

RAS 4627

Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Private Fuel Storage, LLC

Docket Number: 72-22-ISFSI; ASLBP No. 97-732-02-ISFSI

Location: Rockville, Maryland

Date: Monday, June 17, 2002

2002 JUL 10 AM 9: 57
OFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

DOCKETED
USNRC

Work Order No.: NRC-428

Pages 10811-11080

NEAL R. GROSS AND CO., INC.
Court Reporters and Transcribers
1323 Rhode Island Avenue, N.W.
Washington, D.C. 20005
(202) 234-4433

Template=SECY-D32

SECY-02

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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

ASLBP Hearing Room
 Third Floor
 Two White Flint North Building
 11545 Rockville Pike
 Rockville, Maryland

June 17, 2002

The above-entitled matter came on for hearing, pursuant to notice, at 9:00 a.m. before:

MICHAEL C. FARRAR, CHAIRMAN
 Administrative Judge
 U. S. Nuclear Regulatory Commission

DR. JERRY R. KLINE
 Administrative Judge
 U. S. Nuclear Regulatory Commission

DR. PETER S. LAM
 Administrative Judge
 U. S. Nuclear Regulatory Commission

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
 1323 RHODE ISLAND AVE., N.W.
 WASHINGTON, D.C. 20005-3701

A P P E A R A N C E S

FOR THE STATE OF UTAH:

Denise Chancellor, Esq.
Connie Nakahara, Esq.
ASSISTANT ATTORNEY 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:

Jay Silberg, Esq.
Sean Barnett, Esq.
Paul Gaukler, Esq.
SHAW PITTMAN
Attorneys at Law
2300 N Street, N.W.
Washington, D.C. 20037

FOR THE SKULL VALLEY BAND OF GOSHUTE INDIANS:

Timothy Vollmann, Esq.
Attorney at Law

FOR THE U.S. NUCLEAR REGULATORY COMMISSION:

Sherwin E. Turk, Esq.
Catherine Marco, Esq.
Office of the General Counsel
Mail Stop - 0-15 B18
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

FOR THE SOUTHERN UTAH WILDERNESS ALLIANCE:

Joro Walker
Director, Utah Office
Land and Water Fund of the Rockies
1473 South 1100 East, Suite F
Salt Lake City, Utah 84105

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

I-N-D-E-X

WITNESSES

PETER TRUDEAU
ANWAR WISSA

Prefiled Testimony	10834
Direct Examination by Mr. Travieso Diaz . . .	10832
Cross Examination by Mr. O'Neill	10837
Cross Examination by Ms. Chancellor	10852
Redirect Examination by Mr. Travieso-Diaz . .	10962
Recross Examination by Mr. O'Neill	10972
Recross Examination by Ms. Chancellor	10974
Redirect Examination by Mr. Travieso-Diaz . .	10990
Recross Examination by Mr. O'Neill	10992
Recross Examination by Ms. Chancellor	10993

GOODLUCK I. OFOEGBU

Prefiled Testimony	11001
Direct Examination by Mr. O'Neill	10999
Cross Examination by Ms. Nakahara	11002
Cross Examination by Mr. Travieso-Diaz . . .	11029
Redirect Examination by Mr. O'Neill	11026
Further Recross Examination by Ms. Nakahara .	11025

JAMES MITCHELL
STEVEN BARTLETT

Prefiled Testimony	11033
Direct Examination by Ms. Chancellor	11032
Cross Examination by Mr. Travieso-Diaz . . .	11041

EXHIBITS

<u>NUMBER</u>	<u>DESCRIPTION</u>	<u>MARK</u>	<u>RECD</u>
<u>Applicant</u>			
GGG	Soil Cement Mixes	10835	10837
HHH	ACI Report	10836	10837
III	Mitchell Deposition	10836	10837
JJJ	PFS Safety Analysis	10836	10837
<u>State</u>			
212	Enlargement of PFS SAR Fig. 4.2-7	10867	10990
213	AGEC Test Results	10877	10990
105	James Mitchell CV	11035	11035
106	PFS SAR Sect. 2.6.4.11	11035	11035
108	Trudeau Deposition	11035	11035
109	Wissa Deposition	11035	11035
<u>PFS</u>			
228	Mitchell Deposition	11046	
228A	Mitchell Deposition w/corrections	11052	
229	Soil Cement Mixes	11068	

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

P-R-O-C-E-E-D-I-N-G-S

9:32 a.m.

1 CHAIRMAN FARRAR: Good morning, everyone.
2
3 We said we would try to start at 9:30 if the moving in
4 problems didn't cause you too much delays. Is everyone
5 ready to go? I will talk slowly while you get
6 organized.
7

8 I want to welcome everyone to the
9 Licensing Board's hearing room at the NRC headquarters
10 in Rockville, Maryland. We've conducted six weeks of
11 hearings in Salt Lake City, four of them on seismic
12 issues.

13 We are here today to begin two weeks of
14 additional hearings on seismic matters. For the
15 benefit of the Court Reporters, could you all
16 introduce yourselves briefly?

17 MR. GAULKER: Paul Gaulker, Counsel for
18 Applicant, Private Fuel Storage.

19 MR. TRAVIESO-DIAZ: Matias Travieso Diaz,
20 Counsel for PFS.

21 MR. SILBERG: Jay Silberg, also counsel
22 for PFS. We are all from the Washington law firm of
23 Shaw Pittman.

24 CHAIRMAN FARRAR: For the State of Utah?

25 MS. CHANCELLOR: Denise Chancellor, State

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 of Utah, Connie Nakahara, State of Utah. On my right
2 is Dr. Steven Bartlett, and on my left is Dr. James
3 Mitchell, who will be witnesses in this Proceeding.

4 CHAIRMAN FARRAR: For the Staff?

5 MR. O'NEILL: Martin O'Neill, Counsel for
6 the NRC Staff.

7 MS. MARCO: Catherine Marco, Counsel for
8 NRC.

9 MR. TURK: Sherwin Turk, with the same
10 office.

11 CHAIRMAN FARRAR: Good to see you all here
12 again. Let's go off the record for a moment to
13 discuss some logistical matters.

14 (Whereupon, the above-entitled matter
15 went off the record at 9:34 a.m. and
16 went back on the record at 9:35 a.m.)

17 CHAIRMAN FARRAR: Are there any
18 preliminary matters before we start with the
19 Applicant's witnesses?

20 MR. GAULKER: Yes, Your Honor, there is
21 one preliminary matter, to update the Board on the
22 latest discussions we've had among the parties for the
23 schedule for these two weeks of seismic hearings.

24 As discussed we are starting out with the
25 start soil witnesses, today and tomorrow. We will be

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 starting with Dr. Bartlett, the cross examination of
2 Dr. Bartlett, and any rebuttal that Staff may have
3 with respect to the Sandia report, on Wednesday.

4 We've set that as to the exact time we
5 will start on that. And I believe there was some
6 discussion to the extent we have time on Tuesday
7 afternoon, available, we have two options.

8 One is to try to do his rebuttal testimony
9 on Section D, which we didn't get to in Salt Lake
10 City, or potentially start soils, whichever one works
11 out the best.

12 CHAIRMAN FARRAR: Okay.

13 MR. GAULKER: Then Thursday we would go to
14 the soils part of section C, and do that Thursday, and
15 complete that on Friday.

16 MS. CHANCELLOR: Your Honor, I might add
17 that the State does not necessarily agree that we
18 should start Dr. Luke on Wednesday, but that may be a
19 moot point, depending on what happens with soil
20 cement.

21 And I agree with Mr. Gaulker, we haven't
22 decided yet how we will fill the afternoon on Tuesday.

23 MR. TRAVIESO-DIAZ: We will need to get a
24 notice as to which way the State prefers to go, so
25 that we can have the paperwork ready.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. TURK: May I note, before we move to
2 the second week, that Dr. Luke will be available this
3 week. He is flying out on Tuesday, he will be here
4 Tuesday night. So for that reason we proposed the
5 cross examination of Dr. Bartlett, with respect to his
6 rebuttal testimony concerning Dr. Luke's report, to
7 commence Wednesday morning.

8 CHAIRMAN FARRAR: And you need Dr. Luke
9 here to do that, is that the --

10 MR. TURK: Correct. It is for that reason
11 that we discussed with the other parties the need, if
12 we do need to fill Tuesday afternoon, we would do that
13 with the Trudeau rebuttals, or some of the soils
14 testimony.

15 CHAIRMAN FARRAR: Now, do you envision,
16 then, that Dr. Luke would provide rebuttal testimony?

17 MR. TURK: Yes.

18 CHAIRMAN FARRAR: And we would have to fit
19 that into the same time?

20 MR. TURK: That would come in on
21 Wednesday, and I don't see any problem with that,
22 because if we start with Dr. Bartlett's cross
23 examination, I don't imagine that will go more than a
24 few hours at the most. We would have time for Dr.
25 Luke's rebuttal.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 CHAIRMAN FARRAR: All right. Before we go
2 to the second week, as planned, we will be recessing
3 at 2 p.m. on Friday, and then you will be working with
4 Judge Bullwork on the electronic information exchange
5 for about an hour or so, and then be free to go.

6 MR. TRAVIESO-DIAZ: And the understanding
7 is that we will start early on Friday?

8 CHAIRMAN FARRAR: Yes, 8 o'clock on
9 Friday. And we will be at 9 every day the rest of
10 this week, and our contemplation is to do the same
11 thing that we did in Salt Lake City, go from 9 to
12 12:30, 12:30 to 1:30 lunch, 1:30 to 5 to complete, but
13 we would be willing to stay if it is necessary to
14 complete a particular witness, or an important phase.

15 Mr. Gaulker, you were going to tell us
16 about the second week?

17 MR. GAULKER: Yes, the second week --

18 MS. CHANCELLOR: What about the first week
19 and the Holtec report?

20 MR. TRAVIESO-DIAZ: We will talk about in
21 a moment.

22 MS. CHANCELLOR: Okay.

23 MR. GAULKER: The second week we had
24 originally discussed not having a hearing on Monday,
25 but the parties have discussed, and believe that we

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 should have hearing on Monday. And we will start, we
2 propose to start with the radiation dose consequences
3 of Section E, because of the weekend, and travel,
4 Counsel would like to start at 10 o'clock on Monday,
5 if we could.

6 CHAIRMAN FARRAR: That is fine.

7 MR. GAULKER: We would have radiation dose
8 consequences, we expect that to take two to three
9 days. We would definitely start with the cross
10 examination of Dr. Bartlett on Section E, on Thursday.

11 To the extent that we have some time on
12 Wednesday, because radiation dose consequences may get
13 done earlier, we would have the rebuttal testimony of
14 John Stamatakos, I believe is what we had discussed,
15 on Section E.

16 And then we would have Dr. Bartlett's
17 direct testimony on Section E on Thursday, and we will
18 have any rebuttal on Section E, we envision some small
19 rebuttal ourselves, on Friday.

20 And to the extent we didn't get to Dr.
21 Stamatakos on Wednesday, then his rebuttal would be on
22 Friday.

23 CHAIRMAN FARRAR: And under that schedule
24 we finish in two weeks?

25 MR. GAULKER: Yes.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MS. CHANCELLOR: All being well.

2 CHAIRMAN FARRAR: That would make a total
3 of six weeks on seismic?

4 MS. CHANCELLOR: I might add with the
5 rebuttal on Dr. Stamatakos, Mr. Turk sent me a draft
6 that arrived after hours on Friday. So Dr. Aravas
7 hasn't had a chance to look at that.

8 There is the potential that we may need to
9 tie Dr. Aravas in by video conference.

10 CHAIRMAN FARRAR: We can arrange that if
11 necessary.

12 MS. CHANCELLOR: And I need to check on
13 his availability.

14 CHAIRMAN FARRAR: All right. He is at the
15 university?

16 MS. CHANCELLOR: That is correct.

17 CHAIRMAN FARRAR: And that is where we did
18 the video facilities last time?

19 MS. CHANCELLOR: Yes, the broadcast
20 center, that is correct. And Dr. Bartlett will be
21 going back on the weekend, so that is the reason why
22 we are starting him at a date certain on Thursday.

23 CHAIRMAN FARRAR: All right. Again, the
24 Board wants to commend the parties for working
25 together on witness scheduling, in an issue on which

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 you have 21 panels the witnesses, this is certainly a
2 better way to do it than us trying to direct traffic,
3 so we appreciate your help.

4 Any other preliminary matters?

5 MR. TRAVIESO-DIAZ: Yes, Your Honor.

6 CHAIRMAN FARRAR: Okay.

7 MR. TRAVIESO-DIAZ: Two more. First, the
8 more general of the two. If I recall, the Board
9 commended the parties to attempt to expedite, or
10 facilitate the rebuttal process, which as we saw in
11 Salt Lake City, can be convoluted.

12 In an effort to do that, we have
13 tentatively agreed that this discussion with the
14 State, I don't think we ever had a chance to talk
15 about this with the Staff, that to the extent
16 feasible, we would try to have a witness present, for
17 his direct testimony, and any rebuttal that he may
18 have to other parties' testimony at the same time.

19 In an effort to achieve that, I circulated
20 late last night, and I apologize for the lateness, but
21 the witnesses were traveling, and they didn't get here
22 until late.

23 A rebuttal testimony by Mr. Trudeau and
24 Dr. Wissa, to the testimony of Dr. Bartlett and Dr.
25 Mitchell, and our view, the witnesses will be

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 available to answer questions on that rebuttal at the
2 same time they give their direct testimony.

3 However, the State may feel that they need
4 more time to review it, and in this instance, it is
5 possible that they may want to have, revert to the
6 procedure that we used in Salt Lake City for these
7 witnesses.

8 But our view is that the better practice,
9 if at all possible, would be to have what we intended,
10 which is to have this witness address direct and
11 rebuttal at the same time, be the way we go.

12 With the understanding, of course, that we
13 may need to have additional oral rebuttal based on the
14 testimony that the other parties give.

15 CHAIRMAN FARRAR: We appreciate that
16 offer. When we had gotten your rebuttal that question
17 crossed our minds, if it wouldn't be more efficient to
18 do both at once, rather than what we did in Salt Lake
19 City.

20 But certainly efficiency takes second
21 place to fairness, so the -- it would have to be
22 either by the State's ability, at least in this
23 instance, given the lateness of the filing, to proceed
24 in that fashion.

25 MR. O'NEILL: I would note that we haven't

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 received a copy of that yet, so we would certainly
2 request some additional time to review it.

3 MR. TURK: Could we hear from the State?

4 MS. CHANCELLOR: Yes. We received a copy
5 around about midnight last night, and the two
6 witnesses here have only just had a chance to look at
7 it first thing this morning.

8 So I think in this instance it would be
9 more efficient if we did it as part of the overall
10 rebuttal, rather than part of direct.

11 CHAIRMAN FARRAR: All right.

12 MR. TURK: May I address it also, Your
13 Honor?

14 CHAIRMAN FARRAR: Go ahead, Mr. Turk.

15 MR. TURK: We received it electronically,
16 I saw it on my machine this morning. But we didn't
17 understand that, upon receiving it, that it was
18 intended to be presented first thing this morning.

19 So we have not had a chance to review it
20 ourselves, yet. I think with respect to that piece of
21 rebuttal testimony, we are probably best served by
22 doing it in the normal course of doing the other
23 witnesses, then coming to the rebuttal.

24 But with respect to other testimony, if we
25 get it in time, we don't have a problem with the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 Applicant's suggestion.

2 CHAIRMAN FARRAR: That would be our
3 thought, that to the extent that can be done in future
4 instances, it is certainly a time saving procedure.
5 In this instance we appreciate the offer, but it
6 sounds like it would be better not to do it this time.

7 MR. TRAVIESO-DIAZ: One other preliminary
8 matter. As it will become apparent, in the
9 discussions on the soil cement issue, there is a
10 concern raised by the State that moisture may
11 accumulate under the cement treated soil, in the soil
12 directly underneath, and weaken the soil.

13 And I'm not trying to characterize their
14 position, but just give you background for what I'm
15 going to say.

16 Our position to the contrary is that for
17 a number of reasons this is not going to happen. One
18 of the reasons we claim this is not going to happen,
19 is that the waste storage casks, that sit on the pad,
20 in addition to being radioactively hot, they also are
21 at a fairly elevated temperature, and they release
22 heat.

23 That heat goes through the pad, through
24 the cement treated soil, and ultimately into the soil
25 beneath, driving moisture away. To demonstrate that

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 we have prepared, and we sent to the State last week,
2 a calculation that Holtec did, intending to
3 demonstrate that in fact how the heat transfer process
4 occurs, and that there is a positive temperature
5 gradient going from the cement treated soil, to the
6 top layer of the subsoil.

7 Therefore --

8 CHAIRMAN FARRAR: Now, you touched on this
9 conceptually in your testimony?

10 MR. TRAVIESO-DIAZ: Correct. And the
11 State wishes to cross examine on that issue. And they
12 want to cross examine the author of the report, the
13 person who is going to sponsor this, Dr. Singh.

14 MS. CHANCELLOR: Could we just establish
15 that this is part of rebuttal, and not part of direct
16 testimony? Because it wasn't introduced as part of
17 the direct prefiled testimony.

18 MR. TRAVIESO-DIAZ: That is correct. And
19 -- but the reason we are raising all this at this
20 point is that the State feels that they need to have
21 Dr. Bartlett present when that examination takes
22 place.

23 We have suggested to do it next week,
24 because Dr. Singh will be participating here with the
25 radiation release panel. However, the state feels

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealgross.com

1 that they want to have Dr. Bartlett available for that
2 examination he won't be here.

3 Well, we accommodate the State --

4 CHAIRMAN FARRAR: I thought he was coming
5 back Monday?

6 MS. CHANCELLOR: No, he is coming back
7 Thursday. I think the main point is that this is part
8 of soil cement testimony, it is not part of radiation
9 dose testimony.

10 And in addition I need the experts here.
11 It is a bit of a crossover. There are some radiation
12 issues with respect to the amount of heat transfer.
13 But it is presented in the context of soil cement, and
14 that is why I felt like it should be this week when we
15 are doing soils this week.

16 MR. TRAVIESO-DIAZ: The reason why I bring
17 it up this before you now, is that we think the only
18 way this can be done, effectively, is by tying Dr.
19 Singh by radioconferencing tomorrow, given that time,
20 so that he can be examined on that issue without
21 having to come here, given that it is rather narrow.

22 And I think the State is agreeable to that
23 procedure, is that correct?

24 MS. CHANCELLOR: Yes, that is correct.

25 CHAIRMAN FARRAR: Where will he be?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. GAULKER: He will be at his offices up
2 in New Jersey. They do have videoconferencing
3 capabilities, is my understanding, Holtec does.

4 MR. TRAVIESO-DIAZ: So what we need to do
5 is establish a time certain tomorrow, in which that
6 videoconference can take place, and make the necessary
7 arrangements.

8 CHAIRMAN FARRAR: Hold on a minute.

9 (Pause.)

10 JUDGE LAM: Mr. Travieso-Diaz?

11 MR. TRAVIESO-DIAZ: Yes.

12 JUDGE LAM: What do you intend to
13 demonstrate with this new thermal calculation by Dr.
14 Singh?

15 MR. TRAVIESO-DIAZ: Well, intuitively the
16 principle is well understood. If the cask emits heat,
17 that heat may in fact find its because the heat will
18 tend to die mostly away. And, in fact, it will stay
19 in the soil.

20 However, that is just in principle. We
21 have actually quantified that principle and
22 demonstrated that there is such a gradient of a number
23 of degrees Fahrenheit.

24 So at all times the top layer of the
25 subsoil will be warmer than the area underneath it,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 therefore moisture will be migrating away from the
2 area underneath the pad, as opposed to into it.

3 So it is a quantification of what I think
4 we understand to be a physical principle.

5 MS. CHANCELLOR: Your Honor, I guess it is
6 a question of what it is rebutting.

7 MR. TRAVIESO-DIAZ: Excuse me?

8 MS. CHANCELLOR: I mean, it is being
9 offered as rebuttal testimony, correct?

10 MR. TRAVIESO-DIAZ: Yes.

11 MS. CHANCELLOR: So it is a question of
12 what that rebuttal testimony is rebutting.

13 MR. TRAVIESO-DIAZ: It is rebutting the
14 claim that is made by the State witnesses, that one of
15 the potential concerns with the use of soil cement, is
16 that the subsoil underneath the soil cement will be --
17 that moisture will be trapped by having, essentially,
18 a concrete pad above that doesn't let the normal
19 traffic, if you will, of moisture to go in and out.
20 That is part of their testimony.

