, not by any parties or any counsel's |
| 11 | unfair dealing or inattention to detail. |
| 12 | MS. CHANCELLOR: I would like to make |
| 13 | just one point, your Honor. During the deposition |
| 14 | I understand it came out that Dr. Luk knew nothing |
| 15 | about the properties at the site. He got those |
| 16 | properties from Dr. Mahendra Shah at NRC. So we |
| 17 | couldn't have asked Dr. Luk anything about the |
| 18 | properties at the site, whether there were |
| 19 | constraints by Holtec based on its cask tip-over |
| 20 | analysis, for example, and with respect to Young's |
| 21 | Modulus. So I take that into account with respect |
| 22 | to whether or not we could have pursued this with |
| 23 | Dr. Luk. And I did mention it, I don't think it |
| 24 | was a surprise. |
| 25 | JUDGE FARRAR: Okay. We have a |
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situation which is important and which we have to deal with in the interest of fairness and efficiency and a thorough record, and we will now attempt to solve it.

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5 (The Board confers off the record.) 6 JUDGE FARRAR: We have a strong policy 7 against motions to strike which we would adhere to 8 now except we have thought of the possibility of 9 continuing this line and Mr. Turk could get the 10 transcript to Dr. Luk, but that would be for the purpose of cross-examining these people so they're 11 12 going to have to come back. In other words, we 13 cannot avoid them coming back to be questioned and cross-examined on this subject in the appropriate 14 15 procedural place, whether that's rebuttal or part 16 of this or whatever.

So it seems to me that this is one of 17 those rare times where this testimony should be 19 stricken, not necessarily for the reason that the State should have been prepared to ask Dr. Luk 20 these questions, but Mr. Turk's complaint that Dr. 21 Luk is not here with him to help guide his 22 23 cross-examination.

So that we've talked about fairness being a primary motivator, and here's one where

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| 1 | that point the question began to be answered by Dr. |
| 2 | Bartlett and Dr. Ostadan had no part of the answer. |
| 3 | Is it possible for the reporter to go back to where |
| 4 | my objection was? |
| 5 | JUDGE FARRAR: Sure. Off the record. |
| 6 | (Discussion was held off the record.) |
| 7 | JUDGE FARRAR: Back on the record. We |
| 8 | have identified in the record where, for want of a |
| 9 | better term, we'll say Mr. Turk's objection took on |
| 10 | the different character. Mr. Turk, do you want to |
| 11 | describe that? |
| 12 | MR. TURK: Yes. Your Honor, we were |
| 13 | looking at the reporter's transcript of the last |
| 14 | few minutes of this proceeding and Ms. Chancellor |
| 15 | had asked the question that began with the words |
| 16 | "Based on," and it appears she's asking Dr. |
| 17 | Bartlett, based on what he has now reviewed, does |
| 18 | he have some concerns about whether the Luk report |
| 19 | is specific to the PFS site. And at that point I |
| 20 | objected and then the testimony followed over my |
| 21 | objection. |
| 22 | JUDGE FARRAR: And the nature, in |
| 23 | retrospect, of that objection was stronger than the |
| 24 | previous objections that had been made. |
| 25 | MR. TURK: Yes. Your Honor, it seemed |
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| 1 | to me that the question was asking for new |
| 2 | testimony. You had indicated previously when I had |
| 3 | objected to matters going down the scope of cross |
| 4 | that if the parties believed something serious came |
| 5 | up we should speak. I spoke. And, your Honor, I |
| 6 | appreciate your willingness to listen to me. |
| 7 | MS. CHANCELLOR: Your Honor, I would |
| 8 | like to have it noted for the record that Dr. |
| 9 | Mahendra Shah is sitting by Mr. Turk and he said |
| 10 | that the input parameters relating to the PFS site |
| .11 | came from Dr. Mahendra Shah of NRC and they were |
| 12 | given to Dr. Luk by Dr. Shah. |
| 13 | MR. TURK: I would also note, your |
| 14 | Honor, that the same site-specific parameters are |
| 15 | the ones used by Geomatrix and by the Applicant. |
| 16 | Those are the ones that are the subject of the |
| 17 | State's focus. All of us are using the same data |
| 18 | points. I don't understand |
| 19 | MS. CHANCELLOR: Your Honor, mine was |
| 20 | merely procedural. |
| 21 | JUDGE FARRAR: We don't need to |
| 22 | MR. TURK: No. There's no new |
| 23 | information here at issue, it's information we all |
| 24 | know. |
| 25 | JUDGE FARRAR: We don't need to discuss |
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| 1 | this anymore. What we need is in other words, |
| 2 | we've said what we're going to do now. We're going |
| 3 | to strike the portion of the testimony beginning |
| 4 | with the words we just identified, but now what we |
| 5 | need is a solution or if there's a challenge to Dr. |
| 6 | Luk's report, that's a this is not a trivial |
| 7 | matter in this proceeding, the import of Dr. Luk's |
| 8 | report. So we're going to have to agree on a way |
| 9 | that we're going to in some form or another allow |
| 10 | the State to present at a later time their |
| 11 | challenge given the fact that his deposition took |
| 12 | place at the time that it did. |
| 13 | MR. TURK: I have a solution to offer, |
| 14 | your Honor. |
| 15 | JUDGE FARRAR: Okay. |
| 16 | MR. TURK: You may recall earlier in the |
| 17 | week I mentioned that I had asked both PFS and the |
| 18 | State that if they had rebuttal testimony, to put |
| 19 | it in writing so that we could get it and look at |
| 20 | it. I think this is a place this could be done. |
| 21 | - If the State has a piece of rebuttal they want to |
| 22 | put on about the Luk report, I would ask that they |
| 23 | prepare it in writing, send it to us so we can look |
| 24 | at it, give us at least some time to look at it. |
| 25 | Since the next time we convene will be in |
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| 1 | Washington, we can decide then if we need Dr. Luk |
| 2 | to be with us or whether he can simply look at it |
| 3 | and give me his comments beforehand and we can |
| 4 | avoid troubling him to come to Washington. |
| 5 | JUDGE FARRAR: So we could have these |
| 6 | same gentlemen's rebuttal testimony in writing. |
| 7 | MS. CHANCELLOR: I assume there's no |
| 8 | prohibition on cut and pasting the transcript if |
| 9 | that's our preference? |
| 10 | MR. TURK: That's acceptable with me, |
| 11 | your Honor. |
| 12 | JUDGE FARRAR: Now, were they planning |
| 13 | to be in Washington? |
| 14 | MS. CHANCELLOR: Dr. Ostadan has |
| 15 | extremely limited availability. Dr. Bartlett will |
| 16 | be in Washington, D.C. for the soils testimony. He |
| 17 | will be there Monday through Thursday the week of |
| 18 | June 17th. |
| 19 | JUDGE FARRAR: Is this largely Dr. |
| 20 | Bartlett's cause? |
| 21. | MS. CHANCELLOR: If we do it in |
| 22 | Washington, D.C. it will have to be Dr. Bartlett's |
| 23 | cause because Dr. Ostadan is unavailable. |
| .24 | JUDGE FARRAR: Can you do that, Dr. |
| 25 | Bartlett? I mean, is this sufficiently within |
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| 1 | your range of knowledge? |
| 2 | DR. BARTLETT: Yes. |
| 3 | JUDGE FARRAR: All right. |
| 4 | MS. CHANCELLOR: I think Ms. Nakahara |
| 5 | would like to comment. She's been dealing with Dr. |
| 6 | Luk before. |
| 7 | MS. NAKAHARA: Your Honor, we don't want |
| 8 | to tag team you, but Dr. Bartlett is not addressing |
| 9 | the modeling that Dr. Luk conducted. And Dr. Luk |
| 10 | testified both in the hearing and the deposition |
| 11 | that he has no knowledge of the site-specific |
| 12 | situation at PFS, the parameters. We went through |
| 13 | in cross-examination and identified each piece of |
| 14 | evidence and where Dr. Luk got it from. He got it |
| 15 | from Dr. Mahendra Shah. Dr. Luk, the choice of |
| 16 | input parameters was not Dr. Luk. And Dr. Bartlett |
| 17 | is not addressing or challenging his modeling |
| 18 | techniques, it's the input parameter. |
| 19 | MS. CHANCELLOR: And Dr. Shah is here. |
| 20 | MR. TURK: The input parameters are a |
| 21 | matter of public record. We provided that to the |
| 22 | State in discovery. They're mentioned in the |
| 23 | report, there's no need for questioning on it. |
| 24 | They are what they are. If they're wrong, they're |
| 25 | wrong. If they're right, they're right. |
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| l | JUDGE FARRAR: In discovery when? |
| 2 | MR. TURK: As soon as we were able to we |
| 3 | provided the State with as much information as we |
| 4 | could in April. |
| 5 | JUDGE FARRAR: In April of this year, |
| 6 | not |
| 7 | MR. TURK: Yes. |
| 8 | MS. CHANCELLOR: After testimony. |
| 9 | JUDGE FARRAR: not two years ago. |
| 10 | MR. TURK: No. |
| 11 | MR. GAUKLER: If I could add, the input |
| 12 [.] | parameters are in the report. There may be a |
| 13 | question of what significance those input |
| 14 | parameters have from a modeling sense. In other |
| 15 | words, what does the coefficient of friction of 1.0 |
| 16 | mean in a modeling sense, wholly is different from |
| 17 | what it may mean in a physical sense in terms of |
| 18 | what Dr. Bartlett was talking about. |
| 19 | MR. TURK: I think there's a very good |
| 20 | solution, your Honor. |
| 21 | MS. CHANCELLOR: It's make us do more |
| 22 | work. |
| 23 | JUDGE FARRAR: Well, if it's important |
| 24 | to challenge this, then everyone is going to have |
| 25 | to work. You all, again, did, all of you, an |
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| 1 | extraordinary job doing that Luk deposition and |
| 2 | this is late breaking stuff. When was the Luk |
| 3 | report created? |
| 4 | MR. TURK: The State was given a copy of |
| 5 | the report on March 8, which was complete except |
| 6 | that two tables that were then added. |
| 7 | JUDGE FARRAR: The report was completed |
| 8 | in March? |
| 9 | MR. TURK: March 8th. And then on March |
| 10 | 31st we supplemented it with a revised version and |
| 11 | included the two new tables. So they have had the |
| 12 | report for the last three months. |
| 13 | JUDGE FARRAR: I'm not focusing now on |
| 14 | the State. I'm focusing again on the criticism |
| 15 | generated in some quarters high and low about these |
| 16 | proceedings taking too long because of Licensing |
| 17 | Board inefficiencies. And I just want it to be |
| 18 | very clear that this was late breaking evidence in |
| 19 | a trial that was beginning on April 8th, evidence |
| 20 | that was created in late March. |
| 21 | MR. TURK: Early March. |
| 22 | JUDGE FARRAR: And again I say, I hope |
| 23 | anybody who goes around the country complaining |
| 24 | about our proceedings at least footnotes that fact. |
| 25 | MS. CHANCELLOR: We actually got the |
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| 1 | report that's in evidence on April 2. |
| 2 | JUDGE FARRAR: I'm taking a break right |
| 3 | now. |
| 4 | MS. CHANCELLOR: Sorry. |
| 5 | JUDGE FARRAR: Go ahead, Ms. Chancellor. |
| 6 | MS. CHANCELLOR: I beg your pardon, your |
| 7 | Honor. I just wanted to say that the actual final |
| 8 | report that was submitted with the testimony, we |
| 9 | actually received that on April 2. |
| 10 | JUDGE FARRAR: All right. Given this |
| 11 | background, who is going to testify when and where |
| 12 | so that we can resolve what I think everyone would |
| 13 | agree is an important fact. Given the significance |
| 14 | that's been attributed to the Luk report in these |
| 15 | proceedings, are there deficiencies in it or not? |
| 16 | MS. CHANCELLOR: Your Honor, if I may, |
| 17 | if during the next break I could talk with the |
| 18 | witnesses and amongst ourselves we could decide |
| 19 | what the most efficient way is, then we'll come |
| 20 | back and report to you, if that's satisfactory. I |
| 21 | would hate to commit to something without checking |
| 22 | with the witnesses. |
| 23 | MR. TURK: I would note one other thing, |
| 24 | your Honor, as it occurs to me that we're talking |
| 25 | about hearings the week of June 17th. Dr. Luk is |
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| 1 | scheduled to leave the country on June 20th and not |
| 2 | be back until late August. So I do not anticipate |
| 3 | bringing him to Washington after that point and |
| 4 | because of his trip I probably won't even bring him |
| 5 | to Washington the week of June 17h. I can confer |
| 6 | with him beforehand and if we get the testimony in |
| 7 | enough time we can consult and I can do cross based |
| 8 | on that consultation. |
| 9 | JUDGE FARRAR: Suppose after you finish |
| 10 | your cross there's left in the ether a concern that |
| 11 | Dr. Luk made some hypothetically serious mistakes, |
| 12 | then you would want to have him back to have his |
| 13 | chance to |
| 14 | MR. TURK: I will look for a solution |
| 15 | that doesn't require prolongation of the hearings. |
| 16 | MS. CHANCELLOR: If we could take a |
| 17 | five-minute break I could talk with Dr. Bartlett. |
| 18 | JUDGE FARRAR: All right. Let's take a |
| 19 | little longer than that and come back at 2:00. |
| 20 | Everyone be prepared at that point to stay around |
| 21 | for a while. |
| 22 | (Recess taken.) |
| 23 | JUDGE FARRAR: All right. We had a |
| 24 | break there to see if we could solve our problems. |
| 25 | Ms. Chancellor? |
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| 1 | MS. CHANCELLOR: Recognizing that we |
| 2 | have to get prepared for the soils testimony by the |
| 3 | week of the 17th, the State could file written |
| 4 | rebuttal by Friday, June the 14th to Dr. Luk's |
| 5 | JUDGE FARRAR: Hold on. By Friday, June |
| 6 | 14th? |
| 7 | MS. CHANCELLOR: That's correct. |
| 8 | JUDGE FARRAR: That's a week from now? |
| 9 | MS. CHANCELLOR: That's right. And then |
| 10 | we would be in Washington |
| 11 | JUDGE FARRAR: And that would be by |
| 12 | whom? |
| 13 | MS. CHANCELLOR: Dr. Bartlett. And Dr. |
| 14 | Bartlett will be in Rockville the week of June the |
| 15 | 17th. |
| 16 | JUDGE FARRAR: So we could hear that. |
| 17 | MS. CHANCELLOR: At the end of the soils |
| 18 | testimony. |
| 19 | JUDGE FARRAR: Mr. Turk, if I |
| 20 | understood, you would get that testimony to Dr. |
| 21 | Luk, is the plan? But he's leaving the country |
| 22 | when? |
| 23 | MR. TURK: June 20th is my |
| 24 | understanding. I'll reconfirm with him, but that's |
| 25 | what he had told me the last time we spoke. |
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| | 10369 |
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| 1 | JUDGE FARRAR: And did I correctly |
| 2 | understand your plan that you would get him the |
| 3 | testimony, he would analyze it, report back to you |
| 4 | and then you would use other advisors to help you? |
| 5 | MR. TURK: I don't know how I'll |
| 6 | proceed. I'm going to try to do what I can to move |
| 7 | the proceeding forward, but the dates proposed by |
| 8 | the state won't make it, and I'll tell you why. |
| 9 | Two reasons. Number one, she proposes to present |
| 10 | Dr. Bartlett at the end of the week. Well, by then |
| 11 | Dr. Luk will be out of the country. So if I wanted |
| 12 | to make a telephone call to him he would be |
| 13 | unavailable even by telephone. So I would ask that |
| 14 | this testimony be presented toward the early part |
| 15 | of that week. |
| 16 | Second, she proposes to get me the |
| 17 | testimony on June 14th, Friday. I imagine that |
| 18 | means at the end of Friday when people have left |
| 19 | the office I'll see a piece of testimony. My |
| 20 | witness again will be unavailable to me. I would |
| 21 | ask that the State give us the testimony, |
| 22 | especially since they're prepared to present it |
| 23 | today orally, I don't see why we can't get that in |
| 24 | our hands by Wednesday of next week, and I would |
| 25 | ask that the live testimony be presented towards |
| | |

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| 1 | the beginning part of the week of the 17th. |
| 2 | JUDGE FARRAR: Mr. Gaukler? |
| 3 | MR. GAUKLER: I'll still make the |
| 4 | alternative suggestion, that if the State is |
| 5 | prepared to present it, that can put it on today or |
| 6 | tomorrow and that would be their testimony. Mr. |
| 7 | Turk would have his right to cross-examine after he |
| 8 | showed Dr. Luk the transcript and then he just |
| 9 | would have the cross-examination the first part of |
| 10 | the week of the 17th back in D.C. |
| 11 | JUDGE FARRAR: We will now hear an |
| 12 · | opposing argument from your co-counsel. |
| 13 | MR. TRAVIESO-DIAZ: This is rather |
| 14 | interesting, but if you'll recall, both experts on |
| 15 | soils are available only in the early part of the |
| 16 | week of the 17th. So I will hate to take too much |
| 17 | of that time because then we lose two witnesses on |
| 18 | account of doing it. So if there is a way that |
| 19 | that cross-examination, if it could be done, to put |
| 20 | it on before the 17th, like the 14th or something, |
| 21 | that might serve our purposes better. |
| 22 | JUDGE FARRAR: I hate to say it, Mr. |
| 23 | Gaukler, but your suggestion sounds like where the |
| 24 | Board was trying to go before. Why worry what the |
| 25 | label is, put it on. Mr. Turk, does well, Ms. |
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Chancellor, does that make sense to you? We go 1 2 ahead --3 MS. CHANCELLOR: I'm confused where we 4 are, your Honor. I have no idea what Mr. Gaukler 5 suggested. I'm just at a loss. Sorry, Paul. 6 JUDGE FARRAR: But if I understand his 7 suggestion correctly, it is let's stop the 8 proceeding right now, let's put up the rebuttal 9 witness sign, have these people continue on exactly 10 the lines you were going to be on only we would call it rebuttal, and Mr. Turk would not have to 11 12 cross-examine today on that, he would cross-examine 13 -- he would now have that testimony in front of 14 him, he could consult with his people next week. You, Ms. Chancellor, would not have any written 15 16 work to do, Mr. Turk would consult with his people 17 between now and next week, and Dr. Bartlett would take the stand in D.C. for his cross-examination 18 wearing the rebuttal witness hat. 19 MS. CHANCELLOR: But after Dr. Mitchell 20 21 and Dr. Whistler testify. JUDGE FARRAR: That is the people Mr. 22 23 Travieso-Diaz were referring to. MR. TURK: That seems to make sense. Ι 24 25 would expect, then, that the State will complete NEAL R. GROSS COURT REPORTERS AND TRANSCRIBERS 1323 RHODE ISLAND AVE., N.W. (202) 234-4433 WASHINGTON, D.C. 20005-3701 www.nealrgross.com

10371

| 1 | 10372 |
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| 1 | whatever rebuttal they wish to do with Dr. Bartlett |
| 2 | at this time and then if Dr. Ostadan isn't |
| 3 | available for cross-examination he won't be asked |
| 4 | the questions now, it will be Dr. Bartlett, and |
| 5 | we'll see Dr. Bartlett in Washington for |
| 6 | cross-examination. |
| 7 | MR. GAUKLER: Then let's not strike the |
| 8 | testimony and proceed forward. |
| 9 | JUDGE FARRAR: I thought that was stereo |
| 10 | because Dr. Kline was whispering that in my right |
| 11 | ear while you were saying it in my left ear. |
| 12 | MS. CHANCELLOR: And I was saying over |
| 13 | here, what else do I have to ask? |
| 14 | MR. TURK: I have to note, I asked Mr. |
| 15 | Gaukler, is that a gun in your pocket, is there a |
| 16 | knife? What am I looking for? But this was a |
| 17 | fairly good suggestion. |
| 18 | JUDGE FARRAR: Then our only mistake |
| 19 | earlier when I was trying to urge this was not |
| 20 | recognizing that Mr. Turk would get to defer |
| 21 | cross-examination. |
| 22 | MR. TURK: That was an option that we |
| 23 | didn't consider. |
| 24 | JUDGE FARRAR: Right. |
| 25 | MS. CHANCELLOR: I would like to put a |
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| 1 | fly in the ointment. |
| 2 | JUDGE FARRAR: Okay. |
| 3 | MS. CHANCELLOR: I would like to put a |
| 4 | fly in the ointment. |
| 5 | JUDGE FARRAR: Wait. Hold on. You just |
| 6 | won. |
| 7 | MS. CHANCELLOR: Just one what? |
| 8 | JUDGE FARRAR: No, no. I say you just |
| 9 | won, W-O-N. You're getting to do what you want. |
| 10 | MS. NAKAHARA: Just one minute, your |
| 11 | Honor. |
| 12 | (Discussion was held off the record.) |
| 13 | MS. CHANCELLOR: So, your Honor, are we |
| 14 | asking questions again or are we just undeleting |
| 15 | the record? |
| 16 | JUDGE FARRAR: We will take the since |
| 17 | we disfavor motions to strike, we will ungrant or |
| 18 | unstrike the testimony, leave it in there, but |
| 19 | beginning at the point with Mr. Turk's help we |
| 20 | identified in the transcript that will now be the |
| 21 | beginning of the State's rebuttal testimony, but |
| 22 | the Staff will not be required to conduct cross at |
| 23 | this point. They will conduct cross-examination on |
| 24 | that subject during the week of June 17th. |
| 25 | And I commend you all for, again, |
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| 1helping us struggle through a difficult situation2created through no one's fault and finding a3sensible solution that will result in a thorough4record fairly and efficiently compiled.5MS. CHANCELLOR: And this rebuttal6testimony is specific to Dr. Luk's report and it7doesn't deal with any other rebuttal testimony that8the State may have to offer in this proceeding; is9that correct?10JUDGE FARRAR: I believe that's correct.11MR. TURK: Subject to reservation. I12don't know what other rebuttal they're planning, I13don't if we'll have the same problem. But we'll14wait and see.15JUDGE FARRAR: Right. But this is16rebuttal out of order. Any other rebuttal that17they come up with will be subject to the usual18rules.19Q. (By Ms. Chancellor) Dr. Bartlett, could | |
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| 18 rules. 19 Q. (By Ms. Chancellor) Dr. Bartlett, could | |
| 19 Q. (By Ms. Chancellor) Dr. Bartlett, could | |
| | |
| 20 you recap why you believe that Dr. Luk's report, | |
| 21 Staff's Exhibit P, does not represent, does not | |
| 22 model that it does not model the properties at | |
| 23 the PFS site? | |
| 24 DR. BARTLETT: My review of the Luk | |
| 25 report was focused solely on looking at the | |
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| 1 | different layers and the strength properties that |
| 2 | were used in the model. The PFS site |
| 3 | Q. Just one moment, please. Could thank |
| 4 | you. We had a little noise in the back of the |
| 5 | room. |
| 6 | JUDGE FARRAR: Off the record. |
| 7 | (Discussion held off the record.) |
| 8 | JUDGE FARRAR: Back on the record. Go |
| 9 | ahead. |
| 10 | Q. (By Ms. Chancellor) Sorry. Go ahead. |
| 11 | DR. BARTLETT: The PFS site conditions |
| 12 | are, starting from the top, a concrete pad that |
| 13 | will be placed on top of a cement treated soil that |
| 14 | has been described as an aeolian silt that is |
| 15 | underlain by what we have characterized as the |
| 16 | Bonneville clay, which is a clay silt silty clay. |
| 17 | The intent of the PFS design, as explained in the |
| 18 | pad seismic stability analysis, is to provide a |
| 19 | cement treated soil with adequate cohesion such |
| 20 | that there is complete bonding of the cement |
| 21 | treated soil to the base of the pad, and likewise, |
| 22 | a bond to the top of the Bonneville clay, thus |
| 23 | using the cement treated soil as an engineered |
| 24 | mechanism to transfer inertial courses that are |
| 25 | coming down from the cask pads down through cement |

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| 1 | treated soil and to the top of the Bonneville clay. |
| 2 | The intent of the PFS design, as I |
| 3 | understand it, is to establish that there is enough |
| 4 | cohesion in the cement treated soil so that this |
| 5 | bonding will not be disrupted by any seismic |
| 6 | forces. In other words, it's a perfect bonding |
| 7 | with no sliding. |
| 8 | When I looked at Dr. Luk's report and |
| 9 | saw how he was modeling these interfaces, let's go |
| 10 | to I believe it's Table 8 again. Yes, it's Table 8 |
| 11 | on page 30. There are different internal or |
| 12 | interfacial coefficients of friction assigned to |
| 13 | different elements in this model. The first |
| 14 | elements are at the cask's pad interface, and that |
| 15 | has been designated as the Mu 1 interface. Then |
| 16 | the pad soil cement and soil cement soil foundation |
| 17 | layer are designated as Mu 2. So there is Mu 2 |
| 18 | pertains to both those interfaces. You may note |
| 19 | that really when we speak of the soil cement that |
| 20 | Dr. Luk has presented in this report it's really |
| 21 | the cement treated soil that's being proposed by |
| 22 | PFS. |
| 23 | The friction elements that are used here |
| 24 | will allow sliding when the horizontal force |
| 25 | exceeds a certain value. So that it's modeling |
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these interface layers as if they were frictional. And we explained earlier that a frictional material to us in this case would be something like a sand or a gravel that derived their strengths primarily from grain-to-grain contact.