21 And we have a number of answers to it.
22 One of them is that it simply is not going to happen,
23 because moisture will not gather underneath the pads,
24 and the soil cement, because the heat that migrates
25 downwards will prevent it.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 I can refer you specifically to --

2 MS. CHANCELLOR: No, it is fine, I don't
3 want to get into an argument.

4 CHAIRMAN FARRAR: Well, before we make the
5 effort to set up the videoconference for Dr. Singh,
6 Ms. Chancellor, if you have an argument that this is
7 improper rebuttal, then we ought to hear it at some
8 point before we make the arrangements.

9 Do you want to do that at some later time
10 today?

11 MS. CHANCELLOR: Could we do that after
12 lunch?

13 CHAIRMAN FARRAR: Fine. If assuming that
14 argument does not prevail, what time do you want to do
15 Dr. Singh on Tuesday? And the reason I ask is we have
16 to arrange through headquarters videoconferencing
17 people.

18 MR. TRAVIESO-DIAZ: Could we make that the
19 first order of business after lunch tomorrow? And
20 that way we know it is going to be like 1:30.

21 CHAIRMAN FARRAR: All right. Why don't we
22 set that for 1:30 on Tuesday. We will check now to
23 see if we can arrange that, and then we will hear
24 argument later on whether this is appropriate
25 rebuttal.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. TRAVIESO-DIAZ: Thank you.

2 CHAIRMAN FARRAR: Is that all the
3 preliminary matters?

4 MR. TRAVIESO-DIAZ: Yes, sir.

5 CHAIRMAN FARRAR: Then the Applicant was
6 going to present its testimony on soil cement?

7 MR. TRAVIESO-DIAZ: That is correct.

8 CHAIRMAN FARRAR: Go ahead.

9 MS. CHANCELLOR: Your Honor, did you
10 receive a copy of my cross examination plan? If you
11 didn't I have a hard copy with me.

12 CHAIRMAN FARRAR: Yes, we have that.

13 MS. CHANCELLOR: Okay.

14 CHAIRMAN FARRAR: Thank you. For the
15 benefit of Counsel, if we have a situation where you
16 need to go over and show the witnesses something,
17 there is a hand held microphone which you can use, if
18 you are away from your desk.

19 Whereupon,

20 PETER TRUDEAU
21 was called as a witness by counsel for the Applicant
22 and, having been previously duly sworn, assumed the
23 witness stand, was examined and testified as follows:
24
25

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 Whereupon,

2 ANWAR WISSA

3 was called as a witness by counsel for the Applicant
4 and, having been duly sworn, assumed the witness
5 stand, was examined and testified as follows:

6 DIRECT EXAMINATION

7 MR. TRAVIESO-DIAZ: Gentlemen, would you
8 state your name for the record, please?

9 MR. TRUDEAU: Good morning. My name is
10 Paul J. Trudeau.

11 DR. WISSA: Anwar Wissa.

12 MR. TRAVIESO-DIAZ: Do you both have in
13 front of you a document bearing the caption of this
14 Proceeding, dated April 1st, 2002, and entitled:
15 Joint Testimony of Paul J. Trudeau, and Anwar Ez
16 Wissa, on Section C of Unified Content Utah L-QQ?

17 DR. WISSA: Yes.

18 MR. TRUDEAU: Yes.

19 MR. TRAVIESO-DIAZ: Are there any
20 corrections you wish to make to that testimony?

21 MR. TRUDEAU: I have one correction that
22 I would like to make to the response on page 17, which
23 is A-23.

24 In the last line of that paragraph I had
25 indicated, at that time, that -- excuse me, let me

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealrgross.com

1 back up. The stress controlled tests were performed
2 by PFS showed very little defamiation, indicating no
3 significant reduction in shear strength, even after
4 500 cycles of loading.

5 And then parenthetically it says: Versus
6 about 8 to 15 for the PFS design earthquake. I would
7 like to change the 8 to 15 to say 7 to 11, which is
8 consistent with the numbers that I'm using in my
9 rebuttal testimony on part D.

10 I was advised by Dr. Robert Young last
11 week that when we include directivity effects 7 to 11
12 are the appropriate numbers for this site, and
13 directivity of the earthquake is a significant well-
14 known issue for the site.

15 So it is appropriate to use the 7 to 11 in
16 that case, instead of the 8 to 15 that I had
17 originally included.

18 MR. TRAVIESO-DIAZ: Did you both prepare
19 this testimony, or was it prepared under your direct
20 supervision and control?

21 MR. TRUDEAU: Yes.

22 DR. WISSA: Yes.

23 MR. TRAVIESO-DIAZ: With the correction
24 that you noted, Mr. Trudeau, is that testimony true
25 and correct to the best of your knowledge?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. TRUDEAU: Yes.

2 MR. TRAVIESO-DIAZ: I would like to, Dr.
3 Wissa, is it true and correct?

4 DR. WISSA: Yes.

5 MR. TRAVIESO-DIAZ: I would like to move
6 to have this testimony admitted into evidence, and
7 incorporated into the record.

8 CHAIRMAN FARRAR: Any objection?

9 MS. CHANCELLOR: No objection, Your Honor.

10 MR. O'NEILL: No objection, Your Honor.

11 CHAIRMAN FARRAR: All right, then the
12 testimony of this panel will be bound into the record
13 at this point, as if read.

14 (Insert prefiled testimony of Dr. Trudeau and
15 Dr. Wissa here.)

16

17

18

19

20

21

22

23

24

25

CONDENSED TRANSCRIPT

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of)
PRIVATE FUEL STORAGE) Docket No. 72-22
L.L.C.) ASLPB No. 97-732-02-ISFSI
(Private Fuel Storage) DEPOSITION OF:
Facility) PAUL J. TRUDEAU
)
) (Utah Contention L/QQ)

March 6, 2002 - 1:06 p.m.

Location: Office of the Attorney General
160 East 300 South, 5th Floor
Salt Lake City, Utah

Reporter: Susette M. Snider, RPR, CRR
Notary Public in and for the State of Utah



CitiCourt, LLC
THE REPORTING GROUP

State's
Exhibit 108

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

801.532.3441

TOLL FREE 877.532.3441

FAX 801.532.3414

1 **A. That's response spectra, I believe.**
2 MR. TRAVIESO-DIAZ: Excuse me for
3 interrupting. Do you mean 1160?
4 THE WITNESS: It's 1.165.
5 Q. (By Ms. Chancellor) No, you said 1.60?
6 **A. 60, yeah. It might be 1. -- I don't know.**
7 **I don't know whether --**
8 MR. TRAVIESO-DIAZ: That was the basis of
9 my objection before. You know, it is very hard for the
10 witness to remember without being presented a document,
11 Are you familiar with it?
12 MS. CHANCELLOR: That's fine. If he's
13 given me the name of the document and given me his best
14 recollection of the reg guide. I'm not going to
15 challenge if he relies on a document that he's got in
16 his filing cabinet.
17 Q. I'm just trying to get a sense of what reg
18 guides and what regulations you work with, in general,
19 with respect to your geotechnical investigation. So
20 we've got 1.567, 0800 and reg guide dealing with
21 response spectra.
22 Anything else you'd like to add to the
23 list?
24 **A. No.**
25 MS. CHANCELLOR: Okay. If I could have

1 this document marked as Exhibit 12.
2 (A discussion was held off the record.)
3 (Exhibit-12 was marked.)
4 Q. (By Ms. Chancellor) Mr. Trudeau, I've
5 handed you a copy of PFS -- an excerpt from PFS's
6 SAR, Revision 22, Section 2.6.4.11, Techniques to
7 Improve Subsurface Conditions. Are you familiar with
8 this section of the SAR?
9 **A. Yes.**
10 Q. Are you primarily responsible for authoring
11 this section of the SAR?
12 **A. Yes.**
13 Q. And does this section, in general, deal
14 with PFS's application of soil cement in its foundation
15 design?
16 **A. Yes.**
17 Q. And what experience have you had in
18 applying soil cement in foundation design in any other
19 project?
20 **A. I have none.**
21 Q. Are you responsible for any other sections
22 of the SAR where you've been basically the primary
23 author?
24 **A. Chapter --**
25 Q. I've got a copy of Chapter 2 here and a

1 part of -- if you'd like to take a look at it. I don't
2 have all of Chapter 2 but the first part of Chapter 2.
3 **A. But not the table of contents?**
4 Q. Oh, doesn't it have -- at the beginning of
5 the chapter, doesn't it have the table of contents?
6 **A. Sorry. Found it.**
7 Q. I think that was a document control
8 argument.
9 You can take the clip out.
10 **A. How detailed a list do you want here?**
11 Q. Oh, just the main general areas --
12 **A. 2.6.1.5, Facility Plot Plan and Geologic**
13 **Investigations, I co-authored or authored most of that,**
14 **I would say.**
15 **Same with .6, Relationship of Major**
16 **Foundations to Subsurface Materials, I authored that.**
17 **2.6.1.7, Excavations and Backfill, likely I**
18 **wrote that --**
19 Q. Okay.
20 **A. -- back in '97.**
21 **I probably had input to the Site**
22 **Groundwater Conditions in 2.6.1.9, but that may have**
23 **been authored by someone else. Same with 2.6.1.10,**
24 **Geophysical Surveys.**
25 **2.1.1.11, Static and Dynamic Rock**

1 **Properties at the Site, is largely going to be my work.**
2 **And 2.6.1.12, Stability of Foundations for**
3 **Structures and Embankments, will be largely my work.**
4 **2.6.4, Stability of Subsurface Materials,**
5 **was probably authored by me as well.**
6 **2.6.4.7, Response of Soil and Rock to**
7 **Dynamic Loading.**
8 **2.6.4.8, Liquefaction Potential.**
9 **2.6.4.9, Design Basis Ground Motion, I**
10 **probably authored, but it just refers to Geomatrix's**
11 **work earlier in the SAR.**
12 **2.6.4.10, Static Analyses.**
13 Q. Going back to the design basis ground
14 motion, would that be the way in which you reviewed and
15 used -- an example of the way in which you used and
16 reviewed the Geomatrix calculation to write up the --
17 **A. This section of the -- this section of the**
18 **SAR just simply just defines what the design basis**
19 **ground motion is, and it references back to Geomatrix's**
20 **complete description in early sections of the SAR.**
21 Q. Okay.
22 **A. So this just gets that it's .117 g**
23 **horizontal, .695 g vertical, and it refers to the**
24 **Geomatrix reports.**
25 Q. Okay. I understand. Thank you.

1 Q. Now, looking at SAR on page 1.6-108,
2 towards the bottom of the page, it says that -- one,
3 two, three, four lines from the bottom, it says that,
4 Compacted clay soils will be used to raise the
5 elevation of the subgrade.

6 Will that be -- will the soils be compacted
7 on-site, those clay soils?

8 A. Correct.

9 Q. And what consideration have you given to
10 the remolding of those clay soils from compaction?

11 A. Well, they will be remolded as part of the
12 compaction, but we'll -- we'll have to demonstrate by
13 testing that we've got adequate strength in those
14 compacted clay soils.

15 Q. And how will you demonstrate that?

16 A. By testing.

17 Q. When?

18 A. As the project moves ahead.

19 Q. And how --

20 A. These -- these areas represent a very minor
21 portion of that entire pad emplacement area. I'm -- to
22 hazard a guess, I would say it's probably less than
23 2 percent of the entire area. It's just mentioned here
24 in case we hit that eventuality. We understand that
25 we've got a 2-foot limitation. If we've got a

1 2-and-a-half-foot-deep hole, we've got to put something
2 else in there. And there may be 2 percent of the
3 entire area where we're going to find that the in situ
4 subgrade with the design grades are such that we need
5 to fill it a little thicker than the 2-foot limitation
6 of the soil cement below the pad. So this statement is
7 what we're planning to do to get that piece of the
8 subgrade filled in.

9 Q. And what's your basis for assuming that
10 you'll only find about 2 percent of --

11 A. That's based on a review of the data that
12 we've got, the profiles that are shown in the SAR,
13 Figures 2.6-5 --

14 Q. The pallet --

15 A. Yeah. -- sheets 1 through 14. If you take
16 a look at where the pads are shown on those figures,
17 you'll see that almost all of them are within the
18 2-foot limitation.

19 (A discussion was held off the record.)

20 Q. (By Ms. Chancellor) Do you plan to develop
21 a grading plan to show these clay -- clay areas -- just
22 a moment.

23 (A discussion was held off the record.)

24 Q. (By Ms. Chancellor) I was way off.
25 Do you plan to develop a grading plan to

1 show these silty areas where you'll need to have the
2 compacted soils?

3 A. I would expect that we'll have some sort of
4 an excavation plan that will be part of the
5 construction drawings that will be produced. I don't
6 know that we'll actually go out and do any additional
7 work at this point to try to identify where this bottom
8 is that -- that we're discussing right now prior to
9 getting out and excavating, but those discussions will
10 be held as part of the normal process of getting the
11 construction specs set up for this -- for this project.

12 Q. On page 3.6-113 of the SAR, if you'd turn
13 to that page, it states that --

14 A. You mean 2.6?

15 Q. What did I say? Yeah, 2.6.113. In the
16 middle of the first full paragraph, the sentence that
17 starts, This continuous layer of soil cement existing
18 under and between the pads will spread the loads from
19 the pads beyond the footprint of the pads resulting in
20 decreased total differential settlement of the pads.

21 In -- in the settlement calculations you --
22 it showed the settlement of the pads was 3 inches, and
23 now it's 1.7 inches. Is this statement the reason for
24 that decrease in the settlement of the pads?

25 MR. TRAVIESO-DIAZ: Do you understand the

1 question?

2 THE WITNESS: That's not the reason for
3 this decrease, no.

4 Q. (By Ms. Chancellor) What's the reason --

5 A. I mean this here text in the SAR is not the
6 reason for the decrease in the settlement numbers that
7 you just cited. I don't recall exactly what's in the
8 calcs that you've cited, but if you've got them, I'll
9 take a look and --

10 Q. Which ones do you need?

11 A. The one that cites the 1.7.

12 Q. I've got the 1.7 in the SAR, but I didn't
13 bring the -- I didn't bring the settlement calcs with
14 me. I can get those.

15 On page 2.6.5, Revision 22, of the SAR,
16 which I'm handing you now, it has a -- it shows the
17 settlement of the pads as 1.7, and in Revision 17 the
18 elastic settlement was 0.5. The next number, which I
19 can't read upside down, consolidated settlement,
20 changed from 1.7 to 0.8, and a secondary compression
21 from 1.1 to 0.4.

22 What is the reason -- if we need to get the
23 calculations, we can pick this up later, but what is
24 the reason for the change in settlement from 3.3 inches
25 to 1.7 inches?

1 find it. If you're happy with what I've given you so
2 far, we can go move on.

3 Q. No. You take as much time as you like.

4 MR. TRAVIESO-DIAZ: Can we go off the
5 record for a second?

6 MS. CHANCELLOR: Sure.

7 (A discussion was held off the record.)

8 MS. CHANCELLOR: Back on the record.

9 THE WITNESS: Commitments that I can find
10 stated in this section of the SAR at this point in time
11 are on page 2.6-111. The second sentence in the second
12 paragraph reads, PFS has committed to performing
13 site-specific testing to confirm that the required
14 interface strengths are available to resist sliding
15 forces due to an earthquake.

16 It continues on, a sentence following the
17 next one, In addition, PFS is committed to augmenting
18 this field testing program by performing additional
19 site-specific testing of the strengths achieved at the
20 interface between the bottom of the soil cement and the
21 underlying soils.

22 So those are the commitments I was
23 referring to in my response to the interrogatory.

24 Q. (By Ms. Chancellor) So on page 109, 117
25 and on page 111 is what you've testified to at the

1 moment?

2 MR. TRAVIESO-DIAZ: I think he said 117 not
3 107, 117.

4 MS. CHANCELLOR: Did I say --

5 MR. TRAVIESO-DIAZ: I thought you said 107.

6 MS. CHANCELLOR: I meant 117. I beg your
7 pardon.

8 THE WITNESS: Yes.

9 Q. (By Ms. Chancellor) Okay. And is it true
10 that PFS will implement a document called
11 State-of-the-Art on Soil Cement, a document by American
12 Concrete Institute? If we look on page 2.6-117, in the
13 last paragraph of the design placement testing, PFS
14 will development site-specific procedures to implement
15 the recommendations presented in State-Of-the-Art
16 Report on Soil Cement, ACI 1998?

17 A. Correct.

18 Q. I'm handing you a document,
19 State-of-the-Art Report on Soil Cement, ACI 230.1 R-90.
20 Is this the document that is referred to on page
21 2.6.117 of the SAR?

22 A. I do not think so. I think this is an
23 earlier version of it.

24 Q. Okay. Thank you.

25 Have you produced to the State a copy of

1 this document, State-Of-the-Art Report on Soil Cement,
2 1998, that you're using? If not, we'd like to request
3 a copy. It's a document referred to on 2.6-117.

4 Can we go off the record a moment?

5 (A discussion was held off the record.)

6 Q. (By Ms. Chancellor) Mr. Trudeau,
7 Mr. O'Neill from NRC during the break handed me a copy
8 of a document entitled State-Of-the-Art Report on Soil
9 Cement, ACI 230.1R-90, Reapproved 1997. If you'd take
10 a look at that document, is that the document that is
11 referred to on 2.6.117 of the SAR?

12 A. Yes, I believe it is.

13 Q. Thank you.

14 Could you describe the PFS soil cement test
15 program?

16 A. Yes.

17 Q. Would you?

18 A. The purpose of the ongoing program is to
19 develop design mix, a soil cement design mix with the
20 site soils. Essentially it's to determine how much
21 cement we need to mix with the various types of soils
22 that we've encountered in the test pits that we took at
23 the site to produce a durable soil cement mix, one that
24 will meet the requirements of the ASTM tests for
25 wet/dry cycles and freeze/thaw cycles.

1 The program included digging 16 test pits
2 at the site where we sampled -- took bulk samples of
3 the soils on a 2-foot interval, going down below ground
4 in each of these 16 locations. For the southeast
5 quadrant of the site, the Phase 1 area of the pad
6 emplacement area, for each of the 2-foot depths we took
7 a bucket every 6 inches, essentially, so we ended up
8 with four buckets for the zero-to-2-foot depth and four
9 buckets for the 2-to-4-foot department and four buckets
10 for the 4-to-6-foot depth in each of test pits 1
11 through 4. The other three quadrants, we only took one
12 bucket for each of the 2-foot depths.

13 So we collected quite a number of buckets
14 of soil from the site -- these are 5-gallon buckets --
15 for testing for the soil cement mix design process.

16 The first phase of the laboratory testing
17 included index property testing, measuring water
18 contents of all of these samples that we tested,
19 Atterberg limits for most of them -- each of the depth
20 ranges we measured Atterberg limits. We didn't test
21 all four buckets from each of the four test pits in the
22 Phase 1 area to this date, but we've gotten gradations
23 performed on those as well, including both sieve
24 analyses and hydrometer analyses.

25 Based on that -- the results of that

1 Q. And is that maximum strength approximately
2 a hundred psi?
3 A. Yes.
4 Q. And is the strength a factor on how much
5 portland cement you mix with the silt?
6 A. Yes.
7 Q. And in your test program are you mixing
8 various percentages of cement to determine what the
9 recipe should be?
10 A. Yes.
11 Q. And what are those percentages?
12 A. The ESSOW identifies some in that
13 Section 1.0, Scope of Work - General, in the third
14 paragraph.
15 Q. Oh, I knew I saw it somewhere. Okay.
16 A. Now, this says the expected cement contents
17 to be used in the testing process of 6, 9 and
18 12 percent. These are representative of what we
19 expected for the soil cement, not the cement-treated
20 soil.
21 Q. Okay.
22 A. So we expect that we'll be using less
23 cement than these for the cement-treated soil. But the
24 cement-treated soil is located below the pad, which is
25 36 inches thick, so it does not have to withstand

1 freeze/thaw cycles, so it will not need to comply with
2 the freeze/thaw durability test. It's below the frost
3 zone in Skull Valley, which is only 30 inches below
4 grade.
5 Q. So the soil cement program, is that limited
6 to true soil cement which you will use around the CTB
7 and around the pads?
8 A. That's -- that may be what this ESSOW says,
9 but we realize that we need to have testing of the
10 cement-treated soil as well. So I don't -- I don't
11 recall that we have any specific discussion of the
12 cement-treated soil in here, but we have to do the
13 testing on the cement-treated soil. So it will be
14 tested as part of this program, eventually.
15 Q. But the cement-treated soil will not be
16 tested on the freeze/thaw ASTM test --
17 A. Correct. It will be tested for compressive
18 strength and modulus because those are the required
19 parameters for design.
20 Q. Will it be tested for durability or is that
21 only the freeze/thaw --
22 A. The freeze/thaw and the wet/dry tests are
23 the durability tests.
24 Q. Well, will the cement-treated soil be
25 "treated" for wet/dry tests?