So what Dr. Luk is really modeling at these interfaces are granular materials, and that is not what is present at the PFS design. The cement treated soil derives its strength primarily from cohesion. Likewise, the Bonneville clay is not a granular material, it derives its strength from cohesion or what we term the undrained shear strength.

The interfaces here that I see that Dr. 14 Luk has provided, if one simply takes the normal 15 16 force under gravity loads and calculates the force that's required to initiate sliding greatly 17 18 underestimate the actual forces that are required to initiate sliding if cohesion was considered in 19 20 the model. Hence, my instincts tell me because of the fact that sliding has been overemphasized by 21 22 Dr. Luk's model, that he may tend to underpredict the inertial forces transferred to the pads and to 23 24 the casks.

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I also in my review looked at how the

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1 cement treated soil was being modeled as far as its Young's Modulus. PFS has placed a limit on the 2 Young's Modulus of the cement treated soil due to 3 4 the hypothetical drop in tipover analysis that Holtec has done, the limit that's been placed on 5 6 the Young's Modulus of the soil cement -- excuse 7 me, the cement treated soil underneath the pads is 8 75,000 psi. If we look at the layer properties 9 that Dr. Luk has used in his report on Table 2 of 10 page 10, there is on the second line of Table 2 a 11 soil cement 2 foot 4 -- excuse me, we need to go to 12 the third line, to the soil cement 2 foot underneath the pad, which is more properly termed 13 the cement treated soil that is underneath the pad. 14 15 The design requirements that have been placed on 16 that is 75,000 psi. Dr. Luk has modeled that as 17 270,000 psi. Also, the thickness of that layer has been restricted by the design. It has to be 18 somewhere between 1 foot and 2 foot, 2 foot maximum 19 20 and 1 foot minimum. Dr. Luk has apparently modeled it at its maximum thickness. 21 And how did Dr. Luk obtain the input 22 ο. parameters that he used in the model, if you know? 23 DR. BARTLETT: This came out in 24 25 deposition and I think we also asked questions NEAL R. GROSS

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| 1 | during his testimony, that he had obtained the soil |
| 2 | properties from NRC Staff. |
| 3 | Q. And do you know whether Dr. Luk accepted |
| 4 | those properties he obtained from the Staff on |
| 5 | their face value? |
| 6 | DR. BARTLETT: That's my understanding. |
| 7 | He said that he just took the parameters that had |
| 8 | been sent to him and modeled them as had been given |
| 9 | to him. |
| 10 | Q. Do you have anything else you would like |
| 11 | to add with respect to the Luk report? |
| 12 | DR. BARTLETT: No. |
| 13 | MS. CHANCELLOR: Your Honor, I would |
| 14 | request Dr. Bartlett take off his rebuttal hat. I |
| 15 | have just a few more questions for the witnesses |
| 16 | with respect to the redirect. So I would put a |
| 17 | line here. |
| 18 | MR. TURK: So I understand, your Honor, |
| 19 | we'll do cross-examination on the testimony that |
| 20 | had been stricken and now unstricken, plus this |
| 21 | latest piece that's the State's rebuttal on this |
| 22 | testimony? |
| 23 | JUDGE FARRAR: Yes. Off the record. |
| 24 | (Discussion held off the record.) |
| 25 | JUDGE FARRAR: Ms. Chancellor, I take it |
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| 1 | that there will be no objection to putting on the |
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| 2 | original hat at this point, so we'll proceed that |
| 3 | way. Go ahead. |
| 4 | MS. CHANCELLOR: I have very few |
| 5 | questions left, your Honor. |
| 6 | |
| 7 | REDIRECT EXAMINATION ON PREVIOUS TESTIMONY |
| 8 | BY MS. CHANCELLOR: |
| 9 | Q. Dr. Ostadan, it's your turn now. Has |
| 10 | PFS accounted for forces from pad-to-pad |
| 11 | interaction in the pad stability analysis? |
| 12 | DR. OSTADAN: No. That component has |
| 13 | not been considered in the stability analysis. |
| 14 | Q. And could you describe what they have |
| 15 | failed to do and why you believe that there are |
| 16 | forces from pad-to-pad interaction? |
| 17 | DR. OSTADAN: Yes. The concern is, |
| 18 | again, we have to remember the design and the |
| 19 | layout of these pads. These pads are only 5 feet |
| 20 | apart in the long direction of each pad. And I |
| 21 | think both side agree that soil structure |
| 22 | interaction is important with respect to the |
| 23 | seismic response of the pads and the cask. |
| 24 | What it means is that there's a tendency |
| 25 | for the pad and the cask to move differently from |
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| 1 | the free-field motion. So as a result, it's it |
| 2 | can be viewed that a pad or a group of pads could |
| 3 | be moving all the place with the neighboring pad or |
| 4 | the neighboring group of pads, and this pull and |
| 5 | push action will be additional force that will be |
| 6 | exerted on the pad that should have been considered |
| 7 | in the stability analysis of the pads. This has |
| 8 | simply not been included. |
| 9 | Q. Do you have any idea what forces we're |
| 10 | talking about? |
| 11 | DR. OSTADAN: I have not calculated |
| 12 | these forces myself. There was a recent report |
| 13 | that I believe got some time ago that Holtec |
| 14 | perform an analysis to address whether or not |
| 15 | pad-to-pad interaction impacts the response. And |
| 16 | in that report, unfortunately the they only focus |
| 17 | on the displacement of the cask. But then they |
| 18 | also cite amount of force that gets transmitted |
| 19 | from one pad to the other. It's a significant |
| 20 | number. I don't remember number, but in the order |
| 21 | of 1,000 kips to 2,000 kips. I have to look it up. |
| 22 | Q. Would you like a copy of the report? |
| 23 | DR. OSTADAN: Yes, please. |
| 24 | Q. This is PFS Exhibit, for the record, PFS |
| 25 | Exhibit 225. |
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| 1 | DR. OSTADAN: Okay. If we go to page 28 |
| 2 | of 43 there is a Table there. For example, if we |
| 3 | look at the middle row where it says two pads and |
| 4 | this is a scenario where compression of the soil |
| 5 | cement within the two pads have been modeled. In |
| 6 | other words, assume the soil cement will not have |
| 7 | any tensile capacity, but would have compressive |
| 8 | capacity. And if you look at the third column |
| 9 | under that row, a maximum compression load in soil |
| 10 | cement between pads is reported to be 1,900 kips, |
| 11 | so almost 2000 kips. |
| 12 | So to answer your question, at least |
| 13 | based on this calculation, there could be a force |
| 14 | transfer in the order of 2,000 kips. |
| 15 | Q. And do you think there's enough design |
| 16 | margin in PF well, if you believe PFS and |
| 17 | thought that there was some design margin in their |
| 18 | design, would that be able to handle this 2,000 |
| 19 | kips? |
| 20 | DR. OSTADAN: Oh, no way. I think the |
| 21 | margin is so slim and there are serious concern |
| 22 | with the margin that exists there already away and |
| 23 | apart from this additional force. |
| 24 | Q. Dr. Bartlett, Mr. Travieso-Diaz asked |
| 25 | you a hypothetical question, I believe, about |
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| 1 | qualification and testing of soil cement, and if |
| 2 | PFS adequately qualified and tested soil cement, |
| 3 | would that cause a would that cause you concern |
| 4 | with respect to their design. What did you |
| 5 | understand qualification to mean? |
| 6 | DR. BARTLETT: Qualifications usually |
| 7 | meant if we are using a new material or a material |
| 8 | in a different way that we would qualify it for its |
| 9 | intended use. We do both the analysis and testing |
| 10 | to show that the material would meet its intended |
| 11 | function and perform adequately. |
| 12 | Q. And what did you mean by testing? What |
| 13 | did you take testing to mean? |
| 14 | DR. BARTLETT: If qualifications |
| 15 | require, for example, for a new product, there |
| 16 | would be some pretesting before the material is |
| 17 | actually placed. For example, UDOT quite often |
| 18 | receives materials that different vendors want them |
| 19 | to consider for use in construction. It's given |
| 20 | up the potential use of a new product or |
| 21 | material is given to UDOT research to evaluate. |
| 22 | Quite often, depending on its use, UDOT will |
| 23 | require a certain amount of testing to demonstrate |
| 24 | that it does do what it's claimed to do, and that |
| 25 | may be anywhere from specific testing of the |

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10384 1 product or asking the vendor to document and show its application in use and performance elsewhere if 2 3 it's not been used by UDOT. 4 There's a review of that particular 5 product, the different test data that the vendor 6 has given, and basically a panel of UDOT engineers 7 review it to see if it can be put on the approved list and gualified for use. 8 In your mind, is there a difference 9 0. 10 between testing to determine the acceptability of a design as opposed to testing to ensure that you 11 have met quality assurance quality control similar 12 13 to the questions that Mr. Turk was asking you 14 today? DR. BARTLETT: I think I understand your 15 16 question, I would reword it a little bit 17 differently. 18 Q. Thank you. The testing for 19 DR. BARTLETT: qualification of a material for use and for 20 application is different than the quality assurance 21 22 quality control testing. The testing done for qualification is preapplication of the material. 23 It is done to see if the material can even be used 24 25 on the project. NEAL R. GROSS COURT REPORTERS AND TRANSCRIBERS

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| 1 | There's a chance that if the particular |
| 2 | product doesn't satisfy UDOT's concerns that it |
| 3 | will not be qualified for use and be rejected. |
| 4 | That's qualifying a material by testing and that's |
| 5 | certainly different than quality assurance quality |
| 6 | control testing. Quality assurance quality control |
| 7 | testing is done on now something that has been |
| 8 | preapproved and qualified for use and it is not |
| 9 | just done to verify during construction that the |
| 10 | particular product or material has been placed |
| 11 | according to standard design specifications. |
| 12 | Q. And is it your understanding with |
| 13 | respect to soil cement that PFS will be doing both |
| 14 | qualification testing and QA testing at some point |
| 15 | in the future after these proceedings, at least |
| 16 | after these proceedings have concluded? |
| 17 | DR. BARTLETT: I understand that PFS |
| 18 | intends to do what I would call qualification |
| 19 | testing to try to demonstrate that the cement |
| 20 | treated soil and soil cement would meet its design |
| 21 | intent and develop the design criteria has been |
| 22 | postponed to a future date beyond this date. And |
| 23 | also that there are I believe language in the SAR |
| 24 | that discusses quality assurance quality control |
| 25 | testing that would be done during construction, or |