1 A. No.
2 Q. Even though you claim it's below the frost
3 line, won't it still be subject to wet/dry conditions?
4 A. Not really.
5 Q. Why not?
6 A. It's 3 feet down, below the soil cement,
7 below the concrete pad -- actually, the concrete pad is
8 the critical area.
9 Q. The testing program for the cement-treated
10 soil, has any work started on that?
11 A. It's the same soils as are being tested in
12 this program, so all of the Phase 1 work is still
13 applicable for those soils.
14 Q. And the Phase 1 is the collection of the
15 samples?
16 A. It's the index property testing that's been
17 done. The Phase 2 testing I would say is the moisture
18 density testing that's been done, although I'm not sure
19 I've got final results on that testing. But I think I
20 might have.
21 So those test results are applicable to the
22 materials that would be used also for the cement
23 treated soil. The follow-on testing hasn't been done
24 yet, the strength testing that's necessary to be done,
25 the moduli testing hadn't been done yet.

1 Q. So Phase 3 will include, for the
2 cement-treated soil, strength testing and moduli
3 testing?
4 A. For the cement-treated soil, that's
5 correct.
6 Q. You waved your hand when we mentioned
7 strength. Was that a qualification?
8 A. Well, the strength testing will be done on
9 the soil cement specimens as well, but I consider that
10 part of Phase 4. The durability testing is Phase 3, in
11 my estimation.
12 Q. Oh, I see. So Phase 3 of the testing
13 program is not applicable to the cement-treated soil --
14 A. Correct.
15 Q. -- but Phase 4, the strength and modulus
16 testing, is applicable to both the cement-treated --
17 no? You tell me, then.
18 A. Okay. The Phase 4 testing for the soil
19 cement will include the compressive strength testing to
20 demonstrate that we've got at least 250 psi. We're
21 expecting that it's going to be higher than that, more
22 like -- more likely 400 psi, but our design is based on
23 250 because we felt we could comfortably achieve the
24 250 based on the data that's presented in the
25 State-of-the-Art Report on Soil Cement.

In the Matter of Private Fuel Storage
Paul J. Trudeau * March 6, 2002

PAGE 69

69

1 Q. So we're talking about true soil cement
2 now?
3 A. That's correct.
4 Q. Okay.
5 A. So the Phase 4 testing of the true soil
6 cement is the stuff around the Canister Transfer
7 Building. That, we need to show the compressive
8 strength exceeds 250 psi. So that's the Phase 4
9 testing for that material.
10 The testing of the cement-treated soil, in
11 addition to the compressive strength requirement of
12 11.1 psi, which is insignificant for the cement-treated
13 soil -- we're basing our design on 40 psi for that
14 value that -- as the lower bound of the value. So --
15 for the cement-treated soil. So we need to demonstrate
16 that our compressive strength is at least 40 psi to
17 comply with what we state in the SAR for the
18 cement-treated soil. But in addition to that strength
19 requirement for the cement-treated soil, we have
20 modulus limitation. So those specimens, we will
21 measure the modulus of elasticity during compression --
22 Q. And that's only applicable to the
23 cement-treated soil, the modulus limits?
24 A. Because of the cask tipover problem --
25 Q. Okay.

PAGE 70

70

1 A. -- right.
2 Q. In the ESSOW, Exhibit 14, if you would look
3 on page 3, has any information been redacted or blacked
4 out here?
5 A. I don't know.
6 MR. TRAVIESO-DIAZ: You're not suggesting
7 he can tell you that from memory, are you?
8 MS. CHANCELLOR: Well, this is our copy,
9 and it's just got one line and two words on it and --
10 THE WITNESS: This does not look like my
11 copy, so I don't -- I don't know what happened on that
12 page.
13 MS. CHANCELLOR: Can I request that you
14 review to see whether we've got a complete copy of
15 this? If there's been any redacted material, I'd like
16 to know the basis upon which it was redacted.
17 THE WITNESS: Yeah, you could.
18 MS. CHANCELLOR: That was directed at
19 Mr. Travieso-Diaz.
20 THE WITNESS: Oh. Excuse me.
21 Q. (By Ms. Chancellor) If you look at 5.5 of
22 the ESSOW, which is on page 12 under Schedule --
23 A. 5.5?
24 Q. 5.5 on page "4."
25 A. Oh, my God.

PAGE 71

71

1 Q. When did AGECE -- let me just read 5.5.
2 "On the premise that notification to proceed will
3 be received by the Contractor not later than
4 February 1, 2000, the laboratory work shall be
5 completed and the draft laboratory testing report
6 shall be delivered on or before March 30, 2001."
7 A. Oh, your copy doesn't say in the best of
8 all possible worlds? Sorry. That hasn't happened.
9 Q. When has AGECE received a notice to
10 proceed -- notification to proceed?
11 A. I don't recall the exact date that they
12 were told to get started, but we've had problems
13 getting that program moving because of the need to
14 update all of our calculations and our SAR documents
15 and the licensing litigation. This program has lower
16 priority than those other items have required, so
17 that's why it's hung up so long.
18 Q. To the best of your recollection, when do
19 you think Stone & Webster gave the notification to
20 start to AGECE? When did they -- when do you think
21 they --
22 A. I think it was last spring sometime, but I
23 don't know exactly when.
24 Q. So the best you can come up with is the
25 spring of 2001?

PAGE 72

72

1 A. It might have been March.
2 Q. About a year ago?
3 A. Right.
4 Q. And do you expect the program to be
5 completed in the 13-month time period that is suggested
6 here by the schedule in the ESSOW, from February 1 to
7 March 30?
8 A. No.
9 Q. How long do you expect the program to take?
10 A. Well, it's on hold right now, so it's going
11 to take until we can get it moving ahead again.
12 Q. Now, why is it on hold?
13 A. Because we've received some results that
14 have indicated that they didn't compact the test
15 specimens properly. We've brought on board Dr. Anwar
16 Wissa as an expert in soil cement to assist us in
17 evaluating why this could have -- how this could have
18 happened, what did they do wrong that would have caused
19 the densities to be so low?
20 They're supposed to be within 2 percent of
21 the maximum density from the moisture density tests
22 that are performed in accordance with ASTM D558, the
23 standard test method for moisture density relations of
24 soil cement mixtures. They were off by 8 percent or
25 more in some of these specimens. So clearly specimens

1 not compacted to sufficient density would not be
2 expected to pass this durability test regimen.
3 So that's where we are today. We've, as I
4 said, brought Anwar Wissa on board to assist us in
5 moving ahead. And we're currently involved in this
6 litigation so we're not moving ahead on the lab
7 testing, but we will sooner -- as soon as time permits.
8 Q. Do you have concerns about the ability of
9 AGECE to conduct the test program to Stone & Webster's
10 satisfaction?
11 A. No, I don't. The AGECE is in the business
12 of performing geotechnical testing services. I'm sure
13 they've been audited by the -- I don't know the correct
14 name of the group that does the auditing of
15 geotechnical labs, but I know there is one that does
16 that in accordance with ASTMs for that purpose. And
17 I -- I expect that AGECE complies with all those
18 requirements and can follow procedures to get these
19 tests done.
20 So I think they can get there, I just think
21 that they had a bad day, you know? I mean, you know,
22 one of the possibilities could be that they didn't --
23 they did not compact the specimens quickly enough to
24 get the density that they needed, so this is some --
25 one of the things that we'll be looking at when we get

1 moving ahead again with this program.
2 Q. When the program does move, how long do you
3 anticipate it will take to complete?
4 A. It's going to take a while yet because it
5 involves another round of durability testing that's
6 12 cycles of 48 hours per cycle, minimum, so that's --
7 that's at least a month's worth of testing there, not
8 counting weekends. Could be six weeks to get that
9 done.
10 The compression test specimens have to be
11 compacted with the right recipes and then cured. I
12 don't recall right now what the cure times are, but
13 they're at least 7 days. They may be 28 days.
14 Q. So this is Phase 2 of the testing; is that
15 correct?
16 A. That will be Phase 3, the durability is
17 Phase 3, the compression tests --
18 Q. The moisture density is Phase 2, right?
19 A. Right.
20 Q. And --
21 A. That we're comfortable with. That's been
22 done.
23 Q. And have you received results from the
24 moisture density --
25 A. Yes.

1 Q. -- and indexing?
2 A. And -- yes, the Phase 1 property index
3 testing I have results for.
4 MS. CHANCELLOR: And could we obtain copies
5 of those results?
6 MR. TRAVIESO-DIAZ: Well, the testing
7 program, as such, is not complete until you get results
8 that reflect the various tests that are being run. I
9 don't believe that either the Phase 1 or any of the
10 other phases have now been reviewed and approved by QA
11 or it has been formally submitted to Stone & Webster.
12 It is a just ongoing, in-process work.
13 MS. CHANCELLOR: Could you check --
14 Mr. Trudeau testified that he is satisfied with the
15 indexing, Phase 1 and Phase 2 of moisture density parts
16 of the test program. I would like to request copies of
17 whatever Mr. Trudeau is relying upon to make that
18 statement, to support that statement.
19 MR. TRAVIESO-DIAZ: Well, if you are asking
20 for the materials that Mr. Trudeau has reviewed as
21 such, those materials can be provided. If you're
22 asking on the representation that these are formal test
23 results that have been reviewed by everybody else
24 including but not limited to Mr. Trudeau that has to
25 approve the results of the program, that I cannot

1 supply because I don't believe it exists. I think I
2 explained that.
3 MS. CHANCELLOR: I would like the former,
4 anything that Mr. Trudeau is relying upon to say that
5 he is satisfied with Phase 1 and Phase 2 of the cement
6 test program.
7 MR. TRAVIESO-DIAZ: Okay. So we are clear,
8 you're asking for the material that Mr. Trudeau has
9 reviewed that has led him to believe that he's
10 satisfied with the results of Phase 1 and Phase 2. Is
11 that what you're asking for?
12 MS. CHANCELLOR: That's what I'm asking
13 for.
14 MR. TRAVIESO-DIAZ: All right.
15 MS. CHANCELLOR: If and when it has been
16 QA'd and it has gone through all the formal review, if
17 it is at that stage, I'd like a copy of that too.
18 THE WITNESS: I expected to assemble all of
19 these phases' results into a complete report that would
20 be issued to the NRC and the world, but --
21 Q. (By Ms. Chancellor) That would be
22 post-license, correct?
23 A. I don't know.
24 Q. At the rate it's going, do you anticipate
25 that it will be by April 1 when prefiled testimony is

In the Matter of Private Fuel Storage
Paul J. Trudeau * March 6, 2002

PAGE 77

77

1 due?
2 Okay. So --
3 A. She's got a mean sense of humor, doesn't
4 she?
5 Q. So Phase 1 and 2 you're satisfied with.
6 Phase 3, because of the -- of failure to
7 compress the samples or whatever, part of Phase 3 or
8 all of Phase 3 has to be redone?
9 A. Correct.
10 Q. And can you give me a ballpark estimate of
11 how long that will take?
12 A. It will take at least four weeks from the
13 day we start to maybe as much as six weeks because of
14 the 12 cycles at 48 hours per cycle for the test, plus
15 probably a week to create the specimens. So we're
16 talking between four and seven weeks, it seems to me,
17 for the durability tests to be repeated.
18 Q. Okay. And then Phase 4, from when you
19 start that or when you start writing the specs for
20 that, how long do you anticipate that that will take?
21 A. I would guess about a month, depending on
22 the cure requirements, again. There may be a 28-day
23 cure requirement which would delay it another month.
24 But the actual testing itself is not that -- doesn't
25 take that much time. It's -- the samples can be set up

PAGE 78

78

1 rather quickly, but they've got to be cured for a
2 period of time. And then once they've cured, it
3 doesn't take long for the tests to be performed and the
4 data to be presented.
5 Q. Does the one-month time period take into
6 account --
7 A. The curing?
8 Q. -- any curing that may be required?
9 A. No.
10 Q. Okay. So go to whoa, from the beginning of
11 Phase 1, including the curing, about how long is that
12 going to take?
13 A. The compression testing phase will probably
14 take two months, one month for the setup and curing and
15 another month to get the testing done and the results
16 produced.
17 MR. O'NEILL: Can I ask a question just
18 quick?
19 With respect to the four to seven weeks,
20 you had mentioned that was concerning which phase?
21 THE WITNESS: During the durability testing
22 phase, Phase 3 I'm calling that.
23 MR. O'NEILL: Phase 3, durability? Okay.
24 Q. (By Ms. Chancellor) Is there any other
25 type of strength test planned besides compression?

PAGE 79

79

1 A. Yes.
2 Q. And what is that?
3 A. Some direct shears testing.
4 Q. I've heard that terminology before. And
5 when will that be done?
6 A. After we get the recipe ready.
7 Q. So that will be at the end of the soil
8 cement testing program?
9 A. It will follow Phase 3, definitely. It may
10 be able to be done in parallel with the compression
11 testing.
12 Q. Okay. So for the compression testing, we
13 have two months.
14 And what about the modulus testing, isn't
15 that part of Phase 4?
16 A. It's the -- for the cement-treated soil
17 testing, right.
18 What's the question?
19 Q. How long is that going to take?
20 A. How long? That will also require curing,
21 which I think will be a 28-day period. It may be
22 another month -- you know, it's a couple months to
23 three months kind of time frame, would be my guess.
24 Q. And --
25 A. But that can be done in parallel too.

PAGE 80

80

1 Q. That was my question. So you can do the
2 compression and the modulus testing at the same time?
3 A. In parallel.
4 Q. Okay. So all told, including the modulus
5 testing, we're looking at about three months for
6 Phase 4?
7 A. Sounds about right, yes.
8 Q. And about almost two months for Phase 3,
9 four to seven weeks?
10 A. Yes.
11 Q. And is there a Phase 5?
12 A. I don't remember right now.
13 Q. What happens at the end of Phase 4? Are
14 you done?
15 A. At the end of Phase 4, we'll know that
16 we've got a soil cement recipe that meets the 250 psi
17 requirement for strength and the durability
18 requirements. So for the Canister Transfer Building
19 soil cement, yes, we'll be done. For the
20 cement-treated soil, we need the modulus limitation
21 met, and we need the bottom end of the 40 psi strength
22 met. So --
23 Q. It will be done after Phase 4?
24 A. Perhaps. The direct shear testing will be
25 to test the interface strengths between these various

1 materials.
2 Q. Is that where you talk about the test
3 similar to DeGroot?
4 A. Correct, the bonding study. And --
5 Q. And is that part of this ESSOW?
6 A. Not part of this ESSOW yet, but it's part
7 of the work that needs to be done.
8 Q. Phase 5?
9 A. I guess.
10 Q. And how will that study be conducted?
11 A. We will get samples of the dirt from the
12 site and mix it to the recipe that we've identified and
13 bond concrete to the top of that soil cement -- I mean,
14 cement-treated soil mixture and cure it and then test
15 it for strength to confirm that we've got the strength
16 we needed and do the same thing for that cement-treated
17 soil mixture cured on top of undisturbed samples of
18 this clay that we'll have to obtain from the site.
19 We're planning to get some block samples to do that.
20 Q. Do you consider this proving your design
21 through all these testing?
22 A. It will -- it will prove the design.
23 (A discussion was held off the record.)
24 Q. (By Ms. Chancellor) Getting back to the
25 ESSOW, the Scope of Work, paragraph -- second paragraph

1 where it talks about samples will be obtained by
2 others, are they the bucket samples --
3 A. Correct.
4 Q. -- that you referred to?
5 A. That is correct.
6 Q. Gradations will be performed. By whom?
7 A. AGECE.
8 Q. Okay. Same with Atterberg limits shall be
9 performed?
10 A. Correct. That's the Phase 1 testing.
11 Q. Moisture density freeze/thaw, wet/dry
12 compressive strength, that's AGECE, correct?
13 A. This whole ESSOW is AGECE.
14 Q. But it's not -- maybe I'm worrying this to
15 death, but it doesn't say who's doing it.
16 A. This is the scope of work for this ESSOW
17 so --
18 Q. It doesn't say AGECE shall conduct Atterberg
19 limits.
20 A. It says AGECE, on the cover, is doing this
21 work.
22 Q. Tensile strength -- tensile strength -- I
23 can't say that word -- is that going to be performed by
24 AGECE?
25 A. That was intended at the time, yes.

1 Q. And it's no longer intended?
2 A. Well, I don't know. That's part of what
3 we've got Wissa on board to help with. You know, at
4 the time I thought that -- based on the previous
5 depositions, that it would be worthwhile to get some
6 tensile measurements, but as I've indicated today, I
7 don't believe that it's important to the -- to the --
8 our design that we have tensile measurements of this
9 material. We're not relying on the tensile strength of
10 this stuff.
11 Q. So tensile strength is on hold, you don't
12 know whether you'll do that or not under this?
13 A. Correct.
14 Q. Permeability tests?
15 A. Same.
16 Q. On hold?
17 A. Yes. The whole program's on hold, but,
18 yes --
19 Q. I mean -- I mean --
20 A. -- yes.
21 Q. -- in terms of whether it will be included
22 in the program.
23 A. Correct.
24 Q. And the compressive strength relates to
25 both soil cement and cement-treated soil, correct?

1 A. Correct.
2 Q. If you do tensile strength and permeability
3 tests, if you do decide to do those, will that be for
4 both the cement-treated soil and the soil cement or
5 would it be for one or the other of them?
6 A. Yes. I would think that we might be doing
7 them only for the soil cement if we -- if we do them.
8 Q. In the third paragraph it states, The
9 engineers shall specify the testing process, including
10 the percentages of cement to be tested. What does this
11 mean, specify the testing process?
12 A. Well, it means which samples of the test
13 pit buckets we want to have tested, how much cement we
14 want put into these, what types of tests we want
15 performed on each of these different buckets.
16 Q. And you testified that Dr. Wissa is
17 involved in this testing program --
18 A. He is --
19 Q. -- or assisting in the testing program?
20 A. Correct. He's been retained as a soil
21 cement expert.
22 Q. And is he being retained by -- to assist
23 Stone & Webster?
24 A. Correct.
25 Q. And --

In the Matter of Private Fuel Storage
Paul J. Trudeau * March 6, 2002

PAGE 85

85

1 A. He, by the way, is the same Anwar Wissa
2 that's on the committee that issued the
3 state-of-the-art report that we talked about earlier,
4 the ACI 230.1R-90.

5 Q. And how have you used Dr. Wissa to date?

6 A. We've had discussions of the Utah QQ --
7 MR. TRAVIESO-DIAZ: Excuse me. You are
8 instructed not to refer to any conversations with or
9 for counsel. So to the extent you describe what
10 Dr. Wissa has done, his work on behalf of performance
11 of the test program, as opposed to any
12 litigation-related activities.

13 MS. CHANCELLOR: Unless you're relying on
14 litigation-related activities as part of his soil
15 cement testing program.

16 THE WITNESS: You know, I think I might
17 have misspoken. Isn't Wissa retained through Shaw
18 Pittman?

19 MR. TRAVIESO-DIAZ: I do not recall how,
20 but, again, bearing clearly the distinction in mind
21 that to the extent Dr. Wissa has provided support on
22 behalf of litigation or for litigation-related
23 activities, you are instructed not to refer to those.
24 To the extent Dr. Wissa has provided help with the
25 definition of performance of future work in the program

PAGE 86

86

1 itself, you can speak to that.

2 MS. CHANCELLOR: And also whether he has
3 critiqued the work that has been done to date.

4 Q. What technical assistance has Dr. Wissa
5 provided to you?

6 A. I'm a little confused as to what I can
7 say --

8 Q. Why don't you start, and if you get into an
9 area that you -- that Mat is uncomfortable with, I'm
10 sure he will object.

11 A. Okay. He's reviewed what we propose to do.
12 It's my understanding that he has no problems with what
13 we've proposed to do, that clearly this is going to
14 work. This is not some esoteric application of soil
15 cement, that it will, indeed, provide and we will,
16 indeed, be able to demonstrate the bonding that we're
17 saying we'll be able to get between the concrete pad
18 and the soil cement and that we'll be able to get the
19 interface strength within the layers of soil cement or
20 cement-treated site to be greater than the strength of
21 the in situ clays and that we will be able to
22 demonstrate the strength of the bond between the
23 cement-treated soil and the underlying clayey soils.

24 Q. This is the DeGroot-type --

25 A. Correct.

PAGE 87

87

1 Q. -- issues?

2 A. The bonding study stuff.

3 Q. What about the -- has Dr. Wissa commented
4 or had any involvement in the AGECE testing aspects of
5 the soil cement?

6 A. I've shown him the results that we've
7 received to date, and he agrees that these durability
8 tests likely failed because the densities weren't
9 correct. And he suggested that perhaps the densities
10 weren't correct because there was a delay time between
11 mixing the specimens and getting them compacted during
12 the operation at AGECE. So that's one of the things
13 that we need to confirm doesn't happen in the -- in the
14 rerun of the -- retest of those durability tests.

15 Q. And have you used or will you use Dr. Wissa
16 to refine the various phases of the soil testing
17 program under AGECE? You have four phases --

18 A. That's what I expect to happen, yes.

19 Q. Has he refined any of those phases to date?

20 A. No.

21 Q. Is there any -- other than this ESSOW, is
22 there anything -- any one document that comprehensively
23 describes the various phases and total extent of the
24 soil testing program?

25 A. Not clearly identified as phases that we've

PAGE 88

88

1 been talking about here, but the SAR describes all of
2 the testing that we're planning to do.

3 Q. Okay. So in terms of a comprehensive
4 description of the soil cement program, we would look
5 to Section 2.6.4.11 of the SAR?

6 A. Correct.

7 MR. TRAVIESO-DIAZ: In the last question
8 you went beyond what is in the ESSOW.

9 MS. CHANCELLOR: I beg your pardon?

10 MR. TRAVIESO-DIAZ: In your last question
11 you went beyond what is in the ESSOW.

12 MS. CHANCELLOR: I'm sorry. I didn't
13 understand --

14 THE WITNESS: Beyond.

15 MR. TRAVIESO-DIAZ: Beyond what is in the
16 ESSOW. Your question, if I recall, was is there a
17 comprehensive document that describes what will be
18 done, right?

19 MS. CHANCELLOR: My question was is there a
20 comprehensive document that describes PFS's soil cement
21 program. I don't think I limited it to testing, just
22 the soil cement program.

23 MR. TRAVIESO-DIAZ: Oh, okay.

24 Do you understand the question now?

25 THE WITNESS: The best description of the

1 soil cement testing and construction program is in the
2 SAR.
3 Q. (By Ms. Chancellor) And to --
4 A. Chapter 2.6. There may -- I think there's
5 another section as well that discusses soil cement
6 but --
7 Q. Certainly.
8 (A discussion was held off the record.)
9 THE WITNESS: Certain aspects of the soil
10 cement are also discussed in Section 2.6.1.12,
11 Stability of Foundations for Structures.
12 Q. (By Ms. Chancellor) Could you give me that
13 cite again?
14 A. 2.6.1.12. But the best description is this
15 2.6.4.11.
16 Q. In response to Interrogatory No. 3, you
17 state that you've retained Dr. Wissa as a consultant to
18 assist in the soil cement program. Is there an
19 engineering services scope of work for Dr. Wissa?
20 A. Not at this point, but we expect that his
21 firm will be doing some of the -- like the interface
22 strength tests for us, so there will be an ESSOW to lay
23 out that program. And we're -- at this point we're
24 expecting that his company is going to be doing that
25 testing.

1 Q. But is it correct that the testing that
2 Dr. Wissa will do would follow Phase 4 of the AGECS
3 soil cement test program?
4 A. That's -- that's correct. He may do the
5 Phase 3 work on the cement-treated soil. I don't know
6 yet. That was the modulus testing, you know, the --
7 Q. We called that Phase 4, but it's really
8 Phase 3.
9 A. For the cement-treated soil. It's the next
10 phase for the cement-treated soil.
11 Q. Cement-treated soil?
12 A. If you're more comfortable with Phase 4 --
13 Q. No, that's fine. I just didn't want the
14 record to be unclear.
15 So that's the modulus and the --
16 A. Compression --
17 Q. Compression --
18 A. -- testing of the cement-treated soil,
19 because that's the same material that we're going to be
20 running these interface strength tests on that we're
21 anticipating he will be doing for us.
22 Q. Will Dr. Wissa also be doing direct shear
23 tests?
24 A. It remains to be determined what the
25 interface strength test is going to look like, but I

1 think it wants to be a direct shear test because we
2 want to force failure along that plane. So I think,
3 yes, they will be direct shear tests.
4 Q. So is it correct to say that the direct
5 shear test and this DeGroot-type testing, we're only
6 talking about the cement-treated soil under the pads?
7 A. Correct.
8 Q. Once you go through all this testing, the
9 way in which the construction is done of the soil
10 cement, will that have an effect on whether the soil
11 cement will perform as intended or the
12 cement-treated --
13 A. Well, construction techniques can have
14 effects that would be detrimental to the performance of
15 soil cement, but those need to be controlled during
16 construction so that we produce the interface strengths
17 that we're looking for, that we're relying on.
18 Q. And do you anticipate that you'll use
19 Dr. Wissa to develop any construction procedures or
20 QA/QC measures?
21 A. I expect he will participate in the
22 development of those.
23 Q. And when do you anticipate that those
24 procedures will be written up?
25 A. Following this laboratory testing work.

1 It's further down the road.
2 Q. And are any of these -- any of the general
3 outlines of the construction procedures and QA/QC
4 measures for the placement and construction of the soil
5 cement, are any of these found in the SAR? Is there
6 any discussion at all of construction procedures or
7 QA/QC measures for construction?
8 A. I suspect there is in 2.6.4.11, but I don't
9 know. I will check.
10 Construction techniques are described
11 somewhere in here. Whether the QA aspects of it are
12 clearly delineated, I'm not sure.
13 It says on page 12.6-118, for instance,
14 Procedures required for placement and treatment of the
15 soil cement lift surfaces and foundation contact will
16 be established in accordance with the recommendations
17 of ACI 1998 during the mix design and testing process.
18 Specific construction techniques and field quality
19 control requirements will be identified in the
20 construction specifications developed by PFS during
21 this detailed design phase of the project.
22 Q. And on page 2.6-113 of the SAR, the last
23 paragraph, it mentions that soil cement has been used
24 extensively. Is this true soil cement or are we
25 talking about cement-treated soil, do you know, in

In the Matter of Private Fuel Storage
Paul J. Trudeau * March 6, 2002

PAGE 93

93

1 this --

2 **A. It's true for both, but this, I think, is**
3 **referring to soil -- true soil cement.**

4 **Q.** And the examples given here, the South
5 Texas Nuclear Power Plant near Houston and the nuclear
6 power plant in Koeberg, South Africa, was soil -- if
7 you know, was soil cement there used because of
8 liquefaction?

9 **A. In South Africa, that's correct.**

10 **Q.** In Texas was it used to provide
11 additional -- you objected to the way in which I
12 rephrased it -- to provide sliding resistance?

13 **A. I do not believe it was used to provide**
14 **sliding resistance at the Texas plant.**

15 **It says in the SAR here that at the south**
16 **Texas plant it was used as slope protection for a**
17 **7,000-acre cooling water reservoir.**

18 **Q.** So are these examples of soil cement
19 providing -- do you know of any examples of soil cement
20 used to provide sliding resistance?

21 **A. No.**

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

24 (Lunch recess was taken.)

25 **Q.** (By Ms. Chancellor) Okay. I'd like to now

PAGE 94

94

1 turn to the native soils underlying the soil-treated
2 cement under the pads. Now, you've testified earlier
3 today that the top layer of soil in the pad emplacement
4 area are eolian soils, correct?

5 **A. Correct.**

6 **Q.** And that PFS is going to remove those
7 eolian soils and mix these soils with portland cement?

8 **A. Yes.**

9 **Q.** And then the cement-treated soil will then
10 be directly beneath the pads?

11 **A. Correct.**

12 **Q.** Do you agree that the soils directly below
13 the cement-treated soil are partially saturated silty
14 clay/clayey silt?

15 **A. Yes.**

16 **Q.** For purposes of this discussion, can we
17 call the silty clay/clayey silt upper Lake Bonneville
18 deposits?

19 **A. Certainly. That's so much easier.**

20 **Q.** Especially for the court reporter.

21 What role, if any, does adhesion and
22 cohesion of upper Bonneville clay play in providing the
23 slide stability of the pads and the CTB foundations,
24 according to the calculations you've performed?

25 **A. It provides the resistance we need to keep**

PAGE 95

95

1 **the pads in place.**

2 **Q.** Is adhesion and cohesion important, then?

3 **A. Yes.**

4 **Q.** Do you believe that the upper Lake
5 Bonneville deposits are partially saturated?

6 **A. Yes.**

7 **Q.** Do you have an opinion on whether there
8 will be any change in the moisture content of the upper
9 Bonneville deposits when the cement-treated soil is
10 placed on top of them?

11 **A. Yes.**

12 **Q.** And what is that opinion?

13 **A. I understand that there's a concern that**
14 **the soil cement to be placed at the site may serve as**
15 **an impermeable barrier that will permit moisture**
16 **changes in these soils, but I have a hard time**
17 **believing that that's going to be a big problem for**
18 **these soils because of the great depth to the**
19 **groundwater table at the site -- it's down 125 feet --**
20 **and because of the semiarid conditions out in Skull**
21 **Valley. I think we're talking like less than 8 inches**
22 **of rainfall per year, most of which will not be able to**
23 **permeate through the soil cement cap. So I just have a**
24 **hard time understanding the proposition that we're**
25 **going to have a moisture change problem in those soils.**

PAGE 96

96

1 **Q.** Now, do you agree that Skull Valley is in
2 the basin and range?

3 **A. Yes.**

4 **Q.** And have you worked in -- have you done any
5 geotechnical work in the basin and range area?

6 **A. Not prior to this project.**

7 **Q.** Do you have an opinion, and, if so, what is
8 it, on whether the construction processes will impact
9 the Bonneville deposits?

10 **A. I understand and expect that the**
11 **construction techniques to be used have the opportunity**
12 **to destroy the surface of the subgrade if we're not**
13 **careful in protecting those. There are -- there are a**
14 **variety of construction equipment available that can,**
15 **indeed, destroy the cohesion that's inherent in these**
16 **soils. But clearly, where the cohesion available in**
17 **these soils is required as a design -- part of the**
18 **design of these pads, we need to protect those soils**
19 **during construction, and we need to demonstrate at the**
20 **start of construction that the techniques that we're**
21 **using will not have an adverse impact on the strength**
22 **of these soils.**

23 **Q.** So is it the equipment or the techniques or
24 both that can destroy the cohesion?

25 **A. It's both.**

1 Q. And I think you testified earlier that any
2 sort of construction procedures and QA/QC methods will
3 not be developed until --

4 A. Later in the design process. But -- but
5 it's not -- I mean we're talking about the pads at this
6 point where we need the cohesive strength of this clay
7 as -- for the soil cement on top of the --
8 cement-treated soil, actually to be bonded to this
9 layer, so it's that subgrade -- the top of that
10 subgrade at the end of the excavation directly under
11 the pads that's the concern.

12 These pads are not that big. They're 30
13 feet wide. There is construction equipment that can
14 sit on either side of these pads and reach out to make
15 a cut to the final subgrade surface. And all other
16 construction equipment can be -- all construction
17 equipment, period, can be kept off of the exposed
18 subgrade. So I'm convinced that we can get that
19 subgrade protected sufficiently so that we're not
20 destroying the strength of that material when we're
21 building this.

22 The exposed subgrade doesn't want to stay
23 exposed either, so the construction procedures will
24 require that that final excavation doesn't take place
25 until they're ready to put that first lift of

1 cement-treated soil down to protect it. And that lift
2 of cement-treated soil can be pushed out onto the
3 surface of the subgrade with low ground pressure
4 equipment that won't have an impact, an adverse impact
5 on the underlying clay. And in that manner we can
6 ensure that we don't destroy the cohesion that we need
7 and that we can develop the bond that we need.

8 Q. But if the eolian silts -- if the clay
9 layer doesn't come to the grade level that you
10 anticipate, you'll need to put construction equipment
11 in the pad emplacement area to compact the silts that
12 are there, correct?

13 A. For the -- for the few minor areas on the
14 site where we might require more than 2 feet of
15 cement-treated soil under the pad, in that area we
16 would have to put in a compacted clay material, a low
17 plasticity clay material, which we will have to
18 demonstrate by laboratory testing that that compacted
19 clay will have the cohesion that we need underneath the
20 cement-treated soil.

21 And that will have to be done by equipment
22 placed in the hole where the pad will be constructed,
23 yes, but that -- that process will not result -- I mean
24 the clays that we're talking about using will be the
25 same materials that we're trying to protect in the

1 other areas. Those -- those are stiff clays now that
2 we're expecting we will be able to use -- we'll be able
3 to test some of those in the lab to show that we can
4 compact those and get the strengths that we need so
5 that the compacted clay surface will provide the
6 cohesion that we need under the cement-treated soil.
7 So if they -- if the equipment that we're using to put
8 this new clay fill in damages the surrounding area, the
9 surrounding area will end up being compacted along with
10 this other clay area.

11 Q. How --

12 A. It can be -- you know, the compacted clay
13 is going to have sufficient strength to resist the
14 sliding forces that --

15 Q. How will you know whether the surrounding
16 clays to those that are being compacted will be
17 affected by the equipment?

18 A. Well, it will be obvious that they've been
19 destroyed by the -- just by looking at the stuff. I
20 mean it's -- the material is a very stiff clay right
21 now, and if you work it enough, you can remold it to a
22 point where you can't -- let me rephrase that. If it
23 gets remolded or worked up by the equipment, it would
24 be obvious that it's in a condition that's not
25 suitable.

1 Q. Okay.

2 A. Okay?

3 Q. Do you agree that a change in water content
4 of the Bonneville clays will affect the settlement
5 strength and adhesion between the soil and the
6 cement-treated soil?

7 A. I do not believe the water content change
8 would affect the settlements of these materials. We
9 have performed consolidation tests dry on these
10 specimens -- not really dry but, in the in situ
11 moisture content, and we've performed tests on
12 comparable samples of this soil with complete
13 inundation and not noted any marked change in the
14 settlement for those inundated samples with respect to
15 the non-inundated samples. So I don't believe it will
16 affect the settlements at all. It's possible that a
17 moisture change could affect the strength of the soils.

18 Was there more to that question that I
19 don't recall?

20 Q. Adhesion.

21 A. Adhesion? As the strength might be
22 affected, the adhesion might be affected.

23 Q. And will the strength be less?

24 A. Less, yes.

25 Q. And the adhesion will be less?

In the Matter of Private Fuel Storage
Paul J. Trudeau * March 6, 2002

PAGE 109

109

1 that you're going to excavate from the top of the pad
2 emplacement areas?

3 A. The eolian silts, yes. The material that
4 had the higher sulfate is not that material, it's the
5 upper Bonneville --

6 Q. Oh, the upper Bonneville.

7 A. -- clay material that we won't be using --

8 Q. I thought you said both.

9 A. -- that we won't be using --

10 Q. Okay.

11 A. -- in making soil cement or cement-treated
12 soil.

13 Q. Okay.

14 A. That's the material that we would likely
15 use as the compacted clay soil in those few areas where
16 we might be low.

17 (A discussion was held off the record.)

18 Q. (By Ms. Chancellor) Have you performed or
19 are you going to perform any testing regarding the
20 potential interaction of the cement-treated soils with
21 the native soils?

22 A. Yes.

23 Q. And when and to what extent?

24 A. That will be part of the interface strength
25 testing program that Wissa will be doing for us, as I

PAGE 110

110

1 said earlier. We're expecting to go to the site, get
2 some block samples of the -- these upper Bonneville
3 clay soil subgrade to take to Wissa's lab, and he would
4 make the cement-treated soil mix and place it,
5 compacted, on top of this block sample and cure it and
6 then run the direct shear test, I think, to measure the
7 interface strength available.

8 That testing is -- I described in the SAR.
9 It's not in the ESSOW yet, as we said earlier, but it
10 is in the SAR.

11 Q. When do you anticipate you'll develop an
12 ESSOW for Wissa?

13 A. I don't know for sure but within the next
14 month or two would be my guess. I don't know because I
15 don't know how much of my time is going to be dedicated
16 to getting ready for the hearings and my other
17 commitments. But I've got to get together with Wissa
18 at a time convenient for him and me and -- when the
19 project's ready to move ahead with that activity.
20 These other items are obviously higher priority.

21 (A discussion was held off the record.)

22 Q. (By Ms. Chancellor) Moving on to a
23 different area, just so you're not wondering if it has
24 anything to do with native soils, what's your
25 understanding for the regulatory basis for the factor

PAGE 111

111

1 of safety against sliding and overturning, first, for
2 the pads and then for the CTB?

3 MR. TRAVIESO-DIAZ: What do you mean by the
4 regulatory basis? I believe the question is vague.

5 Q. (By Ms. Chancellor) In the SAR, for
6 example, on 2.6.120, you state that, The minimum factor
7 of safety against a bearing capacity failure from
8 static loads is 3.0, from static loads plus loads due
9 to extreme environmental conditions such as design
10 basis ground motion is 1.1.

11 What is your understanding of the
12 regulatory requirement relating to the minimum factor
13 of safety against sliding in extreme environmental
14 conditions as being 1.1? Where does that come from?

15 A. I believe that comes from NUREG-0800, which
16 is applicable for nuclear power plants. As I discussed
17 earlier, nuclear power plants, they're concerned that
18 the structures don't slide typically because there are
19 Category 1 piping systems that need to be protected
20 between the structure and the yard area. So they're
21 anxious for the nuclear power plant structures to make
22 sure that the structures don't slide. And for the
23 earthquake loads they accept a number like 1.1 as
24 evidence that the building won't slide during the
25 event.

PAGE 112

112

1 Now, those -- NUREG-0800 does not apply to
2 these ISFSIs. NUREG-1567, I believe, does.

3 Q. And when you mentioned NUREG-0800 having
4 the 1.1 factor of safety, were you referring to the CTB
5 or to the -- realizing that --

6 A. Well, that's for structures -- that's for
7 structures at a nuclear power plant.

8 Q. Do you consider the pads to be a structure?

9 A. It is a reinforced concrete pad --

10 Q. For purposes of meeting a 1.1 factor of
11 safety against sliding, do you consider it to be a
12 structure?

13 MR. TRAVIESO-DIAZ: Objection. He has not
14 testified that the 1.1 factor for sliding applies to
15 the pads.

16 MS. CHANCELLOR: He says that he looked to
17 NUREG-0800, realizing that it was the nuclear power
18 plants, but that's where the 1.1 factor of safety comes
19 from. And I'm asking him was he referring to the CTB
20 only or the CTB and the pads, and I'm trying to figure
21 out how he categorizes the pads.

22 THE WITNESS: We -- we use the 1.1 as the
23 target factor of safety for sliding for this factor, realizing
24 that the 1.1 applies to structures at a
25 nuclear power plant, understanding that that comes

In The Matter Of:

PRIVATE FUEL STORAGE, L.L.C.

ANWAR E.Z. WISSA

March 15, 2002

BETA REPORTING & VIDEOGRAPHY SERVICES

910 SEVENTEENTH STREET, NW

SUITE 200

WASHINGTON, DC USA 20006

(202) 638-2400 FAX: (202) 833-3030

*Original File AAWISSA.TXT, 84 Pages
Min-U-Script® File ID: 3055856230*

Word Index included with this Min-U-Script®

State's
Exhibit 109

clarify your question?

[15] **BY MS. CURRAN:**

[1] **Q:** Do you agree with the statement
[2] that that's made —

[8] **MR. TRAVIESO-DIAZ:** Do you mean
[19] the entirety of the statement?

[20] **MS. CURRAN:** Yes.

[21] **BY MS. CURRAN:**

[22] **Q:** You can break it down, if you

Page 10

[1] want.

[2] **A:** Let me read it, please.

[3] **Q:** Sure.

[4] **A:** No, I don't necessarily agree with
[5] this.

[6] **Q:** Could you go through and explain?
[7] Maybe you want to break it up be [8]
sub parts.

[9] The applicant has not considered [10]
the impact to native soil caused by [11]
construction and placement of the [12]
cement-treated soil?

[13] **A:** Well, I think there's been some [14]
discussion addressed about how they're
going [15] to possibly construct it, and not
disturbing [16] the soils, and things like
that. So they [17] have be considering that
aspect of it.

[1] **Q:** If we inserted the word [19] "ad-
equately" after "not," would you still [20]
agree with that first part of the statement
[21] that I just read?

[22] **A:** No. I wouldn't agree with that.

Page 11

[1] **Q:** Why not?

[2] **A:** I think for the stage of [3] deve-
lopment of this project, I think it's [4]
been adequately addressed.

[5] **Q:** But for purposes of actually [6]
building the facility, it's not adequate?

[7] **A:** For actual construction, that's [8]
correct.

[9] **Q:** If you look at the second phrase, [10]
which says that the applicant has not [11]
analyzed the impact to settlement, is
your [12] opinion similar, that some in-
formation has [13] been gathered, but not
enough to approve the [14] construction
of the facility?

[15] **A:** Repeat that.

[16] **Q:** If we look at the second phrase [17]
here, whether the applicant has ana-
lyzed the [18] impact to settlement,
would you agree that [19] some in-
formation has been collected?

[20] **A:** Yes.

[21] **Q:** Do you consider that the amount
of [22] information that has been col-
lected is

Page 12

[1] adequate for purposes of going ahead
with [2] construction?

[3] **A:** No. It's not adequate.