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| 1_ | at least alludes that it will be done. I don't |
| 2 | know if it discusses in specific detail the types |
| 3 | of testing, but I believe that is going to be |
| 4 | developed at a future date. |
| 5 | Q. I'm sure we'll be talking more about |
| 6 | this on June 17th. |
| .7 | DR. BARTLETT: I believe so. |
| 8 | Q. When you mentioned UDOT, that's the Utah |
| 9 | Department of Transportation? |
| 10 | DR. BARTLETT: Department of |
| 11 | transportation, that's correct. |
| 12 | Q. Dr. Ostadan, Mr. Turk was asking you |
| 13 | questions about multiple time histories in a NUREG. |
| 14 | With respect to ASCE 4-98, what other requirements. |
| 15 | for nonlinear analysis with respect to time |
| 16 | histories? |
| 17 | DR. OSTADAN: I think ASCE 4-98 put it |
| 18 | in very exact terms as to what is required when you |
| 19 | deal with nonlinear analysis. It clearly is stated |
| 20 | that more than one set of should be used. |
| 21 | Q. And do you consider that ASCE 4-98, that |
| 22 | the requirement of ASCI 4-98 should be the a |
| 23 | standard applicable to the PFS design? |
| 24 | DR. OSTADAN: I think so. The I think |
| 25 | most nuclear projects follow ASCE 4-98 unless there |
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| l | are obvious reasons that can be justified by not. |
| 2 | Q. And staying with ASCE 4-98, this time |
| 3 | with respect to incline waves, Section 3.3.1.2, I |
| 4 | believe, addresses incline waves. Do you know what |
| 5 | the requirement of that section is for |
| 6 | non-vertically propagating waves? |
| 7 | DR. OSTADAN: Yes. I think the issue of |
| 8 | incline waves have been discussed extensively and |
| 9 | the PFS witnesses have done additional calculations |
| 10 | that have been discussed. And even though I don't |
| 11 | quite agree with all the calculation. But let me |
| 12 | look at it from the engineering design perspective |
| 13 | rather than seismological aspect of it as reflected |
| 14 | in ASCE 4-98. |
| 15 | This requirement simply states that |
| 16 | either in your dynamic analysis you need to |
| 17 | consider non-vertically propagating waves or you |
| 18 | consider what is called accidental torsion. And |
| 19 | basically what they are is trying to make sure that |
| 20 | these additional seismic loads that may be caused |
| 21 | either by waves arriving at different angles or |
| 22 | different types of waves coming above and beyond |
| 23 | what is considered in their analysis, or there is |
| 24 | eccentricity in the mass location. |
| 25 | For example, let's say one cask is not |

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10388 1 exactly placed where it's supposed to be on the pad, it's some distance away, it's an operational 2 3 issue. So to cover those sort of situations this 4 requirement states you either consider asymmetric, 5 loading which is non-vertically propagating wave, 6 or you consider conversion of vertically 7 propagating wave, but you go back to your seismic load and add this accidental torsion to your 8 results. 9 PFS has done so with respect to Canister 10 11 Transfer Building. They did not perform non-vertical propagating wave, but they went up to 12 their analysis results that came up out of 13 vertically propagating wave and added the 5 percent 14 15 eccentricity as required in ASCE 4-98. However, 16 when it comes to the pad and the cask, they are not 17 consistent again and that aspect disappears. Thank you, Dr. Ostadan. There have been 18 Q. 19 many questions put to you during cross-examination. Has anything that occurred in cross-examination or 20 anything else that you have heard in this 21 proceeding caused you to change any of the opinions 22 23 that you have espoused during this proceeding? My concern has been 24 DR. OSTADAN: No. really dealing with very fundamental issues rather 25

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| 1 | than really tackling the specific numbers and |
| 2 | maneuvering around the slim margin that has been |
| 3 | shown in these calculations. I still believe that |
| 4 | there are many unprecedented design features called |
| 5 | for here, that they are taking full credit for |
| 6 | isolation sliding and this, in light of not having |
| 7 | any laboratory test data or experience data is not |
| 8 | appropriate. Design doesn't have redundancy of |
| 9 | everything that has been done ought to be correct |
| 10 | or it will not perform to the expectation laid out. |
| 11 | I think in this dynamic analysis the |
| 12 | damping, soil damping, foundation damping has been |
| 13 | overestimated which resulted in reducing seismic |
| 14 | loads. Just a minute ago we talk about pad-to-pad |
| 15 | interaction. I think that's an important aspect of |
| 16 | it. It hasn't been considered. So I remain quite |
| 17 | concerned, particularly with respect to foundation |
| 18 | performance. |
| 19 | Q. Dr. Bartlett, has anything in this |
| 20 ⁻ | proceeding caused you to change your opinion with |
| 21 | respect to the PFS site? |
| 22 | DR. BARTLETT: No. I think Dr. Ostadan |
| 23 | did a good summary also of my position. I might |
| 24 | add that perhaps the not considering settlement and |
| 25 | the effects of settlement and how it impacts the |
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| 1 | sliding of the pads. The other issues that I have |
| 2 . | are primarily to do with the capacity of the |
| 3 | foundations and soils to resist the dynamic |
| 4 | loadings, and we'll discuss those at a future date. |
| 5 | MS. CHANCELLOR: Thank you very much. I |
| 6 | have no further questions. |
| 7 | JUDGE LAM: Let me ask Dr. Ostadan a |
| 8 | question unrelated to Ms. Chancellor's questions. |
| 9 | Dr. Ostadan, are you aware of testimony provided by |
| 10 | Dr. Wen Tseng one of the Applicant's expert |
| 11 | witnesses in this area supporting the Applicant's |
| 12 | application? |
| 13 | DR. OSTADAN: Yes, your Honor, I believe |
| 14 | I reviewed that some time ago. |
| 15 | JUDGE LAM: In the resume, Dr. Ostadan, |
| 16 | you attach to your prefiled testimony, you |
| 17 | indicated that you and Dr. Tseng had worked |
| 18 | together for five years in collaborating and |
| 19 | publishing five technical papers in the areas of |
| 20 | soil structure interaction in five major |
| 21 | international conferences. I would presume there |
| 22 | were no disagreement between you and Dr. Tseng on |
| 23 | these subject matters presented in your technical |
| 24 | papers? |
| 25 | DR. OSTADAN: I think so, yes. |
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| 1 | JUDGE LAM: Then to help me to calibrate |
| 2 | your testimony with that of Dr. Tseng, are there |
| 3 | any areas in soil structure interaction that you |
| 4 | and Dr. Tseng agreed with each other? |
| 5 | DR. OSTADAN: I believe we already |
| 6 | referred with respect to PFS design? |
| 7 | JUDGE LAM: Yes, indeed. Yes, indeed. |
| 8 | I'm glad you reminded me. |
| 9 | DR. OSTADAN: I believe, if I remember |
| 10 | correctly, we both agreed soil structure |
| 11 | interaction is very important, that it changes the |
| 12 | response, it changes the frequency characteristic |
| 13 | of the response. However, I think it's fair to |
| 14 | point out, in fairness to Dr. Tseng, that he was |
| 15 | not given the opportunity, in my view, to perform a |
| 16 | full dynamic soil structure interaction. |
| 17 | What he did for PFS was he was given the |
| 18 | forces from the pads coming from Holtec analysis, |
| 19 | these are dynamic forces after Holtec perform their |
| 20 | version of soil structure interaction, seismic soil |
| 21 | structure interaction analysis, and he was asked to |
| 22 | perform a structural design of the pad. By then 95 |
| 23 | percent of the SSI effect has been decided by |
| 24 | Holtec. |
| 25 | He got the forces. He simply applied |
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| 1 | the forces to the pad and found out what the |
| 2 | stresses are and how much rebar is needed, so on |
| 3 | and so forth. Now, unfortunately, Holtec did not |
| 4 | give him the acceleration of the pad, he had to |
| 5 | assume a number for it. He was not given the |
| 6 | settlement of the pad, and was not conclude it, but |
| 7 | in my view he did not perform a soil structure |
| 8 | interaction for PFS. |
| 9 | JUDGE LAM: Thank you, Dr. Ostadan. |
| 10 | JUDGE FARRAR: Mr. Travieso-Diaz, is it |
| 11 | you or Mr. Gaukler? |
| 12 | MR. TRAVIESO-DIAZ: I think it's my |
| 13 | turn. If I could have five minutes to regroup, but |
| 14 | the good news is I think I'm going to have minutes, |
| 15 | not hours. |
| 16 | JUDGE FARRAR: Then why don't we just |
| 17 | all stay around here, just take five minutes. I |
| 18 | mean, you really only mean five minutes or should |
| 19 | we take a longer break? |
| 20 | MR. TRAVIESO-DIAZ: Let's take 10 so |
| 21 | that we could do other things as well. |
| 22 | JUDGE FARRAR: Okay. |
| 23 | MS. CHANCELLOR: Your Honor, I would |
| 24 | just like to note that next coming up will be |
| 25 | rebuttal and we'll need a little time to regroup |
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| 1 | because our witnesses have not seen the written |
| 2 - | rebuttal testimony that Mr. Travieso-Diaz has given |
| 3 | us. |
| 4 | JUDGE FARRAR: Right, we understand |
| 5 | that. It's quarter of, let's come back at five of. |
| 6 | (Recess taken.) |
| 7 | JUDGE FARRAR: Mr. Travieso-Diaz, we're |
| 8 | ready for your cross-examination. |
| 9 | MR. TRAVIESO-DIAZ: Yes, I am. |
| 10 | |
| 11 | CROSS-EXAMINATION |
| 12 | BY MR. TRAVIESO-DIAZ: |
| 13 | Q. Good afternoon, gentleman. |
| 14 | DR. BARTLETT: Good afternoon. |
| 15 | Q. If I remember correctly, it has been |
| 16 | almost a month exactly since the last time we met. |
| 17 | So I would like to start by asking you a slight |
| 18 | variation of the last question Ms. Chancellor asked |
| 19 | you, which is: In the intervening period of time |
| 20 | up to today, have you learned anything that will |
| 21 | cause you to change the answers that you have given |
| 22 | in the examinations by the various parties from May |
| 23 | to now? In other words, are your answers still |
| 24 | valid? |
| 25 | DR. BARTLETT: There has been additional |
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| 1 | analyses done and things that we've reviewed in the |
| 2 | interim. I think Dr. Ostadan discussed the report |
| 3 | that PFS has produced to discuss this pad-to-pad |
| 4 | interaction, but I don't think it changes our |
| 5 | opinion that pad-to-pad interaction is we still |
| 6 | conclude that pad-to-pad interaction is occurring |
| 7 | and it needs to be taken into account in the |
| 8 | sliding stability analysis of the pads. I've also |
| 9 | had, obviously, more time to reflect on the report |
| 10 | done by Dr. Luk, and we've discussed that |
| 11 . | previously. I think that's where I see myself at |
| 12 | least today. |
| 13 | Q. How about you, Dr. Ostadan? |
| 14 | DR. OSTADAN: As I outline in response |
| 15 | to State's counsel, my main concern with the design |
| 16 | issues remain the same. This new information has |
| 17 | not impacted those concerns. |
| 18 | Q. So what I was trying to get to, if I |
| 19 | were to go back and look at the record of your |
| 20 | testimony of May 8 and May 9 I could still get the |
| 21 | feeling that what you said there is still valid; is |
| 22 | that right? |
| 23 | DR. OSTADAN: I think it's fair to say I |
| 24 | don't expect any change there. |
| 25 | Q. Thank you. |
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| 1 | Now I have to I wasn't planning on |
| 2 | asking this, but Judge Lam proved that he's far |
| 3 | more perceptive than I am. I wasn't aware that, |
| 4 | Dr. Ostadan, you had a professional relationship |
| 5 | with Dr. Wen Tseng which appears to be somewhat |
| 6 | significant. Given that testimony you gave in |
| 7 | response to Judge Lam, would it be your opinion |
| 8 | that Dr. Tseng is a capable professional in the |
| 9 | area of his professional activity, including, as I |
| 10 | understand, soil structure interaction? |
| 11 | DR. OSTADAN: Yes. I believe he is, |
| 12 | yes. |
| 13 | Q. Were you of the view that his opinion |
| 14 | would be given a fair amount of weight? |
| 15 | DR. OSTADAN: I believe he will stand |
| 16 | behind his calculation for what he has been given |
| 17 | and what he has produced. |
| 18 | Q. So the answer is yes? |
| 19 | DR. OSTADAN: The answer is, for what he |
| 20 | has done, I believe should be given credit for what |
| 21 | he has done. |
| 22 | Q. And the last time that we met there were |
| 23 | a series of questions to you, not by me but by Mr. |
| 24 | Turk, on the issue of pad settlement. Do you |
| 25 | remember this set of questions? |
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| 1 | DR. OSTADAN: Yes. |
| 2 | Q. If I remember, both of you testified at |
| 3 | various points essentially to the effect that the |
| 4 | 1.75 inches that PFS was calculating that they |
| 5 | would have a static settlement of the pads over a |
| 6 | long time would be a significant number from the |
| 7 | technical standpoint and perhaps also even more so |
| 8 | for nuclear facilities. Is that what your |
| 9 | testimony was last time? I think I remember |
| 10 | seeing that, but maybe I didn't get it right. |
| 11 | DR. OSTADAN: 1.75 is the number, you |
| 12 | said? |
| 13 | Q. Yes. I understand, maybe I'm wrong, but |
| 14 | let's start, I remember your saying in the order of |
| 15 | two inches. So I think that the number is 1.75. |
| 16 | But putting that aside, is my recollection of your |
| 17 | testimony right? |
| 18 | DR. OSTADAN: That's correct. I think |
| 19 | this number is significant in our practice. |
| 20 | Q. In formulating that opinion did you seek |
| 21 | to investigate the actual operating experience of |
| 22 | nuclear power plants with respect to long-term |
| 23 | static settlement? |
| 24 | DR. OSTADAN: I'm sure you can find bad |
| 25 | examples out there, but for good designs I would |
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| 1 | expect this to be, again, a large number. |
| 2 | Q. Would it change your opinion if I told |
| 3 | you that there is at least a half a dozen operating |
| 4 | nuclear power plants on soil sites that have |
| 5 | settlements in excess of 2 inches underneath |
| 6 | site-related buildings? Would that change your |
| 7 | opinion, assuming it was true? |
| 8 | DR. OSTADAN: It will be surprising to |
| 9 | me. |
| 10 | Q. Would it have an effect on your opinion |
| 11 | if you were confronted with that new information? |
| 12 | DR. OSTADAN: We will have a long |
| 13 | discussion. |
| 14 | Q. I'm sorry, I didn't get your answer. |
| 15 | Say that again. |
| 16 | DR. OSTADAN: It depends on where you |
| 17 | have an issue with me, where and from what sources. |
| 18 | Q. All right. Given the lateness of the |
| 19 | day maybe we'll save it for some other time. Let's |
| 20 | move somewhere else. |
| 21 | If my understanding is correct, neither |
| 22 | of you is a soils cement expert; is that correct? |
| 23 | DR. BARTLETT: That's correct on my |
| 24 | part. |
| 25 | DR. OSTADAN: That's correct on my part. |
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| 1 | MS. CHANCELLOR: Objection. What do you |
| 2 | mean by soil cement expert? |
| 3 | MR. TRAVIESO-DIAZ: I think they |
| 4 | understood the question, they answered it. |
| 5 | Q. (By Mr. Travieso-Diaz) Let me ask a |
| 6 | follow-up question and make it even clear. Isn't |
| 7 | it true, Dr. Bartlett, that when I took your |
| 8 | deposition back in March and I sought to ask you |
| · 9 | questions on soil cement you deferred to your |
| 10 | expert Dr. Mitchell on the subject? |
| 11 | DR. BARTLETT: Yes, that we considered |
| 12 | Dr. Mitchell the expert on soil cement on the team. |
| 13 . | Q. Now, the reason I'm asking is because, |
| 14 | Dr. Ostadan, you expressed the view that there is |
| 15 | something inherently conflicting in having a soil |
| 16 | cement formula, if you will, that is at the same |
| 17 | time, if I recall correctly, I'm trying to read my |
| 18 | notes here, strong enough to take the loadings from |
| 19 | the pad from the cask, and at the same time stiff |
| 20 | enough not to help me out, please, how you say |
| 21 | it. |
| 22 | DR. OSTADAN: Yes. The conflict came |
| 23 | from the fact that on the one hand due to cask |
| 24 | tipover and drop analysis we won't have a flexible |
| 25 | foundation so that it can absorb the energy and the |
| | |
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acceleration to be based on, I believe, 45 g. So that requires the cement, soil cement or cement treated soil under the pad to be of a weaker mix, whereas, in the seismic analysis with the cask and the pad, it is expected that it should be able to carry the seismic loads down to the soil layers below.