[4] **Q:** And I have the same question with
[5] respect to the last part of that sent-
ence, [6] which refers to adhesion prop-
erties.

[7] **A:** Yes. It's the same answers.

[8] **Q:** Is there any aspect of the issue [9] of
the design of soil cement or [10] cement-
treated soil for which you feel or [11] you
believe that the applicant has obtained
[12] sufficient information in order to
proceed [13] with construction?

[14] **A:** No. I don't think it's enough to [15]
proceed with construction, no.

[16] **Q:** Dr. Wissa, is there a standard [17]
formula for soil cement?

[18] **A:** A standard formula?

[19] **Q:** Yes.

[20] **A:** Can you explain what you mean
by [21] formula?

[22] **Q:** Well, you know exact proportions

Page 13

[1] of every ingredient that goes into it
and [2] what they are?

[3] **A:** Well, we know what ingredients go
[4] into it. But the proportions, we do not
[5] know.

[6] **Q:** And there's a difference between
[7] soil cement and cement-treated soil; is
that [8] correct?

[9] **A:** It's a degree of stabilization and [10]
durability. Its the same concept. But it's
[11] just a degree of stabilization.

[12] **Q:** So that cement-treated soil does
[13] not have the same degree of stab-
ilization [14] and durability as —

[15] **A:** Well, that's the way you are [16]
trying to interpret it. I think the [17]
nomenclature is vague. But I think that's
[18] generally accepted today as not being
as [19] durable.

[20] **Q:** I want to ask you a little bit [21]
about your understanding about the way
that [22] soil cement and cement-treated
soil are to

Page 14

[1] be used at the PFS facility.

[2] **Am I correct in understanding that [3]
the cement-treated soil is going to be [4]
directly underneath the concrete pads
for [5] storage of the casts?**

[6] **A:** Yes.

[7] **Q:** Will the cement-treated soil [8]
extend beyond the perimeter of casts [9]
laterally at all?

[10] **A:** I'm not sure. I don't think so. [11] I
think that beyond that, they're going to
[12] use what you call cement stabilized
soil. [13] But I couldn't swear to that. I'm a
bit [14] vague about it. But I believe it's [15]

primarily under the — I don't know the
[16] answer exactly. I can't recall. It's there
[17] somewhere in the —

[18] **Q:** And do you know, taking the soil
[19] cement that's going to be around the
edge of [20] the pads, how far out will it
extend beyond [21] the edge of the pads?
Do you know?

[22] **A:** Well, the pads — now speaking of

Page 15

[1] the stabilized, or the soil treated?

[2] **Q:** The soil cement?

[3] **A:** The soil cement?

[4] **Q:** Yes.

[5] **A:** It connects one pad to the next [6]
one. So it is within the distance between
[7] the pads. And I don't recall the exact [8]
clearance between them. But it extends
from [9] one pad to the next pad.

[10] **Q:** And at the outer perimeter, how
[11] far does it go out?

[12] **A:** I don't recall. But I assume it [13]
goes out to some distance. I don't know.

[14] **Q:** And do you know how far it
extends [15] beyond the perimeter of the
canister [16] transfer building?

[17] **A:** I know it's quite some distance. [18]
It's not speaking tens of feet, but pro-
bably [19] a hundred or more.

[20] **Q:** What is your understanding of
how [21] construction will be carried out
with [22] respect to the soil cement and

Page 16

[1] cement-treated soil?

[2] **A:** How it will be carried out I think [3]
will have to be left to the contractor and
[4] the availability of his equipment and
his [5] experience. I think, to me, is how it
will [6] not be done. By that, is that certain
[7] things should be in the specifications
of [8] construction that you would not
allow him to [9] do.

[10] **Q:** And what are they?

[11] **A:** Well, for example, you will [12]
minimize disturbance of the subgrade of
the [13] excavation. You will minimize it
from [14] getting exposed to the ele-
ments. You will [15] not allow it to be
reworked. Things like [16] that, things
which — it's more of a [17] preventative
than telling him how he is to [18] do his
job.

[19] And he will come back, as I would [20]
see it, with his concept. And then one [21]
would agree with it or say it doesn't meet
[22] with the objects of — and I'm just
giving

Page 17

[1] you one example in the case of the
subgrade [2] of the excavation. And what
he's going to [3] do is going to cause
disturbance and damage [4] those sub-

grade.

[5] I'm calling it the subgrade. But [6] it's the bottom layer, say, the way you're [7] going to start placing your soil cement, for [8] example.

[9] **Q:** You're talking about the clay [10] silt, silty clay? That's the subgrade?

[11] **A:** That's correct.

[12] **Q:** Why would you want to minimize [13] disturbance to the subgrade?

[14] **A:** Because you don't want remodeling [15] and the possible loss of strength will [16] increase compressibility.

[17] **Q:** And what affect, if you were to [18] lose stress and compressibility, what would [19] that affect?

[20] **A:** Well, I don't know at this time. [21] Because we don't know how sensitive these [22] soils are to disturbance. Okay. This is

Page 18

[1] hypothetical. I think that once we know [2] this, we will be in a better position to [3] either be flexible or more rigid on what he [4] can or cannot do.

[5] **Q:** But in terms of why you would [6] worry about this, is it because if you were [7] to disturb the subgrade, that it might be [8] less resistant in an earthquake?

[9] **A:** I think to answer you, first of [10] all, I'm not as much concerned about [11] settlements as about loss in strength and, [12] therefore, its ability to have the shearer [13] resistance for this lateral movement which [14] we're relying on.

[15] **Q:** And you also mentioned exposure to [16] the elements.

[17] Why would that be a concern?

[18] **A:** Well, in a similar way. If you [19] got a lot of rain and the whole site was [20] open, you would have it flooded, maybe if it [21] was a heavy rainfall for a long time. Then [22] it's probably more a problem of efficiency.

Page 19

[1] Because then you'd have to let it dry out [2] substantially before you'd want to start [3] construction again. So there is a practical [4] problem of it, too, of exposing it to the [5] elements.

[6] **Q:** So during construction, what will [7] be done here is, equipment will be set up [8] for mixing soil and cement; is that correct?

[9] **A:** Yes.

[10] **Q:** And it will be mixed right on [11] site?

[12] **A:** Yes.

[13] **Q:** And will it be mixed in place or [14] done off to one side? Or can you give me a [15] picture of how that's going to happen?

[16] **A:** Well, I think here it's going to [17] be a function of a contractor, his ability, [18] his experience, and so on. There are two [19] approaches to it. One is mix in place. And [20] the other is plant-mixing it; in other [21] words, you hold material away. You put it [22] into a central plant, mix it, and hold it

Page 20

[1] back, and place it.

[2] **Q:** And you don't know which one will [3] be used?

[4] **A:** Not at this time, no.

[5] **Q:** Does it matter which one you use, [6] in terms of the impact on the subgrade?

[7] **A:** If you can achieve the quality [8] control, no, it wouldn't. Everyone has [9] their preferences.

[10] **Q:** Which one do you prefer, and why?

[11] **A:** I prefer the central plant mixing. [12] You have better quality control on the [13] amount of cement, the amount of water, the [14] mixing, than mixing in place.

[15] **Q:** So you —

[16] **A:** But you could — a good contractor [17] with the right equipment could achieve the [18] same by mixing in place.

[19] **Q:** Why do you say a good contractor? [20] It's harder to do, to mix in place?

[21] **A:** I would say it takes more [22] experience for a contractor to mix in place

Page 21

[1] than to haul it away and have a plant there [2] which does it. There's less human [3] influence.

[4] **Q:** I would think that, to just say it [5] another way, that there's more of an impact [6] on the site if you're mixing it in place, [7] because you have more heavy equipment that's [8] right? There is that fair to say?

[9] **A:** No. We are talking about an [10] interesting situation, unlike a highway [11] where you have miles of it. These pads are [12] fairly small. The quantity of soil cement [13] is not large per pad. And, therefore, you [14] could do one pad at a time. And you [15] wouldn't need a lot amount of equipment [16] moving around in place. So I don't think [17] that's a main issue.

[18] **Q:** Have you done this before? Have [19] you supervised this process of mixing soil [20] and cement and making soil cement?

[21] What do you do if the soil is too [22] wet?

Page 22

[1] **A:** You have several options. [2] Obviously, one option which is usually done [3] is you work it, pulverize it, and have it [4] dry out. Another thing, in some instances [5] you may want to add quick line or something [6] to dry out the soil. But then you change [7] its properties. But that is a method of [8] improving the soil, making it easier to [9] work. That's two which come to mind. I [10] think those are probably the most common [11] ones.

[12] **Q:** If you used the first method, you [13] dry it out first and then you pulverize it, [14] where do you do that?

[15] **A:** You are taking the — I'm sorry — [16] you're taking the soil and excavating it, [17] stockpiling it. And now, if it's wet, you [18] will work it, spread it, out, let it dry [19] out. That's not in the location where [20] you're going to be compacting it. It's not [21] in the location of the pad itself. Because [22] if you did that, you would disturb the whole

Page 23

[1] area. You would haul it away or spread it [2] somewhere, and then put it back in after it [3] reaches the right moisture content, and [4] mixed in with the cement.

[5] **Q:** So we're talking about a process [6] where you have a backhoe that's digging up [7] the eolian silt, I suppose. And then you [8] are maybe drying it in the pile somewhere on [9] the site, or maybe putting it right on a [10] truck and trucking it out. This is if we go [11] with option A of processing it off site.

[12] Then it gets taken to another [13] plant, and portland cement is added and its [14] put into a cement truck?

[15] **A:** No.

[16] **Q:** What happens then?

[17] **A:** Well —

[18] **Q:** I'm showing my ignorance.

[19] **A:** No. The cement truck, you [20] wouldn't be able to pour it. If you used a [21] cement truck, I think you would have too wet [22] a mix to be able to pour it back in. What

Page 24

[1] you do is — you're right, to some extent, [2] that you take it to the central plant. [3] You'd probably stockpile it there, have [4] moisture equilibrium, so you don't have a [5] bucket of wet, bucket of dry.

[6] Then you put it into the mixing — [7] let's say tank if you want. It could be a [8] continuous process, or it may be a batch [9] process. You would add the cement, and the [10] water, mix that up, and then put it in [11] trucks, and haul it back to

where you want [12] to place it.

[13] Q: You don't have to keep spinning it [14] around to keep it from hardening?

[5] A: You don't — well, you do work — [6] if you're going to delay, it depends on [7] the [17] time between mixing the water and final [18] compaction. If it's going to take along [19] time — by "long time," I'm saying a couple [20] of hours — and if it's hot water, you'd [21] probably want to work it during that period. [22] But preferably, you'd want to place it as

Page 25

[1] soon as possible and not have to rework it.

[2] Q: When you do the mixing in place, [3] what kind of equipment is used in that case?

[4] A: A pulver mixer.

[5] Q: A "powder" mixer?

[6] A: No. Pulver, P-U-L-V-E-R M-I-X-E-R [7] pulverization mixer. They call it a pulver [8] mixer, which is a high-speed Harrow rotating [9] blades which take the soil and break it up [10] first. You have to do this at the right [11] moisture content, so if it's too wet, it [12] gums up. The drier it is, the better you [13] are that way. But if it's too dry, it could [14] get too hard.

[15] But for the right moisture [16] content, [17] you break it up. And then you, at [17] the [18] same time, could be adding the cement, [19] and conceivably also could be adding [20] the [19] water in this pulver mixer. Or you can do [20] it in several passes. You first break it [21] up. Then you add the cement, mix that in. [22] And then you come again, add the water, mix

Page 26

[1] all that in, and then come back.

[2] Q: And you're using a Harrow, like an [3] agricultural machine?

[4] A: Well, it's a little more — it's [5] high-speed blades which break up the [6] material and mix it. So it's not a Harrow. [7] Harrow is the wrong word. Harrow is more [8] just rotating it. It's breaking it up by [9] high-speed rotation of cutters. Or they're [10] high-speed meaning, yeah, spinning.

[11] Q: And this machine, let's call it [12] the high-speed Harrow.

[13] A: Okay. Let's call it that.

[14] Q: We'll just call it that.

[15] A: I call it the pulver mixer.

[16] Q: The pulver mixer?

[17] A: Yeah.

[18] Q: Is it a heavy piece of equipment?

A: Not essentially, no.

[20] Q: How heavy is it?

[21] A: Depends on the size and so on. In [22] this case, these are a lot smaller areas.

Page 27

[1] It wouldn't be very heavy equipment.

[2] Q: Would you foresee it having any [3] kind of an impact on the subgrade by sitting [4] on top of it?

[5] A: Well, let me back off a bit. I [6] have a hard time seeing that you could take [7] two feet of material and in situ mix two [8] feet and recompact it in one layer and go [9] efficiently. I think you'd have to move it [10] beside where you're going to place it, mix [11] it up, and then put it in. So I don't see [12] us really being able to take two feet. I [13] don't know of any equipment which could cut [14] two feet, mix it up well, and put it back [15] in.

[16] Q: Because you would need to be able [17] to cut less, or more?

[18] A: Less.

[19] Q: It's much less?

[20] A: I think the depth of two feet is [21] excessive.

[22] Q: In other words, you don't think

Page 28

[1] that's a reason that it's not advisable to [2] do the in situ mixing?

[3] A: I didn't say that. I think the in [4] situ mixing — let me define in situ mixing [5] a little further. In this context, in situ [6] mixing means using the soils close or [7] located in place, and blending it with that [8] type of equipment, the pulver mixer, versus [9] hauling it away, taking it to a central [10] plant, and mixing it. That's what I call in [11] situ mixing.

[12] It doesn't necessarily have to be [13] literally in situ. And you just take it [14] like you would when we say in situ mixing of [15] these deep foundations, where you would mix [16] in place and you put a cement grout and mix [17] in there. I think even in the case of in [18] situ mixing, you move the soil around.

[19] In the highway, they would wind [20] row it, mix it up, and then spread it out [21] again. So it isn't literally just staying [22] there. You do move it around, even in

Page 29

[1] highways, when you have what you call in [2] situ mixing.

[3] Q: So just so I understand it, using [4] the pulver mixing, it wouldn't necessarily [5] be that you would mix everything right in [6] the exact same place where it was going to [7] be in the end; the mixing might be done off [8] to one side of the ultimate destination?

[9] A: That's correct.

[10] Q: Would you take out Exhibit 21, [11] which is the SAR chapter two?

[12] A: Yes.

[13] Q: And turn to page 2.6118.

[14] A: Yes.

[15] Q: Can you tell me, looking at the [16] second bullet there, what does it mean when [17] it says, The soil cement will be constructed [18] in lifts approximately six inches thick?

[19] A: When you compact soils, if you [20] have too thick a layer, you end up having [21] inadequate density in the bottom of the [22] layer. So you have to limit the thickness

Page 30

[1] of the layer to get adequate compaction. So [2] to achieve two feet, it would be very [3] difficult, if at all possible, to compact it [4] all in one layer. You would have to compact [5] it in several layers. Usually six- to [6] eight-inch is about the maximum you would [7] want to do the compacted layer.

[8] Q: So you do six-inch layers at a [9] time when you —

[10] A: Compacted, yes.

[11] Q: So when you put the material back [12] in the hole, you compact it with some kind [13] of machine?

[14] A: Correct.

[15] Q: What kind of machine is used for [16] that?

[17] A: Well, it depends. It could be a [18] rubber tire compact. It could be a steel [19] drum, smooth tar. Several sheets of — it [20] depends on what the soil is or the soil [21] cement is, and what equipment is available [22] and so on.

Page 31

[1] Q: It says here, in the same section [2] as described in section 6.2.2.5 of ACI 1998, [3] These techniques will include, but will not [4] be limited to, minimizing the time between [5] placement of successive layers of soil [6] cement.

[7] Can you explain what is the [8] minimal time between placement of successive [9] layers of soil cement?

[10] A: Well, I think this, you have to be [11] a little careful of what you mean by that. [12] You want to obviously prevent the surface [13] drying out. Okay. If it does, you have to [14] scarify it. And then what you're interested [15] in is achieving a good bond between each [16] layer. So surface drying out is one thing.

[17] Also, if it — if the first layer, [18] let's say — let's say you prevent it drying [19] out by humid curing it or putting a spray [20] on — well, you wouldn't put a asphaltic [21] seal coat, because you want good bonding. [22] You may want to use a plastic, a

Page 32

[1] geomembrane, to prevent evaporation losses. [2] But then you do get it curing.

[3] So let's say a week later you come [4]

back and want to put the next layer on, you [5] would have a discontinuity. And, therefore, [6] you would have to pretreat your soil to [7] improve the bond. But you don't want to [8] wait a week. So what we're saying here is [9] you try to do it within a reasonable amount [10] of time.

[11] But let's say the equipment breaks [12] down and you have delays. Then you'd have [13] to do something with that surface to make [14] sure you have good bonding again. What it's [15] saying here, basically, you don't want to [16] wait a week between layers, if you can help [17] it.

[18] **Q:** Turning to page 2.6-119. If you [19] look at the first full paragraph there, [20] entitled, Soil cement and in situ clay [21] interface, the first statement says, The [22] soil cement and in situ clay interface will

Page 33

[1] be constructed such that a good bond will be [2] established between the materials.

[3] Can you explain what is the [4] purpose of that bond?

[5] **A:** This is a important — well, it's [6] important throughout. The soil cement, it [7] would be under the pads. Because under the [8] building, you have five feet of concrete [9] that we — five feet of concrete, and no [10] soil cement under the building.

[11] What it is, is you're trying the [12] whole objective here of a soil — modified [13] soil or cement-treated soil, is to transfer [14] the shear stresses due to an earthquake down [15] to the clay below. So you want a good bond [16] between the soil cement and clay interface.

[17] **Q:** And how is that done?

[18] **A:** Well, what you do want is — most [19] likely, we would add a coating of cement or [20] a cement slurry, a thin — thick slurry. [21] And this is going to be established by a [22] test, what's the best way of achieving a

Page 34

[1] good bond.

[2] And that's where these shear tests [3] plan to determine what's the best way of [4] achieving a good bond between the soil [5] cement and the underlying clay subgrade.

[6] **Q:** And you used the term "good bond." [7] Is that something that you define [8] quantitatively?

[9] **A:** No. It's measured. You would [10] measure the — you would cause them to fail. [11] And you would measure the shear strength, or [12] the force required to cause them to slip. [13] And from that, you can say anything — we [14] know what we need as minimum.

[15] **Q:** What's the minimum that you

need?

[16] **A:** I don't recall what the minimum [17] was. But there is — they have worked it [18] out from the analysis what's the minimum [19] required. I don't know it offhand, minimum [20] shear strength required at these interfaces.

[21] **Q:** How do you perform that test?

[22] **A:** There is a — it's a direct shear

Page 35

[1] box, you call it. And usually for this type [2] of test, you'd use one which is probably a [3] one-foot-by-one-foot instead of a — you [4] could use a small one. A small one's [5] usually for size two-inch or [6] four-inch-by-four-inch.

[7] But I think in this case you would [8] probably use one which is maybe a foot [9] square. But it could be a four-inch one.

[10] And it has two boxes, two boxes, halves. [11] And you pull one with respect to the other. [12] And you measure the resist — or the force [13] required to cause them to slip. So half of [14] the box would slip in one direction, the [15] other half in the other direction.

[16] **Q:** That seems like a pretty simple [17] thing to do. You could do that today, [18] right? You could perform that test today?

[19] **A:** Yes.

[20] **Q:** To your knowledge, has that test [21] been performed?

[22] **A:** On this specific job?

Page 36

[1] **Q:** Yes.

[2] **A:** No. To my knowledge it has not [3] been performed.

[4] **Q:** Do you know why not?

[5] **A:** No.

[6] **Q:** And what are the variables that go [7] into meeting that requirement, that shear [8] strength? Is it the nature of the concrete [9] slurry? Is it the weight of the pad on top [10] of the clay?

[11] What are the things that go into [12] if you change it, it changes the shear [13] strength?

[14] **A:** Well, obviously, if you change the [15] loads, you change shear strength. But in [16] this case, we know what the loads are going [17] to be. So we're not going to apply much [18] higher loads than that of the slab and the [19] overburden above it, or whatever's above it, [20] the soil cement above it and the concrete [21] slab. And so then you wouldn't use anything [22] above that.

Page 37

[1] The other factors are the moisture [2] content; the type of treatment, surface [3] treatment, whether it's dry cement, or is it [4] a cement slurry, or a moist slurry.

[5] **Q:** Let me just interrupt you there [6] and clarify. When you say the type of [7] treatment, you're talking about the [8] interface between the subgrade and the [9] cement-treated soil?

[10] **A:** That's correct.

[11] **Q:** Okay. What else? Does it have to [12] do with characteristics of the [13] cement-treated soil, also?

[14] **A:** Yes.

[15] **Q:** What aspects of the cement-treated [16] soil affect the resistance to stress?

[17] **A:** Well, probably the controlling — [18] obviously, if the soil — the cement-treated [19] soil is the weakest link. It's going to [20] fail through the cement-treated soil. If [21] the clay is the weakest link, it's going to [22] fail through clay. If the bond is the

Page 38

[1] weakest link it will fail through that think [2] layer that we're talking about.

[3] And the idea would be to make sure [4] that the thin layer between the two, or the [5] interface, is not the weak link. That's [6] really the objective of all we're doing [7] here, is make sure it fails either through [8] either the underlying clay or the [9] cement-treated soil. And I suspect it's [10] probably going to be through the clay rather [11] than the cement-treated soil.

[12] **Q:** It would be possible, wouldn't it, [13] to design the pads so that their thickness [14] was the thickness of the eolian silt; so [15] that, in other words, they would entirely [16] displace the layer of eolian silt and touch [17] the subgrade below?

[18] **A:** I can't answer that question. [19] Because that's outside my area.

[20] **Q:** You don't do concrete?

[21] **A:** Yes, I do concrete. But I don't [22] get involved with canisters tipping over and

Page 39

[1] things like that, which control the [2] thicknesses.

[3] **Q:** Oh, I see. But there isn't any [4] reason, from the standpoint of the stability [5] of concrete by itself, that would prevent [6] PFS from building a pad that was four or [7] five feet thick, as opposed to two-foot [8] thick?

[9] **A:** I need to understand what you mean [10] by "stability."

[11] **Q:** Well, disregarding the issue that [12] they're holding casts on top of them, if you [13] were just building a pad out in the desert, [14] would there be any reason that you couldn't [15] design the pad to be five feet thick and go [16] down as far as to touch the subgrade layer?

[17] **MR. TRAVIESO-DIAZ:** I'm going to

[18] object to the form of the question. Because [19] it assumes something for which there is no [20] foundation, which that there is a [21] uniform distance from the surface to the [22] layer underneath. And that hasn't been

Page 40

[1] established. What I'm saying is that your [2] question assumes that there is four to five [3] feet uniform distance between the top and [4] the bottom.

[5] **MS. CURRAN:** Okay.

[6] **BY MS. CURRAN:**

[7] **Q:** I'd like to ask you about a [8] statement here also on page 2.6-119.

[9] In the second full paragraph, the [10] first sentence reads, An additional benefit [11] of incorporating the soil cement into the [12] design is that will minimize the [13] environmental impacts of constructing the [14] facility.

[15] This represents that minimizing [16] environmental impacts is an additional [17] benefit of incorporating soil cement into [18] the design.

[19] What's the first benefit of [20] incorporating the soil cement into the [21] design?

[22] **A:** I can only see what's — state

Page 41

what's said here. From what I gather, [2] you're saying, if you read the next [3] sentence, is use of on-site materials to [4] construct soil cement rather than excavating [5] and spoiling these materials is an [6] environmental benefit.

[7] **Q:** Right.

[8] **A:** That's what they're stating here.

[9] **Q:** Right. But it says it's an [10] additional benefit.

[11] So I'm just wondering: Is it a [12] benefit in some other way to incorporate [13] soil cement into this design?

[14] **A:** I don't know. I did not write [15] this paragraph. So I don't know. I'd have [16] to read back over and see what other benefit [17] was involved in it. This was not my [18] wording.

[19] **MS. CURRAN:** I'd like to take a [20] ten-minute break.

[21] (Recess)

[22] **BY MS. CURRAN:**

Page 42

[1] **Q:** I'm going to pass you kind of a [2] bulky item, Doctor. This is a set of some [3] of the exhibits. And I just want to look at [4] one of them, which is Number 13.

These [5] happen to be stapled together. And I'd like [6] you to turn the Exhibit 13, which has [7] already been marked:

Applicants objections [8] and responses to the State of Utah's 14 set [9] of discovery requests directed to the [10]

applicant, dated February 19, 2002.

[11] I believe earlier in the [12] deposition you stated that you had been [13] retained by Shaw Pittman, and not by PFS; is [14] that correct?

[15] **A:** That's correct.

[16] **Q:** Well, I'd like you to turn to page [17] 20 of this discovery response. You'll see [18] at the top of the page, this is an answer to [19] interrogatory number three.

[20] It states, PFS has retained [21] Dr. Anwar E.Z. Wissa as a consultant to [22] assist in the soil cement program.

Page 43

[1] Is that incorrect?

[2] **A:** Well, I haven't received any [3] formal contract or information that I have [4] been retained.

[5] **Q:** Do you have a handshake?

[6] **A:** An insinuation or a handshake may [7] be the case, but no formal agreement of any [8] kind exists. And as of today, I have not [9] spent any time or billed them or done [10] anything with them to confirm that this is [11] the case. As I said, I would hope it would [12] be the case. But from where I'm speaking to [13] you, and I expect they will retain me, but [14] there is no formal agreement as of this [15] date.

[16] **Q:** So the phrase "has retained" is [17] somewhat hopeful language?

[18] **A:** I didn't write this. So whoever [19] wrote this — maybe I should have read this [20] and assumed that I have been retained.

[21] **Q:** Now, it also says here, PFS [22] anticipates that Ardaman & Associates will

Page 44

[1] be performing additional relevant soil [2] cement testing.

[3] Have you been retained to [4] represent soil cement testing?

[5] **A:** I think it's the same context, [6] where we've discussed it; and they told us [7] can we do this work; and are we willing to, [8] and so on. I've agreed yes. But the [9] physical — or the documentation that we [10] have been retained, I do not have yet. It [11] may be in the mail, for all I know.

[12] **Q:** Have you had any involvement with [13] PFS's other consultants in the soil testing [14] that has been done?

[15] **A:** I had a meeting with the lawyers [16] where other consultants were present.

[17] **Q:** Have you had any involvement with [18] AGEC?

[19] **A:** No. I don't think so.

[20] **Q:** Did you participate at all in the [21] engineering services scope of work that

[22] we've all looked at as Exhibit 14?

Page 45

[1] **A:** No.

[2] **MS. CHANCELLOR:** Can I ask a [3] question?

[4] **MS. CURRAN:** Yes. You're breaking [5] up, Denise. I don't know why.

[6] **MS. CHANCELLOR:** Dr. Wissa, have [7] you had any conversations with Paul Trudeau [8] at Stone & Webster?

[9] **MR. TRAVIESO-DIAZ:** I am going to [10] object to having two counsel examine my [11] witness at the same time.

[12] **MS. CHANCELLOR:** Okay. That's [13] fine. We'll do it at a break. And we'll [14] just go back and Diane can ask the [15] questions. That's just fine.

[16] **MR. TRAVIESO-DIAZ:** Just one at a [17] time, please.

[18] **MS. CURRAN:** Well, we were doing [19] it one at a time.

[20] **MS. CHANCELLOR:** I mean, I was [21] trying to be efficient. And I haven't [22] broken in before. I was trying to be

Page 46

[1] efficient so that we could get Dr. Wissa out [2] of there as quickly as possible. If you [3] want to delay this, we have will have phone [4] conversations. We'll go back. We'll cover [5] the same ground. And we'll re-ask the [6] question.

[7] **MR. TRAVIESO-DIAZ:** I'm sorry, [8] Denise. Rule number one in depositions is [9] only one lawyer is allowed to ask questions [10] of a witness at a point in time. If you [11] want to ask questions later, after Diane [12] finishes, then we can talk about it. But no [13] double-teaming, please.

[14] **MS. CHANCELLOR:** Okay. That's [15] fine. I was trying to be efficient.

[16] **MR. TURK:** Denise, I personally [17] don't blame you. I think this is very [18] exciting. And I understand the impulse to [19] break in.

[20] **BY MS. CURRAN:**

[21] **Q:** Dr. Wissa, have you had any [22] conversations with Paul Trudeau of Stone &

Page 47

[1] Webster regarding the PFS design issues?

[2] **A:** Other than with attorneys present?

[3] Other than that?

[4] **Q:** Yes.

[5] **A:** Yes. I've had one.

[6] **Q:** Can you describe it for me, [7] please?

[8] **A:** Paul Trudeau delivered some [9] documents to me at — some plans or — [10] without the attorneys present, just [11]

1 CHAIRMAN FARRAR: And, Mr. Travieso-Diaz,
2 they are available for cross examination?

3 MR. TRAVIESO-DIAZ: Well, there are some
4 exhibits, also, that go with the testimony.

5 CHAIRMAN FARRAR: Go ahead.

6 MR. TRAVIESO-DIAZ: Accompanying the
7 testimony of these witnesses there are four exhibits,
8 exhibit GGG, entitled: Engineering Services Scope of
9 Work for Laboratory Testing of soil cement mixes.

10 (Whereupon, the above-
11 referenced to document was
12 marked as Applicant Exhibit GGG
13 for identification.)

14 MR. TRAVIESO-DIAZ: And I would like to
15 note that the copy that we handed out this morning to
16 the Court Reporter, and to the parties, differs from
17 the prefiled copy, in that the proprietary markings
18 have been removed, consistent with the discussions
19 that we had at the Hearings previously.

20 So it is the same document, but it is now
21 free of all proprietary markings.

22 The next exhibit is exhibit HHH, it is ACI
23 report 230.1R-90, entitled: State of the Art Report
24 on Soil Cement.

25

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 (Whereupon, the above-referenced to
2 document was marked as Applicant Exhibit
3 HHH for identification.)

4 MR. TRAVIESO-DIAZ: The next exhibit is
5 exhibit III, it consists of excerpts from the
6 deposition of James K. Mitchell that took place on
7 Friday, March 15th, 2002.

8 (Whereupon, the above-
9 referenced to document was
10 marked as Applicant Exhibit III
11 for identification.)

12 MR. TRAVIESO-DIAZ: And the fourth and
13 last exhibit JJJ, is Section 2.6.4.11 of the PFS
14 Safety Analysis Report, entitled: Techniques to
15 Improve Subsurface conditions.

16 (Whereupon, the above-
17 referenced to document was
18 marked as Applicant Exhibit
19 JJJ for identification.)

20 MR. TRAVIESO-DIAZ: And I would move that
21 these four exhibits be admitted into evidence.

22 CHAIRMAN FARRAR: Any objection?

23 MS. CHANCELLOR: No objection, Your Honor.

24 CHAIRMAN FARRAR: Staff?

25 MR. O'NEILL: No objection, Your Honor.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 CHAIRMAN FARRAR: All right. Then those
2 four exhibits, III through JJJ will be admitted into
3 evidence.

4 (The documents referred to,
5 having been previously marked
6 for identification as Applicant
7 Exhibits III through JJJ were
8 received in evidence.)

9 MR. TRAVIESO-DIAZ: The witnesses are now
10 available for cross examination.

11 CHAIRMAN FARRAR: Let's go off the record
12 for just a moment.

13 (Whereupon, the above-entitled matter
14 went off the record at 10:00 a.m. and
15 went back on the record at 10:01 a.m.)

16 CHAIRMAN FARRAR: Is the Staff prepared
17 for cross examination?

18 MR. O'NEILL: Yes, Your Honor.

19 CHAIRMAN FARRAR: Go ahead, Mr. O'Neill.

20 CROSS EXAMINATION

21 MR. O'NEILL: Good morning, Mr. Trudeau,
22 Dr. Wissa. I'm Martin O'Neill, Co-Counsel for the NRC
23 Staff.

24 I have a short series of questions
25 pertaining to soil cement issues aimed at obtaining

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 some clarification, or some additional explanation of
2 terms or concepts.

3 My first question is for Mr. Trudeau. I
4 would direct your attention to answer 34, page 23 of
5 your prefiled testimony.

6 In that response you discuss the proposed
7 purposes of the soil cement, cement treated soil.
8 Among those is the proposed use of the cement treated
9 soil to resist sliding forces, correct?

10 MR. TRUDEAU: Correct.

11 MR. O'NEILL: Is it correct that PFS,
12 however, is not taking credit for the resistance to
13 sliding that might be provided of soil cement, or
14 cement treated soil under and around the pads, with
15 respect to its design calculations, specifically the
16 computation of factor against safety, factor of
17 sliding against safety?

18 MR. TRUDEAU: Our base case for the
19 sliding stability of a pad includes the shear strength
20 of the cement treated soil beneath the pads, but it
21 does not include the passive resistance, or the
22 buttressing capability of the soil cement adjacent to
23 the pads.

24 And for those conservative assumptions our
25 factor of safety is at least 1.27 for the pads out on

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 that site.

2 MR. O'NEILL: Without taking into account
3 the passive resistance, correct?

4 MR. TRUDEAU: That is correct.

5 MR. O'NEILL: Mr. Trudeau, you note that
6 one advantage of mixing cement with soils at the site
7 is to avoid the wasting of soil materials, and
8 replacing them with structural fill.

9 Could you tell me whether the cement
10 treated soil is intended to provide a function that is
11 comparable to that typically associated with
12 structural fill, or are there additional functions to
13 be served as well?

14 MR. TRUDEAU: The cement treated soil is
15 better for this application than structural fill would
16 be, because structural fill would typically be a well-
17 graded granular material, which has, or derives its
18 strength from its frictional characteristics.

19 At this site we have a high earthquake
20 load, and when the uplift forces, due to the
21 earthquake, when the forces due to the earthquake act
22 in the upward direction, the normal force is reduced.

23 And the frictional resistance is a
24 function of the tangent of the phi angle of the soils
25 times this normal force. So when the normal force is

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 reduced by having the earthquake forces acting upward,
2 then the resistance to sliding for a structural fill
3 type material is reduced significantly for such a
4 large earthquake.

5 The cement treated soils, on the other
6 hand, derive most of their strength from their
7 cohesion. And the cohesion is not affected by the
8 loss or decrease of normal forces, as is the
9 frictional resistance portion of the strength.

10 So the cement treated soils are better for
11 this application than a structural fill material would
12 be under the pads.

13 MR. O'NEILL: Thank you. Could you please
14 turn your attention to answer 43 on page 29?

15 I believe at some point you state that the
16 test program may include other tests, such as
17 permeability tests, and splitting tensile strength
18 test, even though the design and performance of the
19 foundations are not dependent on these properties.

20 Could you explain, to me, in greater
21 detail how the design and performance of the
22 foundations are not dependent on these particular
23 properties?

24 MR. TRUDEAU: Well, the permeability tests
25 that are referenced here are really, in this response,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealrgross.com

1 primarily based on potential use of soil cement in the
2 detention pond area.

3 This is not a safety related issue, it is
4 just my understanding that PFS has agreed, as part of
5 the settlement for Utah O hydrology, that we may end
6 up with a soil cement layer under the detention pond
7 area to help prevent seepage of any storm water that
8 runs into the detention pond from seeping down into
9 the underlying soil.

10 Now, I don't know that soil cement will be
11 used there, at this point. But this was a for-
12 instance. We might end up doing some permeability
13 test to address that kind of an issue.

14 The splitting tensile strength tests are
15 tests that we have talked about since the original
16 depositions, and they are not that hard to do. So we
17 may, indeed, do some of them to demonstrate what the
18 tensile strength of the soil cement is.

19 But our position is that our design does
20 not rely on the tensile strength of the soil cement.

21 MR. O'NEILL: Well, is it true that your
22 focus is more on the ability of the cement treated
23 soil to transmit stresses, and to resist lateral
24 compression?

25 MR. TRUDEAU: Yes, we are relying on the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 compressive strength of the soil cement to provide
2 passive resistance to sliding of the canister transfer
3 building.

4 And we are relying on the shear strength
5 of the cement treated soils underneath the pads to
6 essentially bond the pads to the underlying stiff
7 clays.

8 MR. O'NEILL: Thank you. I have a
9 question for you, Dr. Wissa, finally.

10 Throughout the testimony you used the term
11 foundation stabilization. Could you provide me with
12 a definition of that term, specifically what it
13 encompasses, with a focus on how it relates to your
14 soil properties, how soil properties might be
15 improved, and what specific properties are improved.

16 DR. WISSA: By foundation in general, are
17 you --

18 MR. O'NEILL: Foundation stabilization.
19 I mean, I know this is a term that is used in the ACI
20 230 report. It is a term that you used as well, in
21 your testimony.

22 And I just wondered if you could explain
23 specifically what you mean by that term.

24 DR. WISSA: Stabilization, let's start by
25 stabilization. It is making something more stable,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 that could be, depending on what you are trying to
2 stabilize, you could do it to stabilize it as far as
3 compression, to make it more rigid, and less flexible.

4 You could do it to stabilize it against
5 movements where you would want strength, compressible
6 shear strength. And in this case we are speaking
7 about improving the properties of the foundation,
8 whether it is of a building, or a pad, or whatever.

9 So I think that is basically what we are
10 talking about, is improving the properties, or making
11 them more stable. I don't know if I've answered the
12 question.

13 MR. O'NEILL: Well, would this include
14 improvement of cohesion soil, cohesion as well?

15 DR. WISSA: Well, cohesion is a form of
16 stabilization. It is a strength. The difference
17 between cohesion and friction, cohesion is independent
18 of the load you place on it. Friction is a function
19 directly of the load.

20 For example, if you take a block and slide
21 it on the surface, depending on the weight of the
22 block, the force required to make it move will
23 increase the heavier the block is.

24 On the other hand, if you take the same
25 block and add an epoxy, and glue it to that surface,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 now the force required to move that block would be
2 dependent on the bond which is, if you want to think
3 of, the cohesion versus the normal load, which would
4 be applied on the weight of a block.

5 So cohesion is a form of strength which is
6 independent of the load you are applying. And this is
7 what Mr. Trudeau was explaining, as far as using
8 structural fill versus soil cement.

9 In one case it is the ability to move, is
10 a function of the normal load of the load you apply.
11 In the other case it is independent of the load
12 applied.

13 MR. O'NEILL: So would the addition of
14 cementitious materials would increase the cohesion of
15 a given soil, correct? I mean, is that the gluing
16 effect you referred to?

17 DR. WISSA: That is the main function, by
18 definition, cementitious materials meet, it cements
19 together, or adheres.

20 MR. O'NEILL: The ACI 230 report, it
21 refers to foundation stabilization as one example of
22 an application of soil cement. Would you agree with
23 me that foundation stabilization is an application
24 that might actually include multiple sub-applications,
25 correct?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 I mean, you may be using soil cement in a
2 number of different applications, but maybe the
3 ultimate goal or function of that soil cement is the
4 same, correct?

5 DR. WISSA: Well, you stabilize it, and it
6 depends for what reason. So you may do it to reduce
7 compressibility, make the movements less. You may do
8 it to improve the ability to spread the loads, which
9 would be as to shear strength.

10 So the applications of using it for
11 stabilization may vary.

12 MR. O'NEILL: So foundation stabilization
13 would encompass all of these in your view, correct?

14 DR. WISSA: Depending on the situation
15 that is correct. It is a wide range of abilities to
16 stabilize, including the possibility of using it as a
17 buttress, or to prevent sliding.

18 MR. O'NEILL: Do you have anything to add,
19 Mr. Trudeau?

20 MR. TRUDEAU: I could add the following.
21 Some of the eolian silts at the site are non-plastic
22 soils. In this condition they behave more like a
23 frictional material.

24 So when we mix those soils with cement, we
25 will be imparting a cohesion to these soils, which

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 improves their characteristics for resisting these
2 horizontal loads due to the earthquake.

3 So in that regard we are stabilizing the
4 non-plastic eolian silts by the introduction of cement
5 and moisture in the proper proportions, and sufficient
6 compaction, to get a stabilized soil cement product.

7 MR. O'NEILL: Thank you. Dr. Wissa, in
8 response to question 49 on page 32 of your prefiled
9 testimony, you state that there is also direct
10 precedent in the industry for using soil cement for
11 foundation stabilization, in the manner proposed by
12 PFS.

13 Specifically what precedent are you
14 referring to? Are there any other cases, in addition
15 to those that were cited in the PFS SAR, or safety
16 analysis report in ACI 230?

17 DR. WISSA: Yes, there has been a more
18 recent situation where, as a matter of fact, it has
19 been used for a very similar application. In this
20 case it was in situ mixing, rather than mixing in a
21 plant.

22 But it has to do with the situation in the
23 Boston area, the Big Dig, where they used in situ
24 mixing of soil and cement. I shouldn't say in situ,
25 deep mixing soil cement to achieve, to be able to

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 transmit shear stresses down to the foundation, which
2 is exactly the same situation as we are talking about
3 here.

4 MR. O'NEILL: Mr. Trudeau, in answer 34,
5 with respect to the canister transfer building, you
6 discuss a proposed use of soil cement to provide
7 additional passive resistance against sliding forces
8 in the event of a design basis earthquake.

9 You define passive resistance as the
10 ability of soils to resist horizontal forces, noting
11 that in this particular case these forces would be the
12 result of earthquake forces.