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So on one hand, to be specific, it is required Young's Modulus of the soil to me to be less than, and I emphasize, to be less than 75,000 psi. On the other hand, it should be strong enough to take the loads.

Q. Let me ask the question this way. What I'm trying to understand is what you mean by an inherent conflict. First of all, are you saying that having these two requirements simultaneously is something that cannot be met?

DR. OSTADAN: I have said that it has not been demonstrated that it can be met.

Q. Correct. So in your mind there is a potential conflict between these two requirements? Would that be a better way to state your concern? DR. OSTADAN: That is correct.

Q. And that conflict, if you will, potential conflict is not the result of your deep

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| 1 | understanding of the soil cement properties but |
| 2 | your expertise as an engineer, am I correct? |
| 3 | DR. OSTADAN: I'm going to have to defer |
| 4 | to Dr. Bartlett to see whether he can provide |
| 5 | additional information. But for me as a concept it |
| 6 | is discomforting, a requirement that has not been |
| 7 | demonstrated. |
| 8 | Q. Well, I'm not trying to put words in |
| 9 | your mouth, but what I'm trying to understand is |
| 10 | whether you feel that this is an unsolvable |
| 11 | conflict or something that, in your mind, needs to |
| 12 | be proven? |
| 13 | DR. OSTADAN: In my mind it needs to be |
| 14 | proven because getting 75,000 psi or less requires |
| 15 | such a small amount of cement to be mixed with the |
| 16 | soil, something less than few percentage, that as |
| 17 | far as I know is not typical or used in the |
| 18 | industry, and how it performs under a static |
| 19 | dynamic loading, shrinkage and other environment |
| 20 | and condition with such a light mix needs to be |
| 21 | established. |
| 22 | Q. So one last question to make it really, |
| 23 | really clear. What you're saying is that this is |
| 24 | an area which you feel that there is a possibility |
| 25 | of a conflict and the only way to satisfy you would |
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| 1 | be to have testing that proved that both things can |
| 2 | be met? |
| 3 | DR. OSTADAN: Of course, yes. |
| 4 | Q. But to your understanding you don't |
| 5 | think this can be done; is that correct? |
| 6 | DR. OSTADAN: No, I am not saying. I |
| 7 | cannot rule it out. |
| 8 | Q. Okay. Now, in one of the first |
| 9 | questions that Ms. Chancellor asked you today, you |
| 10 | referred to the fact that the design of the pads at |
| 11 | the PFS is some form of isolation system. Do you |
| 12 | remember that? |
| 13 | DR. OSTADAN: Correct. |
| 14 | Q. And you said two things. Let me try to |
| 15 | get at both of them. First, you said that you had |
| 16 | a problem with that concept because it was being |
| 17 [.] | propounded or you expect it to be utilized without |
| 18 | the benefit of any test or lab data. Do you |
| 19 | remember saying that? |
| 20 | DR. OSTADAN: Correct. |
| 21 | Q. Now, are you aware that there is |
| 22 | probably at least a dozen facilities in this |
| 23 | country that have anchor casks as being storage? |
| 24 | If I remember, when we were here last time we |
| 25 | talking about San Onofre and we talk about Hatch, |
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| 1 | but there were a number of others, correct? |
| 2 | DR. OSTADAN: I recall a few of them, |
| 3 | yes. |
| 4 | Q. Are you aware whether tests or |
| 5 | laboratory data have been developed for those |
| 6 | facilities in the process of qualifying them for |
| 7 | use? |
| 8 | DR. OSTADAN: No, I am not aware of |
| 9 | whether test. Nor from what I know, I would think |
| 10 | it was it would have been required based on the |
| 11 | designs they had. |
| 12 | Q. Explain that to me, if you will. |
| 13 | DR. OSTADAN: Okay. For I believe |
| 14 | Hatch, was it, the ground motion is very low. It |
| 15 | probably falls under the general certification of |
| 16 | the cask. For San Onofre the cask are horizontal |
| 17 | and they are not vertical. Typically they are |
| 18 | bounded together. So this issue of free-standing |
| 19 | casks is not there to start with. |
| 20 | Q. Okay. But what I'm trying to |
| 21 | understand, I had thought that your problem was |
| 22 | that the PFS intended to apply this design concept |
| 23 | without the benefit of tests. Are you saying that |
| 24 | is only a concern because PFS has high seismicity, |
| 25 | if the seismicity was lower you would require |
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| 1 | testing? Because it seems to me it would be the |
| 2 | same concept regardless of where the earthquake is. |
| 3 | DR. OSTADAN: No. If that was the |
| 4 | impression you got, I need to correct it. This |
| 5 | goes with all the design parameters. The high |
| 6 | intensity of the ground motion, free-standing |
| 7 | nature of this design cask, the cask, the vertical |
| 8 | cask, and to some extent relating to the poor soil |
| . 9 | foundation at the site. |
| 10 | Q. The design basis earthquake for San |
| 11 | Onofre is pretty high, isn't it? |
| 12 | DR. OSTADAN: Yes. |
| 13 | Q. And yet you're not aware that they have |
| 14 | done any testing and lab qualification to get those |
| 15 | casks approved for use, have they? |
| 16 | DR. OSTADAN: No, I am not, nor am I |
| 17 | concerned, because I can't see horizontal cask |
| 18 | falling down or tipping over. They were placed |
| 19 | horizontally to start with. |
| 20 | Q. Of course, it could do other things? |
| 21 | DR. OSTADAN: It could stand up, I |
| 22 ⁻ | guess. |
| 23 | Q. Is it your opinion or your testimony |
| 24 | that just because the casks are horizontal they |
| 25 | won't slide? |
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| | 10404 |
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| 1 | DR. OSTADAN: They will slide, but they |
| 2 | will not have the concern and to that effect the |
| 3 | requirement of tipping at collision no longer. |
| 4 | Q. How far do you think, if you know, will |
| 5 | they slide? |
| 6 | DR. OSTADAN: Oh, I do not know the |
| 7 | detail of that particular design. |
| 8 | Q. I see. Okay. Now, you testified |
| 9 | something to the effect that using the possibility |
| 10 | of cask sliding as a design feature took full |
| 11 | credit for such a possibility as a passive weight |
| 12 | seismic wave loadings? Is that what your opinion |
| 13 | is? |
| 14 | DR. OSTADAN: My opinion was that the |
| 15 | full credit has been taken from the sliding of the |
| 16 | cask on pad which, in effect, reducing the seismic |
| .17 | loads acting on the pad. |
| 18 | Q. How much credit? |
| 19 | DR. OSTADAN: Well, if I have to go back |
| 20 | to your historic memo at PFS it clearly says that |
| 21 | if the casks were to anchor, the pads cannot take |
| 22 | the load. So that's substantial credit. |
| 23 _ | Q. But let me just try to see we compare |
| 24 | this issue a little better. Isn't it true that |
| 25 | Holtec design simply consist of putting the casks |
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| 1 | 10405 |
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| 1 | on the pads and not anchoring them? |
| 2 | DR. OSTADAN: Yes. |
| 3 | Q. The design doesn't do anything else, |
| 4 | does it? |
| 5 | DR. OSTADAN: No. |
| 6 | Q. Just lets the casks be on the pads. |
| 7 | Now, are you referring, then, when you say take |
| 8 | full credit for the analysis that Holtec has |
| 9 | performed to predict the behavior of these casks in |
| 10 | a seismic event? |
| 11 | DR. OSTADAN: Mostly the analysis and |
| 12. | concept there is no buffer zone here. The cask in |
| 13 | the concept are allowed to slide and the analysis |
| 14 | has been modeled to follow that concept. |
| 15 | Q. Well, isn't it true that the analysis |
| 16 | that Holtec has perform includes a range of |
| 17 | coefficients of frictions that, according to the |
| 18 | opinion of both NRC Staff and PFS witnesses, |
| 19 | brackets or bounds all expected potential |
| 20 | conditions from .2 that will about sliding to .8 |
| 21 | that will be not sliding at all? Isn't that what |
| 22 | they have testified? |
| 23 | DR. OSTADAN: Did you say no sliding |
| 24 | under.8? |
| 25 | Q. That's right. |
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| | 10406 |
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| 1 | DR. OSTADAN: I have to correct this |
| 2 | meaning of this coefficient unless you can correct |
| 3 | me. What this coefficient means in this model to |
| 4 | me is that when you have .8, that the sheer stress |
| 5 | acting on the surface of the pad is at any time be |
| 6 | called to .8 times the vertical stress acting on |
| 7 | the pad. And if it's less .2 that means sheer |
| 8 | stress would always be kept .2 times the vertical |
| 9 | stress at the contact point. That's all. That \cdot |
| 10 | doesn't mean it's sliding or it's not sliding, it |
| 11 | means as a matter of fact, it slides all the |
| 12 | time even when it is one. |
| 13 | Q. All right. Let me ask you a different |
| 14 | question. Do you recall from your review of the |
| 15 | numerous computer runs that Holtec has conducted to |
| 16 | weight the various conditions, what the amount of |
| 17 | sliding has been has been predicted on, say, a case |
| 18 | when you have a local coefficient of friction |
| 19 | assumed, are we talking about feet or inches? |
| 20 | DR. OSTADAN: Holtec is predicting |
| 21 | inches, Altran is predicting feet. |
| 22 | Q. As I recall, you testified to or |
| 23 | answered questions of Judge Lam that you didn't |
| 24 | believe the feet that Altran predicted. Did I |
| 25 | understand that correct? |
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| 1 | 10407 |
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| 1 | DR. OSTADAN: I didn't believe their 20, |
| 2 | 30 feet, right, that's correct. I didn't say I |
| 3 | didn't believe a few feet. |
| 4 | Q. Well, isn't it also true just from the |
| 5 | physics of the situation that you have a high |
| 6 | coefficient of friction like .8, most of the |
| 7 | energy, if you will, will be directed at trying to |
| 8 | make the cask rock or tip back and forth as opposed |
| 9 | to sliding? |
| 10 | DR. OSTADAN: It will be our this is |
| 11 | our hope and dream. You know, otherwise Holtec |
| 12 | thinks we have anything in the world we just put it |
| 13 | on the ground on little pad and don't spend the |
| 14 | money and we can be rest assured that the soil |
| 15 | loading will be less. We are not certain about |
| 16 | these phenomenons. |
| 17 | Q. Well, but I think we need to be a little |
| 18 | bit more fair than that to Holtec because they had |
| 19 | to do quite a number of analysis to arrive at their |
| 20 | interest break. |
| 21 | DR. OSTADAN: And that's the unfortunate |
| 22 | nature of this because I think, as I indicated |
| 23 | before, unfortunately everything is based on a |
| 24 | nonlinear time history analysis as far as the |
| 25 | structural design is concerned. |
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| | 10408 |
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| 1 | Q. I'm sorry, I think I asked you a |
| 2 | question before that I didn't quite get an answer |
| 3 | to. I asked you that if you assume a coefficient |
| 4 | of friction of .8 that the behavior of the cask is |
| 5 | going to tend to be far more in the direction of |
| 6 | tipping or rocking or precession as opposed to |
| 7 | sliding. Isn't that the physics situation that |
| 8 | tells you that's going to happen? |
| 9 | DR. OSTADAN: There will be more loads |
| 10 | transferred to the casks, yes, with the higher |
| 11 | coefficient. |
| 12 | Q. And in that particular scenario, if you |
| 13 | will, there will be very little benefit, if you |
| 14 | will, to the sliding portion of the tensile |
| 15 | reducing loads; is that right? |
| 16 | DR. OSTADAN: Well, yes. Still there is |
| 17 | quite a bit of reduction. I don't think anybody, |
| 18 | if he thinks .8 means only 80 percent of the load |
| 19 | goes to the back and 20 percent is not going, is |
| 20 | absolutely wrong notion. The casks are still |
| 21 | moving and there's a substantial reduction of |
| 22 | seismic load. The only way you can find out how |
| 23 | much is the load in the cask that doesn't move, is |
| 24 | just to anchor it in the analysis, you find out |
| 25 | what the loads are. |

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| | 10409 |
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| 1 | Q. This is for you, Dr. Bartlett. I don't |
| 2 | want you to feel left out. |
| 3 | DR. BARTLETT: Sure. |
| 4 | Q. You were expressing some misgivings |
| 5 | about or reservations about, because of the |
| 6 | complexity of the soils, of the success in a |
| 7 | computer program or computer code to model the |
| 8 | behavior of the soils in an earthquake. Did I |
| 9 | understand you right? |
| 10 | DR. BARTLETT: I think I would amend it |
| 11 | just slightly, the failure and post failure |
| 12 | behavior of the soils. |
| 13 | Q. Okay. Isn't it true that to account for |
| 14 | the uncertainties that you express that Geomatrix |
| 15 | provided a wide range of soil parameters to Holtec |
| 16 | that were used to start the different cases? |
| 17 | DR. BARTLETT: I think we're mixing two |
| 18 | analyses. The analyses done by Geomatrix is to get |
| 19 | the dynamic response of the soil in the soil |
| 20 | column. There was best estimate properties, a high |
| 21 | bound and a low bound to take into account the |
| 22 | uncertainties and that would predict the dynamic |
| 23 | response of the free-field soil column. |
| 24 | What I'm discussing is that given |
| 25 | loading conditions, maybe from that response |
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| 1 | analysis, it's a very difficult analysis to couple |
| 2 | the dynamic response analysis with the failure and |
| 3 | post failure behavior of the soils. So I would say |
| 4 | that predicting the behavior of the soils |
| 5 | dynamically in a response analysis before we reach |
| 6 | yielding of the soils is certainly something that's |
| 7 | within our range and knowledge and experience. |
| 8 | What I'm concerned about is once we reach yield and |
| 9 | go into the post yield behavior, the ability of |
| 10 | both the dynamic model to model the post yield |
| 11 | behavior and the stress/strain of the soils once we |
| 12 | have gone into post yield. |
| 13 | Q. I think I understand you better now. |
| 14 | I'm sorry if I misunderstood your answer |
| 15 | previously. Are you saying that your concern is in |
| 16 | the event that you have an earthquake such that |
| 17 | and the soils settle property is such that the |
| 18 | soils will exceed essentially failure? |
| 19 | DR. BARTLETT: It's exceedance elastic |
| 20 | limiting and go into a yield behavior, yes. |
| 21 | Q. And there is not really good way to |
| 22 | qualify happen things, is that what you're saying? |
| 23 | DR. BARTLETT: It's very difficult to do |
| 24 | is what I'm saying. |
| 25 . | Q. Do you know whether any other analysis |
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| 1 | have been conducted by anyone in connection with |
| 2 | this site predicts that there will be such a |
| 3 | failure of soils? |
| 4 | DR. BARTLETT: That is my concern is |
| 5 | that the modeling that we see being done by Holtec |
| 6 | and also by Dr. Luk does not really have the |
| 7 | capabilities of predicting post yield behavior. |
| 8 | But my sense is because of the large loadings that |
| 9 | we see to the pad, that there's certainly the |
| 10 | potential that we're going to exceed the strength |
| 11 | of the Bonneville clays and cause them to go into |
| 12 | yield or post failure condition. |
| 13 | Q. But what I'm trying to get to is whether |
| 14 | you have anything that, in fact, will suggest that |
| 15 | this is going to happen as opposed to the concern |
| 16 | that I understand you just expressed that this |
| 17 | might happen and if it does it will be hard to |
| 18 | model? |
| 19 | DR. BARTLETT: It is our position that |
| 20 | the current design as proposed, when we look at |
| 21 | both the capacity and demand sides, that there is |
| 22 | not adequate factors of safety when we try to |
| 23 | transfer the loads down to the Bonneville clay and |
| 24 | it will go into its post failure behavior, it will |
| 25 | yield. |
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| | 10412 |
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| 1 | Q. Well, my question was only whether you |
| 2 | have seen any data, any analysis results, any test |
| 3 | results that make you think that more than concern |
| 4 | that this is a high likelihood or high probability? |
| 5 | You know what I'm trying to say. |
| 6 | DR. BARTLETT: Have I seen calculations |
| 7 | by the applicant? |
| 8 | Q. By anybody. |
| 9 | DR. BARTLETT: I think that when we look |
| 10 | at the whole of the missing demand that Dr. Ostadan |
| 11 | is concerned about and the dynamic loads and when |
| 12 | we later discuss the capacity of the Bonneville |
| 13 | clays, my concern is yes, it will bring them into |
| 14 | the post yield behavior. |
| 15 | Q. I don't want to belabor the point. My |
| 16 | question, I'm trying to differentiate concerns with |
| 17 | actual data of whatever sort that will make it |
| 18 | likely to predict that this is going to happen. Do |
| 19 | you have anything in that category as opposed to |
| 20 | the former? |
| 21 | MR. TURK: I'm not sure I understand the |
| 22 | question. What is the latter category? |
| 23 | MR. TRAVIESO-DIAZ: Not the letter, the |
| 24 | later. It's my English failing. I'll try again. |
| 25 | Let me try a different question. Actually, let's |
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| 1 | not try anymore questions on that line, let's go |
| 2 | forward. |
| 3 | But just tell me, define again what you |
| 4 | mean by yielding of the soil. Just tell me, what |
| 5 | do you expect the soil will do. |
| 6 | DR. BARTLETT: Sure. When you develop |
| 7 | stresses within the soil there's somewhat of a |
| 8 | linear behavior where stress and strain are linear |
| 9 | and expressed by shear modulus, then it will reach |
| 10 | a peak. And then once upon reaching the peak the |
| 11 | soil cannot really give anymore, per se, have any |
| 12 | more capacity, and it yields, it goes into a post |
| 13 | yield behavior. |
| 14 | Q. And by that you mean what, deformation |
| 15 | or sliding, what? |
| 16 | DR. BARTLETT: It deforms considerably |
| 17 | and behaves nonlinearly and accumulates significant |
| 18 | deformation, yes. |
| 19 | Q. So is that what we were talking about, |
| 20 | the potential basis for pad-to-pad interaction that |
| 21 | we were talking about last time? That is to say, |
| 22 | having a situation that because of earthquake |
| 23 | loadings the soil will deform and the pads will |
| 24 | move along even if it didn't slide on the |
| 25 | interaction; is that what you were talking about |
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last time? 1 2 DR. BARTLETT: I think when we discuss 3 the potential for pad-to-pad interaction, as I 4 recall, there might be two cases that one might 5 look at. One would be, is there potential for 6 pad-to-pad interaction before we reach this yield 7 in the clays and what are those forces. And then 8 certainly once the clay reaches yield, the 9 potential for pad-to-pad interaction is greatly 10 magnified. 11 So I guess I would say that yes, 12 pad-to-pad interaction becomes even a much larger 13 concern once the soils reach the state of yield, 14 but it will still occur even though we haven't 15 reached the state of yield because the clay is 16 still a formidable body. Even though it hasn't yielded it still deforms. 17 18 What I was trying to tie your concern to Q. 19 was I guess the behavior of the cask on the pads, 20 that it is the main issue that we are since 21 centering on. 22 DR. BARTLETT: Correct. 23 Is it your testimony that because of Q. this potential of the nonlinear behavior of the 24 25 soil in an earthquake there is a potential, perhaps NEAL R. GROSS COURT REPORTERS AND TRANSCRIBERS 1323 RHODE ISLAND AVE., N.W.