13 Is that a correct characterization?

14 MR. TRUDEAU: That is correct.

15 MR. O'NEILL: Does this imply that there
16 might be other sources of horizontal forces, not
17 necessarily at the PFS site, but in other applications
18 that utilize soil cement?

19 MR. TRUDEAU: Well, the typical horizontal
20 force that a foundation like a retaining wall is
21 required to resist, are just based on the active
22 pressures of the soils behind the wall.

23 And in those applications there is passive
24 resistances at the toe of the wall that help to
25 provide stability of the wall against sliding.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. O'NEILL: So on balance soil loads
2 would be another example?

3 MR. TRUDEAU: That is correct.

4 MR. O'NEILL: Of horizontal forces that
5 might be acting --

6 MR. TRUDEAU: Or hydrostatic pressures
7 behind a wall. Those cases don't apply here. Our
8 horizontal forces that are driving the canister
9 transfer building are derived from the earthquake at
10 the site.

11 MR. O'NEILL: I understand that, but in
12 your view the soil cement is used to provide
13 additional passive resistance. Wouldn't the ultimate
14 purpose or function be the same regardless of the
15 precise origin of these horizontal forces?

16 I mean, you could draw an analogy,
17 correct?

18 MR. TRUDEAU: Correct. And if we didn't
19 have the soil cement there we would have a structural
20 fill type material there that would also provide
21 passive resistance.

22 But making the soil cement enhances the
23 ability of that material to provide passive
24 resistance. So that is why the cement is added to the
25 soil, rather than using a structural fill. It

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 provides an increased passive resistance.

2 MR. O'NEILL: Thank you. Mr. Trudeau, in
3 answer 53, page 34, you indicate PFS' commitment to
4 perform tests that will demonstrate the necessary
5 bonding of soil cement, I mean, that it can be
6 achieved and this bonding will be achieved at various
7 interfaces that are important providing resistance to
8 sliding in the cask storage pads, correct?

9 MR. TRUDEAU: That is correct.

10 MR. O'NEILL: Now, to your knowledge, the
11 NRC did acknowledge this commitment in its safety
12 evaluation report, correct?

13 MR. TRUDEAU: That is correct.

14 MR. O'NEILL: However, is it your
15 understanding that the Staff's approval of your
16 analysis of the pad stability against sliding does not
17 rely on this commitment per se? I mean, the Staff
18 doesn't view sliding as a safety hazard, correct?

19 MR. TRUDEAU: I understand that, and the
20 basis for that is that there are no safety related
21 connections to either the pads or the canister
22 transfer building.

23 So that whether they slide or not the
24 safety function is not going to be compromised.

25 MR. O'NEILL: Now this question, I guess,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 would be directed to both of you, gentlemen.

2 In answer 59 on page 40, discussing
3 possible cracking of the soil cement around the CTB,
4 in response to claims raised by the State, you
5 mentioned the presence of vertical cracks.

6 I think you suggested that if any cracks
7 were to form they would be primarily vertical, or near
8 vertical. But then you subsequently referred to the
9 random orientation of the cracks.

10 Did you mean to refer to the random
11 location of the cracks? I think you made this
12 statement in the context of the need for the cracks to
13 be aligned parallel to the edge of the foundation to
14 maximize --

15 MR. TRUDEAU: That is correct. By random
16 orientation there I meant if you were looking down at
17 these cracks from the top you would see some that
18 would be lined up parallel to the foundation, perhaps.
19 Some that would be perpendicular to the foundation,
20 some that would be at some angle in between.

21 So the orientation of these vertical
22 cracks with respect to the important direction, which
23 is lined up parallel to the foundation is random. So
24 they aren't all lined up in a row, row after row,
25 after row, parallel to the foundation, where they

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 would have the maximum effect sliding resistance.

2 MR. O'NEILL: So you were referring to the
3 relative locATion, as opposed to their orientation,
4 whether it be vertical, or --

5 MR. TRUDEAU: Yes.

6 MR. O'NEILL: Okay, thank you.

7 Mr. Trudeau, in answer 40 in page 27 you
8 talk about comparisons of the result of moisture
9 density, durability, and strength, test of soil cement
10 specimens from the proposed facility, with empirical
11 data available in the literature that has been
12 developed since the early part of the 1900s.

13 What is this particular empirical data,
14 and what is the purpose of this comparison?

15 MR. TRUDEAU: The data that I'm referring
16 to is the results of compressive strength test,
17 primarily, that show the benefit of adding cement to
18 soils, in various soil types.

19 Some silts, like eolian silts, some clays,
20 and sands, and a wide variety of soils have been used,
21 historically, to make soil cement. And when these
22 soils are used, index property tests are generally
23 performed on these samples, as well as the important
24 compressive strength test.

25 Because those typically provide the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 feature, the design feature that is looked for in a
2 soil cement application, the compressive strength of
3 the soil. Soil cement mix, I mean.

4 MR. O'NEILL: I think that is all I have
5 for now, thank you.

6 CHAIRMAN FARRAR: Thank you, Mr. O'Neill.
7 Go ahead, Ms. Chancellor. Do you need a minute, or?

8 MS. CHANCELLOR: No, I'm fine, thank you,
9 Your Honor.

10 CROSS EXAMINATION

11 MS. CHANCELLOR: Good morning, Mr.
12 Trudeau, good morning, Dr. Wissa. My name is Denise
13 Chancellor, representing the State of Utah.

14 Mr. Trudeau, part of the testimony that
15 you are responsible for includes soils, and I will not
16 be cross examining you on this today. My cross
17 examination will be limited to the soil cement portion
18 of the testimony.

19 MR. TRUDEAU: That is my understanding.

20 MS. CHANCELLOR: Good, that is something
21 we agree on.

22 Mr. Trudeau, have you -- do you know of
23 the geological province, the basin and range?

24 MR. TRUDEAU: Yes.

25 MS. CHANCELLOR: Have you done any

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 geotechnical work in the basin and range before?

2 MR. TRUDEAU: Not prior to this project.

3 MS. CHANCELLOR: Dr. Wissa, other than the
4 PFS site, have you been involved in a seismic design
5 of NRC regulated facilities in areas of high to
6 moderate seismicity, such as the western U.S.?

7 DR. WISSA: No, I have not.

8 MS. CHANCELLOR: Have you been involved in
9 any site where peak ground accelerations are
10 approximately 0.7G?

11 DR. WISSA: No.

12 MS. CHANCELLOR: Have you performed any
13 dynamic analysis of foundations?

14 DR. WISSA: No.

15 MS. CHANCELLOR: Have you any experience
16 with soil structure and direction?

17 DR. WISSA: Other than in college I took
18 courses in it, but I'm not an expert in that area.

19 MS. CHANCELLOR: What other projects have
20 you been involved, have you been involved in any other
21 projects where soil cement, or cement treated soil has
22 been used to provide resistance to sliding of shoddily
23 embedded foundation?

24 DR. WISSA: No other one.

25 MS. CHANCELLOR: Are you aware of any

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 direct examples of the application of soil cement, or
2 cement treated soil, to provide resistance to sliding
3 to shoddily embedded foundation?

4 DR. WISSA: Yes, the example I just gave,
5 which was the case of a soil cement buttress in the
6 Four Point Channel in the Boston area.

7 MS. CHANCELLOR: During your deposition,
8 Dr. Wissa, my understanding was that you had not, at
9 that time, been retained by PFS to assist them,
10 formally retained, to assist them with their soil
11 cement program. Has that changed since that day?

12 DR. WISSA: Yes, to some extent. I've had
13 conversations with them about future work and what
14 type of program would be undertaken.

15 MS. CHANCELLOR: And is there any formal
16 arrangement, as yet, as to any future work?

17 DR. WISSA: No, not at this time.

18 MS. CHANCELLOR: What is the scope of any
19 future work that you may be involved with, with PFS?

20 DR. WISSA: We've discussed what would be
21 needed as a testing program, how it would be
22 implemented.

23 MS. CHANCELLOR: Would you be doing any of
24 the work that is currently being -- that is
25 anticipated to be done by AGECE, the engineering

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 company, Geotechnical Engineering Company in Salt Lake
2 City, that is now performing -- that has performed
3 some of the tests?

4 DR. WISSA: Well, I can't exactly answer
5 that question. To my knowledge I gave the owner an
6 outline of work I think would be needed. And,
7 obviously, some of that work overlaps what has already
8 been undertaken.

9 So there would be duplication or there
10 would be overlap.

11 MS. CHANCELLOR: Your Honor, we haven't
12 seen a copy of any of the scope of work that, the
13 planned scope of work that Dr. Wissa would be involved
14 with, and we would request a copy of that outline, or
15 whatever it is, that he has provided to --

16 Did you give that to Mr. Parken? You
17 stated you gave it to the owner of PFS?

18 DR. WISSA: I gave an outline of my work
19 to Mr. Donnell, I believe.

20 MS. CHANCELLOR: Mr. Donnell?

21 DR. WISSA: Donnell.

22 MR. TRAVIESO-DIAZ: Can we go off the
23 record for a second?

24 CHAIRMAN FARRAR: Yes.

25 (Whereupon, the above-entitled matter

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 went off the record at 10:29 a.m. and
2 went back on the record at 10:34 a.m.)

3 CHAIRMAN FARRAR: Let's go back on the
4 record. We've had off the record a discussion of the
5 availability of documents the State asked for. Ms.
6 Chancellor, is there something you're asking for that
7 might have been created before the discussions we had
8 in Salt Lake City, because we see a difference between
9 anything created before then, and anything created
10 after that.

11 MS. CHANCELLOR: I don't know, Your Honor,
12 because we've never received any documentation that
13 describes the extent or scope, or any information
14 about Dr. Wissa's work with PFS, other than a
15 discovery response saying that PFS expects to retain
16 Dr. Wissa to assist it in its soil testing program,
17 and that's the extent of our knowledge, other than at
18 Dr. Wissa's deposition in March, in the middle of
19 March. And at that time, Dr. Wissa had not -- had
20 just been in preliminary discussions with PFS. It
21 sounds like these discussions have advanced and that
22 maybe Dr. Wissa has proposed a scope of work.

23 It will be rather laborious. I can go
24 through and try and establish through cross
25 examination the scope of his proposed involvement.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 CHAIRMAN FARRAR: Mr. Travieso-Diaz, do
2 you know what documents exist, given where we'd like
3 to head? What can you propose that would solve this?

4 MR. TRAVIESO-DIAZ: Well, first let me
5 state for the record, and Dr. Wissa will confirm, that
6 the document that Ms. Chancellor is interested in was
7 generated after our -- the beginning of the record
8 conversation in Salt Lake City. It was prompted by
9 those conversations. Now again --

10 CHAIRMAN FARRAR: Is there something
11 similar that exists, that was created before that
12 time?

13 MR. TRAVIESO-DIAZ: Not to my knowledge.
14 Dr. Wissa, again, can confirm. There is no piece of
15 paper, aside from the one that we are referring to, in
16 which Dr. Wissa has committed to paper what a program
17 that he will be involved with will consist of. It's
18 true that document he created in a different context
19 at a future time, that during the course of this
20 ongoing proceeding, that will fall under the scope of
21 documents requested by the State, but such a document
22 doesn't exist to date.

23 CHAIRMAN FARRAR: And the Staff has not
24 insisted on such a document being created at this
25 point in connection with its Safety Review.

1 MR. O'NEILL: No, not to my knowledge,
2 Your Honor.

3 MR. TRAVIESO-DIAZ: I want the record to
4 be clear, Dr. Wissa is not now, and has never been
5 under contract to PFS. He has had discussions for
6 some time with PFS representatives, but he is not
7 under contract to do any work at this point, except
8 the work that he's doing in support of the litigation.

9 MS. CHANCELLOR: But we do have a
10 discovery response, and in that discovery response, it
11 was actually stated that he had been retained -- that
12 he would -- had been retained by PFS to assist them in
13 the Soil Cement Program, and during the deposition it
14 was established that no, he had a contract with Shaw
15 Pittman for the expert portion, but the State's a
16 little surprised that PFS states that it's going to
17 use Dr. Wissa for its -- to assist in its Soil Cement
18 Testing Program, and that given that there's no
19 contract, we're wondering if PFS is even going to use
20 Dr. Wissa's proposal, so it's a little late in the day
21 to be trying to figure out where we are on this one.

22 MR. TRAVIESO-DIAZ: I don't understand
23 what the problem is. The situation is very clear. It
24 hasn't changed since his deposition either.

25 Dr. Wissa has been (a) retained to provide

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 litigation assistance in this case. He has
2 concurrently been talking to PFS about potentially
3 being retained to actually do the work at the point at
4 which that work is done. And there is no contract or
5 no agreement between the parties, they just have been
6 talking about it. And I think that that is the
7 beginning and the end of it, and I don't see what
8 problem the State has with it.

9 MR. O'NEILL: Your Honor, I mean, I think
10 a point to keep in mind is, I think what's at issue is
11 the adequacy of the Soil Cement Testing Program as,
12 you know, described in the SAR. I mean, to the extent
13 that this document might have been developed in
14 accordance, or pursuant to the settlement discussions,
15 I'm not sure I see why it would be subject to
16 discovery.

17 CHAIRMAN FARRAR: Ms. Chancellor, at this
18 point, we don't see that there's anything to be
19 produced, or anything permissible to be produced, so
20 there's no --

21 MS. CHANCELLOR: I'll proceed through
22 cross examination, Your Honor.

23 CHAIRMAN FARRAR: Go ahead.

24 MS. CHANCELLOR: Dr. Wissa, are you
25 familiar with PFS Exhibit GGG, which is the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 Engineering Services Scope of Work for laboratory
2 testing of soil cement mixes between Private Fuel
3 Storage and Applied Geotechnical Engineering
4 Consultants, AGECE, dated January 31, 2001? It's
5 attached to your testimony.

6 DR. WISSA: Yes.

7 MS. CHANCELLOR: Do you anticipate that
8 you will -- is it correct that there are certain tests
9 described in this ESSOW that AGECE will perform, such
10 as Section 3.2, Test Procedures?

11 DR. WISSA: Can you clarify that? Whether
12 they will continue doing the testing, is that what
13 you're asking?

14 MS. CHANCELLOR: Well, that's what I'm
15 going to get at. But first of all, do you recognize
16 that in this document it describes certain test
17 procedures that will be conducted for the PFS Soil
18 Cement Testing Program?

19 DR. WISSA: Right.

20 MS. CHANCELLOR: And my understanding is
21 that the first tests were Index Property Testing. Is
22 that correct?

23 DR. WISSA: Yes.

24 MS. CHANCELLOR: Have you -- do you know
25 when AGECE has completed those tests?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 DR. WISSA: No, I'm not familiar with --
2 I've seen work they've produced. Whether that's
3 completed, or whether there's additional work, I do
4 not know.

5 MS. CHANCELLOR: Do you anticipate that
6 you'll be involved in Index Property Testing at the
7 PFS site?

8 DR. WISSA: If I do any work, the first
9 thing you do in any testing program is to classify the
10 soils involved, and Index Testing would be the first
11 step in the process.

12 MS. CHANCELLOR: Would you be willing if
13 you were hired by PFS to step into the Testing Program
14 partway through and accept any of the work that AGECE
15 has already completed?

16 DR. WISSA: Yes and no. Sorry, answering
17 that way. Obviously, any information they have
18 supplied would be beneficial. However, when you go
19 through a program, you want to get the same soils
20 throughout the program, and the probability of getting
21 samples from them, or sufficient material from them to
22 be able to continue a program, or to compliment the
23 program would be difficult, so I would look at their
24 data and take advantage of it. On the other hand, I
25 think I would be inclined to -- well, I would probably

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 want to sample the soils to know what soils you're
2 looking at, get big enough samples to be able to
3 complete the entire program without getting -- going
4 back to the site more than once. So the answer is, I
5 would use their data, however, I would be inclined to
6 repeat some of their testing too.

7 MS. CHANCELLOR: I understand that AGECE
8 used 16 test pits. Is that -- do you know whether
9 that's true?

10 DR. WISSA: I can't remember what it was,
11 but I know they used test pits.

12 MS. CHANCELLOR: Would you use the same
13 test pits?

14 DR. WISSA: Not necessarily. I haven't
15 studied it sufficiently to be able to tell you yes or
16 no. I'd have to look to see that it is
17 representative, and if it is, I'd probably use the
18 test pits. But again, I don't know if they -- they
19 probably have been filled back in, which would make it
20 more difficult to get virgin material, because you
21 wouldn't leave them open for safety reasons.

22 MS. CHANCELLOR: So if you were hired by
23 PFS, you would start by collecting soil samples. Is
24 that correct?

25 DR. WISSA: Of sufficient quantity to

1 complete the program, yes.

2 MS. CHANCELLOR: And then what would be
3 the next step in your program?

4 DR. WISSA: Well, I think my program very
5 much follows what the SAR says. I think maybe in
6 essence it would be implementing that program, maybe
7 in a little more detail, and with more -- looking at
8 more variables.

9 MS. CHANCELLOR: The problem I have with
10 the SAR, it is very short on detail. Would you first
11 do Index Property Testing?

12 DR. WISSA: Yes, I would obviously do
13 Index Property Testing.

14 MS. CHANCELLOR: And then what would be
15 the next areas of -- I'd like to take us through step
16 by step, the entire suite of tests that you would
17 conduct at the PFS site, starting with collection of
18 soil samples. What would be the next step?

19 DR. WISSA: The first step, as you said,
20 would be Index Testing. What that does, allows you to
21 determine the variability of the soils that are going
22 to be stabilized over the entire site, or where we're
23 going to be using Soil Cement or Cement-treated Soil.
24 Once you have that, then you would want to determine
25 how many different type materials need to be

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 investigated based on variability, and that's where
2 the classification or index tests come in useful.

3 Once you have that, you start designing
4 your Soil Cement Mix, and that involves adding
5 different amounts of cement to the range of soils, so
6 you may have three, four, five different soils which
7 will be used, and you'd want to determine how the
8 soils respond to cement stabilization. And from that,
9 once you get a mixed design, if you want, for each
10 soil, then you'd go through varying the cement content
11 and determining how they perform as far as durability,
12 as far as strength and modulus.

13 MS. CHANCELLOR: Now with respect to
14 collecting samples in the Index Test, how long do you
15 anticipate that would take?

16 DR. WISSA: Well, collecting samples, I
17 would say a week in the field should be enough to
18 collect all the samples, provided you have a back-hoe
19 or something to be able to help you collect samples.
20 Then the Index Tests don't take very long. You're
21 speaking by the time you ship the sample and so on,
22 maybe a couple of weeks.

23 MS. CHANCELLOR: And then designing the
24 Soil Cement Mix, getting the correct proportion of
25 cement?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 DR. WISSA: Well, maybe I can simplify
2 things for you. Making it down date by day is
3 difficult. My estimate would be six months, to eight
4 or nine months to complete the whole testing program.

5 MS. CHANCELLOR: So after you design the
6 Soil Cement Mix, and you get three to five soils, you
7 do durability tests, moisture density tests?

8 DR. WISSA: Well, you start by doing
9 moisture density. You also have to look at, in this
10 case, modular, the modulus, because that's a criteria
11 for the case of the Cement-treated Soil. There's no
12 point testing a soil as a Cement-treated Soil if it's
13 too strong. In those cases, for example, you're more
14 interested in modulus and strength versus durability
15 because they're not going to be subjected to climatic
16 conditions, since they are much deeper down, and
17 they're protected by the layers above them, so they're
18 not going to be subjected to environmental conditions
19 that the Soil Cement will be.

20 So each case is slightly different as far
21 as, you have two things you're looking at. You have
22 the Soil Cement, and you have the Cement-treated
23 Soils, and each one has its own program.

24 MS. CHANCELLOR: And would they overlap at
25 times? Is durability testing the only difference

1 between the tests for the Soil Cement and the Cement-
2 treated Soil?

3 DR. WISSA: They overlap in as much as the
4 same properties you'd be looking at, with the one
5 exception, which is the durability aspect of it.

6 MS. CHANCELLOR: And how long do you
7 anticipate that the Bond Testing Program would take?

8 DR. WISSA: The which?

9 MS. CHANCELLOR: The Bonding, the DeGrob
10 Bonding Type Test?

11 DR. WISSA: Well, that would have to come
12 after you've got a mixed design or designs, because it
13 may be more than one soil involved, and therefore,
14 there may be more than one cement content, and
15 moisture conditions, and compaction conditions. But
16 once -- you'd have to have those established before
17 you go into the Bond Testing Program.

18 MS. CHANCELLOR: And how long do you
19 anticipate the Bond Testing Program would take?

20 DR. WISSA: Well, probably a couple -- two
21 to three months because you have to cure your samples
22 beforehand, and then run the test.

23 MS. CHANCELLOR: So with respect to AGECE,
24 you'd only use the data as background information and
25 you would not rely on any of the work they had done to

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 date?