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| 1 | a growing potential for pad-to-pad interaction? |
| 2 | DR. BARTLETT: Correct. As the |
| 3 | deformation potentially increases between the two |
| 4 | adjacent pads and those get larger, the |
| 5 | out-of-phase of these two pads, the out-of-phase |
| 6 | motion of these pads gets larger and the transfer |
| 7 | of inertial forces from one pad to another |
| 8 | certainly gets larger. |
| 9 - | Q. There was a little bit of discussion |
| 10 | early this morning by Ms. Chancellor as to this |
| 11 | demand side of the equation and the capacity side |
| 12 | of the equation. I don't recall which of you was |
| 13 | the one who listed the capacity side. I think both |
| 14 | of you did. So the question is for either of you. |
| 15 | Isn't it true that one part of the capacity that |
| 16 | was not included in your answer is all the capacity |
| 17 | that will be intrinsic in, for example, a cask's |
| 18 | ability to deform under loading and, therefore, |
| 19 | . absorb some of the loading? Would that be part of |
| 20 | the capacity? |
| 21 | DR. BARTLETT: Well, I think the issue |
| 22 | that we focused on is more the effects of the |
| 23 | interaction and on the cask stability. I haven't |
| 24 | proffered any opinions on the robustness of the |
| 25 | casks themselves in the event of something like |
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| | 10416 |
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| 1 | tipping or sliding. |
| 2 | Q. Well, what I was trying to say, and |
| 3 | maybe neither of you has an answer, but isn't it |
| 4 | true that to the extent that subjected to |
| 5 | earthquake loading, a body such as a cask tends to |
| 6 | experience deformation, that physical deformation |
| 7 | would tend to absorb some of the loads? Is that a |
| 8 | good physical principle? |
| 9 | DR. BARTLETT: I'm not understanding the |
| 10 | question. |
| 11 | DR. OSTADAN: Frankly, I don't either. |
| 12 | I don't know what you're addressing, frankly. |
| 13 | Q. (By Mr. Travieso-Diaz) Well, I guess I |
| 14 | will try one more time. When you impose a force on |
| 15 | a body, the body can do a number of things. One of |
| 16 | the things I can think of, the most extreme case, a |
| 17 | pad of silly putty. You throw it against the |
| 18 | floor, most likely the main thing it's going to do |
| 19 | is not going to be bounce, but is going to be |
| 20 | deform and probably stick to the floor. Is that |
| 21 | right? |
| 22 | DR. BARTLETT: The silly putty I played |
| 23 | with usually bounced a few times. That was its |
| 24 | purpose, it was somewhat malleable and plastic. I |
| 25 | understand that it wouldn't rebound, it would just |
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1 stay stuck. 2 What I'm trying to say is that from very ο. 3 basic physical principles, to the extent that your 4 body is capable of absorbing energy by deformation, 5 that would be one portion of the capacity that will be available; isn't that correct? 6 7 Well, it depends how you DR. OSTADAN: want to look at it. It could be also the damage 8 9 you don't want to suffer from. 10 ο. Right. But that's a different issue. 11 Let me ask you a different question. If you have, like in the case of this cask, a complex body that 12 inside has things that rattle and bounce and hit 13 14 the walls, wouldn't you have some energy absorption under those various movements? 15 16 DR. BARTLETT: I guess I'm not 17 understanding why we're talking about casks, our focus has been on the pads, but go ahead. 18 19 Well, here is my point, and perhaps I am Q. 20 articulating it very poorly. Isn't it true that you're going to do your demand versus capacity for 21 22 a system like the one that you have the cask and the pads, you should include the capacity of the 23 soil mechanisms that probably haven't been taken 24 credit for here, but in reality that would tend to 25

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| 1 | absorb some of the energy to reduce loadings and, |
| 2 | therefore, decrease the possibility that you have |
| 3 | on the side of the behavior? That's my point. |
| 4 | DR. BARTLETT: Maybe to help us along a |
| 5 | little bit, I think the point you're trying to make |
| 6 | is in this pad-to-pad interaction if there was some |
| 7 | medium in between, in this case soil cement, would |
| 8 | some of the energy of this pad-to-pad interaction |
| 9 | be absorbed by some of the deformation within the |
| 10 | soil cement due to crushing and that type of thing, |
| 11 | is that |
| 12 | Q. Well, I didn't ask that, but that sounds |
| 13 | like a good question you are asking. |
| 14 | DR. BARTLETT: Yes, there would be some |
| 15 | dissipation of energy in collision between a pad |
| 16 | and the soil cement as it's being compressed as two |
| 17 | pads are now acting out of phases. |
| 18 | Q. All right. Let's move on. I think |
| 19 | maybe we should try a different subject. Dr. |
| 20 | Ostadan, I remember that both today and in the past |
| 21 | you have referred to your understanding that these |
| 22 | pads, pad and cask system have a natural frequency? |
| 23 | DR. OSTADAN: Yes. |
| 24 | Q. And that you expect the natural |
| 25 | frequency will be in the range of 5 to 11 hertz? |
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| 1 | DR. OSTADAN: It's around that, yes. |
| 2 | Q. And your concern with the Holtec |
| 3 | analysis that was conducted is that they didn't try |
| 4 | to match their parameters better or at all to that |
| 5 | frequency? I thought that's what I understood you |
| 6 | testified. Is that right? |
| 7 | DR. OSTADAN: I'm trying to remember |
| 8 | what you are thinking about. One, I think that one |
| 9 | issue was whether or not the soil spring and |
| 10 | damping that Holtec used represents those important |
| 11 | frequencies properly or not. The other was this |
| 12 | stability analysis of the pad Stone & Webster used |
| 13 | peak load acceleration, whereas, the natural |
| 14 | frequency of foundation is somewhere between 5 to |
| 15 | 11 coincided with the peak load spectra. I don't |
| 16 | know which one you're thinking about. |
| 17 | Q. Well, both are good, but let's just |
| 18 | stick with the first since I think that's the one |
| 19 | you talk about today. In other words, my |
| 20 | understanding of what you just said is that you |
| 21 | believe it was incorrect for Holtec not to use |
| 22 | values of springs, masses and dampers that were, if |
| 23 | you will, that corresponded to the natural |
| 24 | frequency of the system that we have. Is that |
| 25 | correct? |

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| 1 | DR. OSTADAN: I believe my testimony was |
| 2 | they have not demonstrated that the spring damping |
| 3 | used represents the appropriate frequency. |
| 4 | Q. Are you aware, Dr. Ostadan that in some |
| 5 | of the computer analysis that Holtec performed |
| 6 | they, in fact, tune their springs so that it |
| 7 | matched to 5 hertz, which was, as I understand, the |
| 8 | frequency you just talked about? Are you aware of |
| 9 | those analyses? |
| 10 | DR. OSTADAN: I have to be careful here. |
| 11 | There are two frequencies we are talking about. |
| 12 | One is between the cask and the pad, we are not |
| 13 | talking about that. The other is the pad and the |
| 14 | soil. I believe you are talking about that one. |
| 15 | Q. Yes. |
| 16 | DR. OSTADAN: As far as I know the |
| 17 | calculation they have done, they used the Newmark |
| 18 | and Rosenblum approach to estimate the spring and |
| 19 | damping coefficients. And I did not see any tuning |
| 20 | of those to any frequency. |
| 21 | Q. So your understanding of what Holtec has |
| 22 | done or failed to do is that they have not run a |
| 23 | case in which the cask/pad system was tuned, if I |
| 24 | can use the term, to a frequency such as 5 hertz? |
| 25 | DR. OSTADAN: I did not say that, no. |
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| 1 | DR. BARTLETT: May I add, though, I was |
| 2 | present, but Dr. Ostadan wasn't present when those |
| 3 | runs were given. |
| 4 | Q. (By Mr. Travieso-Diaz) I always forget |
| 5 | that. Okay, could you help us? |
| 6 | DR. BARTLETT: I recall the tuning of |
| 7 | those springs, yes, I do. |
| 8 | Q. And do you recall what the results were? |
| 9 | DR. BARTLETT: I don't. |
| 10 | Q. On those cases? |
| 11 | DR. BARTLETT: No, I don't. |
| 12 | DR. OSTADAN: May I also add further |
| 13 | information on this? I am not really so much |
| 14 | concerned about the spring, but damping, as I have |
| 15 | emphasized before. Damping is a major player in |
| 16 | generating the seismic loads here. And the way |
| 17 | Newmark, Rosenblum works, in general, you can tune |
| 18 | the spring. As I said, I haven't seen it done, but |
| 19 | it may have been done. But at the same time you |
| 20 | can't tune the damping. Damping is a frequency |
| 21 | independent in this approach. |
| 22 | Q. (By Mr. Travieso-Diaz) I'm sorry, I |
| 23 | don't mean to disrespect, but I need to ask this of |
| 24 | Dr. Bartlett because he has been here all the time. |
| 25 | Isn't it true, Dr. Bartlett, that some of the cases |
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that were presented by Holtec, including earlier 1 2 this week, in fact they artificially set the damping to a low value like 1 percent precisely to 3 try to see what kind of effect that will have? 4 I'm not sure when we 5 DR. BARTLETT: 6 talked about those levels of damping whether they 7 were the damping in the springs of the soils, the 8 soil springs, whether they were the damping at these elements of contact between the casks and the 9 I'm afraid I wasn't completely tuned in. 10 pads. Well, I am just operating on the basis 11 ο. of Dr. Khan's testimony that damping is damping is 12 damping and you pick a value and that's the one you 13 should use. Do you remember Dr. Khan saying that? 14 DR. BARTLETT: Well, no, I really don't. 15 But I think there are different kinds of damping, 16 yes, and one has to be careful how you choose it 17 and where you place it. 18 Thank you. I think that maybe I should 19 ο. 20 quit while I'm behind. 21 DR. BARTLETT: Sure. Let me ask you, do you have Dr. Luk's 22 Q. report here? 23 DR. BARTLETT: Yes, we do. 24 I would like to ask you a couple of 25 ο. **NEAL R. GROSS** COURT REPORTERS AND TRANSCRIBERS 1323 RHODE ISLAND AVE., N.W. WASHINGTON, D.C. 20005-3701 www nealrgross com (202) 234-4433

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10423 1 questions. I don't know the question, 2 MR. TURK: 3 your Honor, but may I note that if it gets into areas that pertain to the rebuttal testimony that I 4 5 may need to reserve the right to cross-examine on 6 that. 7 MR. TRAVIESO-DIAZ: I think I can stay away from the areas that you're concerned about 8 9 because my questions are rather basic, but --MR. TURK: Just so we're clear, I'm not 10 sure that I'll have rebuttal, I'll do 11 12 cross-examination. And I wasn't sure if PFS would be doing cross-examination later when I do it or if 13 they're going to cross-examine on this rebuttal 14 15 piece or not. MR. TRAVIESO-DIAZ: Let me ask a 16 question of the Board. I have some questions that 17 relate to the Luk analysis. It might be more 18 efficient to save them when we cover the rebuttal 19 in the field. Although they don't go directly to 20 the testimony that Dr. Bartlett gave, I'm prepared 21 to defer it until then. 22 MS. CHANCELLOR: Just one caution, Dr. 23 Ostadan will not be back with respect to his 24 testimony on Figures 17 and 20 of the Luk report. 25 **NEAL R. GROSS** COURT REPORTERS AND TRANSCRIBERS

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| 1 | MR. TRAVIESO-DIAZ: I am convinced |
| 2 | because I was going to talk about Figure 17 and 20, |
| 3 | among other things. So if this is a good time to |
| 4 | do it, I'm happy to do it. |
| 5 | JUDGE FARRAR: Yes, why don't you do |
| 6 | that now. |
| 7 | MS. CHANCELLOR: I think it's the only |
| 8 | time. |
| 9 | Q. (By Mr. Travieso-Diaz) As you remember, |
| 10 | there has been several rounds of questions and |
| 11 | answers about this Figure 17 and 20 of the Luk |
| 12 | report. And, in fact, I remember that questions |
| 13 | were asked specifically to you in the past as to |
| 14 | isn't it true that Dr. Luk has said that you cannot |
| 15 | take those 3.0 g, 2.5 g accelerations at face value |
| 16 | for reasons that he explain. What is your basis |
| 17 | for feeling that we should give credence to those |
| 18 | numbers, if you will unfiltered, when Dr. Luk, the |
| 19 | author of the report, caution you that you |
| 20 | shouldn't? |
| 21 | DR. BARTLETT: I think that we |
| 22 | understand Dr. Luk's testimony that he didn't |
| 23 | include I think the frequency proportional damping |
| 24 | so that these runs would tend to overestimate the |
| 25 | high frequency content, and also that this |
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10425 1 represents one point at the base of the pads and 2 generally he would prefer to see that averaged if one was to use this in a structural analysis. 3 4 However, I think, and I'll pass off to 5 Dr. Ostadan again the point that he made on Figure 20, that even though we disregard the high 6 7 frequency content, to maybe look more at the diverse range that these plots still show 8 9 significant accelerations. And the accelerations you're talking 10 ο. about are the ones on Figure 17 to --11 12 DR. BARTLETT: No. Now we have to refer to Figure 20a and 20 B. 13 Figure 20a, that's on page 36 of the 14 Q. 15 report? 16 DR. BARTLETT: Correct. The point of interest that you're 17 ο. talking about there, I take is, the center of the 18 pad, the point D'? 19 DR. BARTLETT: That's my recollection, 20 D' is the center of the pad at the base of 21 ves. So point A is labeled as a free-field 22 the pad. point that would away from the influence of the 23 24 pad. And you wouldn't want to look at that, 25 Q. NEAL R. GROSS COURT REPORTERS AND TRANSCRIBERS 1323 RHODE ISLAND AVE., N.W. (202) 234-4433 WASHINGTON, D.C. 20005-3701 www.nealrgross.com

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| 1 | would you? |
| 2 | DR. BARTLETT: Well, you may want to |
| 3 | compare the two to see the soil structure |
| 4 | interaction effects, and I think that was the |
| 5 | intent of the figures. But for us who are |
| 6 | interested in the accelerations of the pads, we |
| 7 | would be more interested in point D'. |
| 8 | Q. Tell me, if you can, and this is a |
| 9 | little hard to do because the plot of this Figure |
| 10 | 20a is period and frequency is the reverse of |
| 11 | period? |
| 12 | DR. BARTLETT: It's the inverse of |
| 13 | period. So, for example, .2 seconds would be 5 |
| 14 | hertz. |
| 15 | Q. Okay. Let's take a look at that one. |
| 16 | What would be the acceleration that you will see on |
| 17 | this plot for .2 seconds? |
| 18 | DR. BARTLETT: At exactly .2 seconds |
| 19 | it's about 6.5 g. |
| 20 | Q. So is it your view that, notwithstanding |
| 21 | Dr. Luk's testimony, that you will expect that the |
| 22 | pad would see at that frequency an acceleration of |
| 23 | 6 g? |
| 24 | DR. BARTLETT: To be honest, I frankly |
| 25 | believe that's quite high, but I'm not sure I can |
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| 1 | reconcile why it would be so high. |
| 2 | Q. Well, let me tell you my problem. You |
| 3 | had turned a few pages before to the list of |
| 4 | results on pages 30, 31 and 32, which I believe |
| 5 | give the displacements of the casks that Dr. Luk |
| 6 | performed? |
| 7 | DR. BARTLETT: Correct. |
| 8 | Q. And I see that in no case you have |
| 9 | displacements in excess of a few inches. How can |
| 10 | you reconcile yourself today to the fact that you |
| 11 | may have 6 g accelerations and have cask |
| 12 | displacements only a very few inches? What gives |
| 13 | here? I mean, can you explain it? |
| 14 | DR. OSTADAN: I think that's an |
| 15 | excellent question. We will have the same question |
| 16 | for the Applicant, why the displacement are so low |
| 17 | in light of such high accelerations. |
| 18 | Q. Well, I can think of two potential |
| 19 | answers. Tell me if you agree if either of them |
| 20 | make sense. One, the accelerations are not 6 g or, |
| 21 | two, acceleration of 6 g results in the |
| 22 | displacement of only a few inches? Can you think |
| 23 | of any other? |
| 24 | DR. OSTADAN: Well, let me tell you the |
| 25 | difficulty I have and maybe you can help us. These |
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| 1 | are all the same model, the same computer program, |
| 2 | the same input, and they are producing 6, 7 g's and |
| 3 | they are producing 2 inches for the cask movement. |
| 4 | What is the basis of selecting 2 inches and |
| 5 | ignoring 6 g's? Why like part of the solution and |
| 6 | don't like the other part? |
| 7 | Q. Well, I'm going to ask you that very |
| 8 | same question. Why do you like the 6 g's if you |
| 9 | don't like the 2 inches? |
| 10 | DR. OSTADAN: That's exactly the point. |
| 11 | I agree with Dr. Bartlett, I think these responses |
| 12 | are very high. In reality I don't expect it to be |
| 13 | 6, 7 g's, frankly, but I think we have evidence |
| 14 | from your own calculation of Canister Transfer |
| 15 | Building that the pad mat could go up on the order |
| 16 | of 1 g. We don't know anything about the pad, but |
| 17 | I do know that because I believe it will save a lot |
| 18 | of time if Holtec had simply given us their |
| 19 | acceleration of the pad. Especially since they |
| 20 | went back and repeated their analysis to address |
| 21 | some of the concern, they could have reported the |
| 22 | acceleration of the pad and we would be all done by |
| 23 | now. |
| 24 | MR. TRAVIESO-DIAZ: Mr. Chairman, I |
| 25 | think this is all I have. Let me consult with my |
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| 1 | various cohorts here. |
| 2 | (Discussion off the record.) |
| 3 | MR. TRAVIESO-DIAZ: Mr. Chairman, if I |
| 4 | may ask a question of the Board. |
| 5 | JUDGE FARRAR: Yes. |
| 6 | MR. TRAVIESO-DIAZ: I may have some |
| 7 | additional questions, but my understanding is that |
| 8 | to the extent they go to areas other than these |
| 9 | figures that we just discussed I have the right to |
| 10 | preserve those for later; is that correct? |
| 11 | JUDGE FARRAR: Right. |
| 12 | MS. CHANCELLOR: But not as to Dr. |
| 13 | Ostadan. He won't be coming back for rebuttal on |
| 14 | the Luk report. |
| 15 | MR. GAUKLER: Yeah, I was just going to |
| 16 | clarify. To the extent that we have some questions |
| 17 | on what you identified as rebuttal |
| 18 | MS. CHANCELLOR: By Dr. Bartlett. |
| 19 | MR. GAUKLER: By Dr. Bartlett, we can |
| 20 | cross-examine on that in D.C. That's my |
| 21 | understanding, but I just want to be clear. |
| 22 | JUDGE FARRAR: Right, you can. |
| 23 | MS. CHANCELLOR: Or you can do it now. |
| 24 | JUDGE FARRAR: Or if you wanted to you |
| 25 | could since you have not indicated, like Mr. |
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| 1 | Turk did, that you thought it would be unfair to do |
| 2 | it now, you could do it now, but it might be just |
| 3 | as well for the record that we had both sets of |
| 4 | cross at the same time. |
| 5 | MR. TRAVIESO-DIAZ: First, I think I |
| 6 | will have far more questions next time than now. |
| 7 | And second |
| 8 | MS. CHANCELLOR: It will be easier to do |
| 9 | it now. |
| 10 | MR. TRAVIESO-DIAZ: And second, I think |
| 11 | that my knowledge of the Luk report is sufficiently |
| 12 | limited I would rather wait and do it all at once. |
| 13 | JUDGE FARRAR: That's fine. Then you |
| 14 | need to, as Mr. Turk did, reserve the right to |
| 15 | cross-examine Dr. Bartlett on what we characterized |
| 16 | as his rebuttal testimony. You can do that in D.C. |
| 17 | MS. CHANCELLOR: Your Honor, will we |
| 18 | have the opportunity at all to supplement the |
| 19 | testimony that Dr. Bartlett gave on the stand? I |
| 20 | mean, it was on the spur of the moment and I just |
| 21 | don't know whether there will be any, but is that a |
| 22 | possibility that we can put in some written |
| 23 | rebuttal? |
| 24 | JUDGE FARRAR: First, if you did, |
| 25 | without saying whether you can, if you did it would |
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10431 certainly have to be conditioned on something like 1 the schedule Mr. Turk had asked for. 2 In other 3 words, the benefit of doing it now was he now has a 4 week to talk to his people and get ready. He had 5 mentioned I think you filing it by Wednesday, next Wednesday the 12th, because that gave him a chance 6 7 to get his folks and be ready to deal with it the 8 next week. 9 MR. TURK: May I address that point, your Honor? 10 JUDGE FARRAR: Yes. 11 12 MR. TURK: I indicated this morning that we have a schedule problem. I have Dr. Stamatakos 13 14 sitting in the hotel. He has been waiting 15 patiently for the rest of the D testimony after Dr. 16 Arabasz finished. We kept him waiting to present 17 his rebuttal. He's been delayed now because the State took the opportunity to put on this piece of 18 19 rebuttal testimony orally today forcing us to hold back on Dr. Stamatakos. I may not be able to put 20 21 him on tomorrow. The Applicant is waiting to put on four pieces of rebuttal to D. The State has had 22 one bite now. They have been able to put on the 23 oral rebuttal they prepared and now they're saying 24 25 can they do more and ask us to address that later?

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1 We gave them the opportunity, your Honor, with the point of let's expedite it, let's 2 3 get the testimony, we can address it later and we're done. Now they're saying, "Can we do more?" 4 5 It looks like I'm going to have to send Dr. Stamatakos home, having spent two unnecessary days 6 7 waiting for his turn, and then we'll see another piece of testimony that the State wants us to 8 9 address in the future. I think it's time to say the opportunity was provided to put on the oral 10 11 rebuttal, that's it, and now we address it and 12 we're done. 13 MS. CHANCELLOR: Your Honor, if I may. 14 It's not my intent to rehash whatever Dr. Bartlett 15 testified to on the stand. The reason for 16 requesting the opportunity to preserve filing any 17 additional written rebuttal is that if there's something that we missed that Dr. Bartlett on 18 19 reflection feels like he should have testified to, 20 but because it happened on the spur of the moment, 21 I would like the opportunity to file that written rebuttal. And if I have to do it by Wednesday, 22 23 whatever next Wednesday's date is, then that's what 24 we will do. That's what we would be prepared to 25 do.

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| 1 | . (The Board confers off the record.) |
| 2 | MR. TURK: Your Honor, I have one more |
| 3 | point I should have made. If you're ruling in my |
| 4 | favor I won't bother, but if I need to make a point |
| 5 | I better before you rule. |
| 6 | JUDGE FARRAR: Why don't you speak up. |
| 7 | MR. TURK: 'That's not a good sign. |
| 8 | JUDGE FARRAR: Well, you never know. |
| 9 | MR. TURK: The report has been in the |
| 10 | State's hands since March 8th, by my reckoning, or |
| 11 | April 2nd if we say, okay, what was the final |
| 12 | version, no changes. They've had it for several |
| 13 | months. Dr. Bartlett has looked at in the time |
| 14 | since he testified a month ago. The State never |
| 15 | even told me they wanted a rebuttal. They came in |
| 16 | today suddenly with this oral rebuttal and we were |
| 17 | all caught by surprise. I didn't know that they |
| 18 | were going to address new material. |
| 19 | JUDGE FARRAR: And therefore? |
| 20 | MR. TURK: They had the opportunity, we |
| 21 | took up a substantial amount of time today dealing |
| 22 | with it, and I think we should be allowed to say |
| 23 | that's the testimony that they were going to |
| 24 | that was the whole basis for your allowing them to |
| 25 | go forward with oral testimony after my motion to |
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| 1 | strike was unstricken or ungranted, was that that |
| 2 | was going to be their rebuttal. |
| 3 | JUDGE FARRAR: You have got an excellent |
| 4 | point which we were going to make ourselves, but |
| 5 | your conclusion is slightly off. Ms. Chancellor, |
| 6 | given that this report has been available, how much |
| 7 | of a break would you need now to consult with Dr. |
| 8 | Bartlett and ask a very few more questions about |
| 9 | the Luk report as additional rebuttal right now? |
| 10 | MS. CHANCELLOR: If I may suggest just a |
| 11 | little variation on that, PFS is going to be |
| 12 | putting on rebuttal witnesses and we'll take a |
| 13 | break prior to that. Maybe if we conclude this |
| 14 | testimony and either after PFS's first rebuttal |
| 15 | witness, certainly by the end of the day we could |
| 16 | check to see if there's anything additional, but |
| 17 | rather than |
| 18 | JUDGE FARRAR: Fine. That's good. |
| 19 | We'll do that. Mr. Turk, you have another round of |
| 20 | cross? |
| 21 | MR. TURK: Yes. Limited, your Honor. |
| 22 | JUDGE FARRAR: Go ahead. |
| 23 | 11 |
| 24 | 11 |
| 25 | 11 |
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