2 DR. WISSA: I don't know if it's
3 background. It's a piece of data which would be
4 considered in guiding me. The work done to date --
5 any data is helpful about the site. So, for example
6 all index tests would help me determine the
7 variability of soils and be able to help me select
8 soils to do, what I consider, the more extensive
9 program. When I say index tests, I mean
10 classifications tests.

11 MS. CHANCELLOR: I'd like to talk for a
12 moment -- turn for a moment to specifics of the PFS
13 site, and just what's involved with Soil Cement.

14 I'd like to have marked as State's Exhibit
15 212, this is an enlargement of PFS SAR Figure 4.2-7.
16 I believe the entire exhibit is already in the record,
17 but this may help us through our discussion.

18 (State's Exhibit 212 marked for identification.)

19 MR. TRAVIESO-DIAZ: What State exhibit
20 number is this?

21 MS. CHANCELLOR: 212.

22 MR. TRAVIESO-DIAZ: Ms. Chancellor, so the
23 record is clear, this exhibit is a portion of the
24 figure?

25 MS. CHANCELLOR: Yes, it is. It's a

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 portion of Figure 4.2-7, and it has been enlarged
2 about 120 percent, I think. It's a portion of the
3 figure, and it show -- Mr. Trudeau and Dr. Wissa, are
4 either of you familiar with this figure?

5 MR. TRUDEAU: Yes, I am.

6 MS. CHANCELLOR: And does this show a
7 three foot thick concrete storage pad?

8 MR. TRUDEAU: I'm sorry. I didn't
9 understand the first part of that question.

10 MS. CHANCELLOR: Does the top rectangular
11 box, if you will, or top rectangle on the -- the
12 rectangle on the top of the exhibit, does this -- does
13 a certain portion of that show a three foot thick
14 concrete pad?

15 MR. TRUDEAU: Yes, that's correct.

16 MS. CHANCELLOR: And then under that, is
17 there two feet of Cement-treated -- a maximum of two
18 feet of Cement-treated Soil?

19 MR. TRUDEAU: That is correct.

20 MS. CHANCELLOR: : And so there's a total
21 depth of approximately five feet?

22 MR. TRUDEAU: That is correct.

23 MS. CHANCELLOR: And then around the pads,
24 starting at the top where you've got the little
25 circles, is that aggregate, compacted aggregate?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. TRUDEAU: That is correct.

2 MS. CHANCELLOR: And then below is the
3 four foot -- two foot eight layer of Soil Cement?

4 MR. TRUDEAU: Two foot four inch.

5 MS. CHANCELLOR: Isn't there four inches
6 of gravel, and then two foot eight inches of --

7 MR. TRUDEAU: No, it's eight inches of
8 gravel, and --

9 MS. CHANCELLOR: Oh, eight inches. Oh,
10 you're right, and two foot four. And then below that,
11 is there two feet of Cement-treated Soil?

12 MR. TRUDEAU: That is correct.

13 MS. CHANCELLOR: So the Cement-treated --
14 is it correct that the Cement-treated Soil extends
15 both under the pads and under the Soil Cement?

16 MR. TRUDEAU: That's the intent, yes.
17 It'll be easier to construct it that way.

18 MS. CHANCELLOR: So at the sides, you've
19 also got a total depth of five feet.

20 MR. TRUDEAU: That is correct. The key,
21 however, is that the Cement-treated Soil under the
22 pads is the key to this design.

23 MS. CHANCELLOR: And what are the
24 restrictions, if any, that Holtec in its Cast Tip-over
25 Analysis have placed on the pads and the soil

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 treatment with cement?

2 MR. TRUDEAU: The Cast Tip -- because of
3 the Cast Tip-over Analysis, the Cement-treated soil
4 under the pads needs to be -- needs to provide a
5 modulus of elasticity that is less than 75,000 PSI.
6 And to provide sufficient shear resistance to sliding
7 forces, to obtain our factor of safety for sliding
8 greater than 1.1, that material needs to provide an
9 unconfined compressor strength of at least 40 PSI.

10 MS. CHANCELLOR: And has Holtec --

11 CHAIRMAN FARRAR: Now, Ms. Chancellor, let
12 me have that read back, please, that answer.

13 (Answer read back.)

14 CHAIRMAN FARRAR: Okay.

15 JUDGE LAM: Mr. Trudeau, assuming you
16 believe in some of the testimony offered before this
17 licensing board which were, one, sliding may actually
18 be beneficial in terms of earthquake hazard. Two,
19 that the factor of safety of 1.1 may not be binding on
20 the applicant. Assuming you believe that, then you
21 would need the Cement-treated Soil underneath the pad.
22 Is that correct?

23 MR. TRUDEAU: That is correct.

24 JUDGE LAM: Okay. Thank you.

25 CHAIRMAN FARRAR: Go ahead, Ms.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 Chancellor.

2 MS. CHANCELLOR: Mr. Trudeau, will there
3 be any surfacing over the eight inches of compacted
4 aggregate?

5 MR. TRUDEAU: You mean like an asphalt
6 surface?

7 MS. CHANCELLOR: Right.

8 MR. TRUDEAU: That's not intended.

9 MS. CHANCELLOR: Okay. Modulus of
10 elasticity, is that also sometimes refer -- is that
11 the same thing as Young's modulus?

12 MR. TRUDEAU: That is correct.

13 CHAIRMAN FARRAR: Ms. Chancellor, if
14 you're going to shift to a new subject, this might be
15 a good point for a mid-morning break.

16 MS. CHANCELLOR: Always ready for a break,
17 Your Honor.

18 CHAIRMAN FARRAR: It's just about 11, just
19 before 11. Let's come back at 11:15.

20 (Off the record 10:58 - 11:18 a.m.)

21 CHAIRMAN FARRAR: All right. We're back
22 on the record for the State to continue its cross
23 examination. Oh, by the way, if we cannot secure a
24 video conference, would the -- and assuming the State
25 loses its argument that we should not have Dr. Singh,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 is teleconference all right?

2 MS. CHANCELLOR: Yes, that's fine, Your
3 Honor, provided that Dr. Singh has a copy of the
4 document with him.

5 CHAIRMAN FARRAR: All right.

6 MR. TRAVIESO-DIAZ: I'll make the point
7 that Ms. Chancellor hasn't raised the argument yet.
8 She's thinking on it.

9 MS. CHANCELLOR: Yes, I'm mulling it over,
10 Your Honor.

11 CHAIRMAN FARRAR: All right.

12 MS. CHANCELLOR: So there may be nothing
13 to lose.

14 CHAIRMAN FARRAR: Okay.

15 MS. CHANCELLOR: Are we ready, Your Honor?

16 CHAIRMAN FARRAR: Yes. And in terms of
17 privacy of conversations, we have a mute button up
18 here for our microphones, but these are sound
19 activated. As I understand it, you cannot turn your's
20 off, so you have to push them away from you if you
21 don't want to be heard.

22 Go ahead, Ms. Chancellor.

23 MS. CHANCELLOR: Mr. Trudeau, is it
24 correct that PFS will not be -- that the top layer of
25 soil at the PFS site would either have to be used in

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 some way, or carted off-site?

2 MR. TRUDEAU: I don't think that that's
3 correct. It would need to be replaced, so whether it
4 was carted off-site, it's more logical and likely that
5 it would be used for landscaping on site, create berms
6 or something like that, rather than hauled off some
7 place.

8 MS. CHANCELLOR: But PFS needs to do
9 something with that surficial layer of material. Is
10 that right?

11 MR. TRUDEAU: That's correct.

12 MS. CHANCELLOR: And how thick is that
13 surficial layer?

14 MR. TRUDEAU: How?

15 MS. CHANCELLOR: How thick?

16 MR. TRUDEAU: Thick?

17 MS. CHANCELLOR: Thick.

18 MR. TRUDEAU: On the order of three feet,
19 plus or minus.

20 MS. CHANCELLOR: And is it correct that
21 you have described this layer as an Eolian Silt?

22 MR. TRUDEAU: That's correct.

23 MS. CHANCELLOR: Could you describe how
24 Eolian Silts are deposited, and their general geologic
25 characteristics?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. TRUDEAU: Eolian Silts are deposited
2 as windblown deposits, and they're typically non-
3 plastic silts, but they can vary in grain size
4 characteristics. Typically, they're uniform sized
5 particles.

6 At the site here, these soils are slightly
7 plastic, likely due to chemical decomposition through
8 the years, in my estimation. Some of them are,
9 indeed, non-plastic, as have shown up in the Index
10 Property Test, and some of them have slight
11 plasticity.

12 MR. TRAVIESO-DIAZ: Ms. Chancellor, if you
13 don't mind, could I ask the witness to clarify what he
14 means by plastic?

15 MS. CHANCELLOR: Certainly.

16 MR. TRUDEAU: Clay soils have different
17 degrees of plasticity. It's the stickiness of the
18 clay soils, I guess, and non-plastic soils lack this
19 cohesion that's caused by the clay sized particles.

20 MS. CHANCELLOR: And is it true that the
21 Eolian Silts at the PSF site are not -- there's not --
22 is there one predominant grain size in those Eolian
23 Silts?

24 MR. TRUDEAU: I don't know if that's
25 correct.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MS. CHANCELLOR: Do you know whether the
2 Eolian Silts contain a large amount of clay?

3 MR. TRUDEAU: As I just said, I -- some of
4 them do contain some clay. That's what the plasticity
5 is derived from.

6 MS. CHANCELLOR: And how does -- how would
7 -- if you have some areas of highly plastic soil, what
8 does that do with respect to the Soil Cement Mixtures?

9 MR. TRUDEAU: Well, that goes to the
10 number of tests that Dr. Wissa was referring to
11 earlier, the variability of the soils. And, hence, is
12 the need for doing these Classification Tests. One of
13 those Classification Tests is the Attenberg Limits
14 Test that measures the amount of plasticity, and the
15 higher the degree of plasticity, typically the more
16 cement you would need to achieve a certain compressive
17 strength.

18 Our goal would be to use the less plastic,
19 the more non-plastic soils where we need a durable
20 Soil Cement Mixture, because that'll give us a better
21 quality product.

22 MS. CHANCELLOR: Will you be able to
23 distinguish plastic from non-plastic soils when you're
24 excavating the site?

25 MR. TRUDEAU: This can be determined by a

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 visual classification technique, yes. So the soils
2 can be stockpiled according to them.

3 MS. CHANCELLOR: And if you did get some
4 plastic soils within the Eolian Silts, isn't it true
5 that you would then have problems meeting Young's
6 Modulus, and as well as obtaining the 40 PSI
7 compressive strength?

8 MR. TRUDEAU: That particular material is
9 going to be required only directly under the pads. It
10 will be used elsewhere, but its 40 PSI limit, and its
11 75,000 PSI limit is really only of significance and
12 concern directly under each of the pads, so there's a
13 relatively small volume of, let's call it preferred
14 silt-like, you know, Eolian Silt material that we need
15 to have available directly under the pads.

16 MS. CHANCELLOR: And there are 500 pads.
17 Correct?

18 MR. TRUDEAU: That's correct.

19 MS. CHANCELLOR: So is it correct to say
20 that you really can't at this stage say that the
21 Eolian Silts blanket in a horizontal plain the entire
22 99 acre pattern placement area?

23 MR. TRUDEAU: I'm not sure that's fair,
24 because we've seen it in all the borings, and we can
25 see similar soil behavior-types in the Cone

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 Penetration Tests that were done across the site. The
2 thickness near surface varies depending on where it
3 may have been eroded by wind, or perhaps surface water
4 in the past, but typically, it's found in all of the
5 investigations.

6 MS. CHANCELLOR: Typically what is found?

7 MR. TRUDEAU: The Eolian Silt layer at the
8 surface.

9 MS. CHANCELLOR: I'd like to have handed
10 out and mark as State's Exhibit 213. This exhibit
11 consists of a cover letter from AGECE dated March 27,
12 2001, two-page letter, and four pages of test results.
13 Table One, Summary of Laboratory Testing.

14 CHAIRMAN FARRAR: All right. The court
15 reporter will mark that as State 213 for
16 identification.

17 (State's Exhibit 213 marked for identification.)

18 MS. CHANCELLOR: Mr. Trudeau, are you
19 familiar with this Summary of Laboratory Testing,
20 Table One on State's Exhibit 213?

21 MR. TRUDEAU: Yes.

22 MS. CHANCELLOR: If you look at the far
23 right hand column called "Soil Classification" --
24 first of all, are these -- is the Summary of
25 Laboratory Testing in State's Exhibit 1, is this a

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 summary of testing done by AGECE at the PFS site?

2 MR. TRUDEAU: Yes, it is.

3 MS. CHANCELLOR: So these are site
4 specific PFS soils. Is that correct?

5 MR. TRUDEAU: That's correct.

6 MS. CHANCELLOR: And in the soil -- and at
7 what depth are these soils taken?

8 MR. TRUDEAU: They're taken at various
9 depths, as indicated in the depth column on the left
10 hand side.

11 MS. CHANCELLOR: So they range from zero
12 to six feet?

13 MR. TRUDEAU: That's correct.

14 MS. CHANCELLOR: And the second entry at
15 two to four feet, it's got Elastic Silt MH. Is this
16 a plastic soil?

17 MR. TRUDEAU: Yes.

18 MS. CHANCELLOR: One, two, three, the
19 fourth entry at zero to two feet, fat clay with sand
20 CH. Is this also considered a plastic soil?

21 MR. TRUDEAU: Yes.

22 MS. CHANCELLOR: If you go down to one,
23 two, three, four, five, six, seven, the eighth entry
24 taken at two to four feet, elastic silt MH. Is this
25 a plastic soil?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. TRUDEAU: Yes.

2 MS. CHANCELLOR: And third from the
3 bottom, taken at two to four feet, fat clay CH. Is
4 this also plastic?

5 MR. TRUDEAU: Yes.

6 MS. CHANCELLOR: So would anything with an
7 MH or CH be a plastic soil?

8 MR. TRUDEAU: Yes.

9 MS. CHANCELLOR: If you look on the second
10 page of the four entries there that are either CH or
11 MH, the first --

12 MR. TRUDEAU: Yes. Three of them two to
13 four foot deep samples. The other one is at zero to
14 two foot deep sample.

15 MS. CHANCELLOR: And on page five of
16 State's -- page five of Table One, are there five
17 entries there with an MH or CH classification?

18 MR. TRUDEAU: I see one from a depth of
19 four to six feet, two from a depth of four to six
20 feet, one from a depth of zero to two feet, and
21 another one from a depth of four to six feet, and
22 another one from a depth of four to six feet.
23 Clearly, in my estimation, the four to six foot deep
24 samples are the upper Bonneville Clay, and the
25 shallower ones would be more representative of the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 Eolian Silt.

2 Now even for those in the zero to two foot
3 range, those samples were obtained in the lower
4 quadrant, the TP-1 through 4, in six inch increments
5 going down, so even if it showed up there as zero to
6 two feet, it could have been at the lower part of that
7 depth range, and still it could have ended up being
8 the upper Bonneville Clay deposit, rather than the
9 Eolian Silt.

10 MS. CHANCELLOR: If you look on page six
11 of Table One, in TP-14, at zero to two feet, we've got
12 another plastic clay showing up there. Is that
13 correct? Plastic soil showing up there, is that
14 correct?

15 MR. TRUDEAU: That's correct.

16 MS. CHANCELLOR: And at zero to two feet,
17 third from the bottom, is another plastic clay,
18 plastic soil?

19 MR. TRUDEAU: That's correct.

20 MS. CHANCELLOR: And second to the end,
21 two to four feet, another plastic soil. Right?

22 MR. TRUDEAU: That's correct.

23 MS. CHANCELLOR: So it's fair to say that
24 the Eolian Silts are not uniform.

25 MR. TRUDEAU: Some of them may have some

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 plasticity, yes. Some of these samples may not be
2 representative of the Eolian Silt.

3 MS. CHANCELLOR: Well, now when -- if and
4 when Dr. Wissa comes on board, is that right?

5 MR. TRUDEAU: Well, that's why we do these
6 tests, to find out how to categorize the soils, and to
7 see which ones to put different percentages of cement
8 into.

9 MS. CHANCELLOR: Do you know whether
10 sulfates are present in any appreciable quantities in
11 the Eolian Silts at the PSF site?

12 MR. TRUDEAU: We have measured sulfates in
13 some of the sample. And typically, the results for
14 the zero to two foot depth samples show minimal
15 sulfates. We did have two specimens that I believe
16 were in the Bonneville Clay layer at two to four foot
17 depth, that had higher amounts of sulfates, in the
18 order of 13,000 parts per million, I believe.

19 MS. CHANCELLOR: Thirteen eight, does that
20 sound right? Thirteen thousand eight hundred PPM?

21 MR. TRUDEAU: That's around 13,000. Yes.

22 MS. CHANCELLOR: Dr. Wissa, any --

23 CHAIRMAN FARRAR: Ms. Chancellor, before
24 you leave that, just so the record is clear, what do
25 these various abbreviations stand for?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. TRUDEAU: The MH is high plasticity
2 silt. ML is a low plasticity --

3 CHAIRMAN FARRAR: MH means?

4 MR. TRUDEAU: Silt. It's not an acronym.

5 MR. SILBERG: It's phonics.

6 CHAIRMAN FARRAR: It's phonics, so I
7 shouldn't try to figure out what MH stands for.

8 MR. TRUDEAU: I don't know what the M
9 stands for. The H is high, and the L is low.

10 CHAIRMAN FARRAR: Okay. At some point,
11 someone can put this on the record for us, but the H
12 and the L are high and low?

13 MR. TRUDEAU: For plasticity, yes.

14 CHAIRMAN FARRAR: Okay. The Cs do mean
15 clays.

16 MS. CHANCELLOR: Your Honor, Dr. Mitchell
17 has the answer is you want to do it now, or I can ask
18 him on redirect.

19 CHAIRMAN FARRAR: Ask him on redirect.

20 MS. CHANCELLOR: Okay. Dr. Wissa, would
21 any program that you anticipate developing for the PFS
22 site, will that include Sulfate Testing?

23 DR. WISSA: Yes.

24 MS. CHANCELLOR: And how will you test for
25 sulfates?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 DR. WISSA: I'm not sure of the actual
2 procedure off-hand. I think it's a Titration Test, a
3 color change test, to determine sulfates, but I
4 couldn't swear to that. Wait a minute. There may be
5 a -- I believe there may be a specific electrode you
6 can use too for it. I'm not a chemist, so I don't
7 know the exact procedure, but you would -- you're
8 looking at the soil for sulfates, and it's not a very
9 complicated test. I know that.

10 MS. CHANCELLOR: Dr. Wissa, how in the
11 field would you anticipate excluding either Bonneville
12 Clays, Sulfate material, or plastic soils, how would
13 you exclude those from the mix that goes into the
14 Cement-treated Soil that will be beneath the pads?

15 DR. WISSA: The -- first of all, to
16 differentiate between a highly plastic soil, and a low
17 plasticity or non-plastic soil, there's a standard
18 visual procedure which by feel, so anyone with
19 experience can classify highly plastic materials from
20 low plasticity materials, or granule materials.
21 That's a fairly simple thing that anyone who has done
22 any geotechnical engineering, even our undergraduates,
23 are given that test to classify soils visually.

24 MS. CHANCELLOR: Would a contractor be
25 able to classify such material over a 99 acre site?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealrgross.com

1 DR. WISSA: The contractor usually has
2 engineers on site, and in addition, I would assume
3 that the owner would have representatives for quality
4 control and quality assurance who would be there to
5 supervise the work. You don't leave a contractor on-
6 site on his own without supervision and monitoring.
7 My company does a lot of this type of work, and we
8 have people who essentially are there during
9 construction to make sure the right materials are
10 excavated, stockpiled and placed, so in a job like
11 this I would see a lot of people on site.

12 In addition, you would have an on-site
13 laboratory to do testing, so if there's any debate or
14 question, you would probably have it sent to the
15 laboratory. But generally, I'd say it's a fairly
16 simple way to identify highly plastic CH Clays, let's
17 say, from silt. It doesn't take an expert to do that.

18 MS. CHANCELLOR: But getting back to how
19 many people you have on-site, and whether you have an
20 on-site lab, a lot of that gets down to dollars, the
21 cost. Isn't that true?

22 DR. WISSA: No, it isn't true. I think it
23 comes down to what you expect as quality of work
24 finally, and it's inherent in the cost of any project.
25 I mean, I don't think any reputable engineer would

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 sign-off on a project without having representation
2 on-site during construction.

3 MS. CHANCELLOR: What about an on-site
4 lab?

5 DR. WISSA: Depending on the size of the
6 project, it's more efficient usually having a -- for
7 this size project, I'd say it's taken -- and usually
8 the contractor may supply the facilities that an
9 engineer can use, or the engineer may put it on, so
10 this is not an out-of-the-ordinary situation.

11 MS. CHANCELLOR: But that assumption is
12 based on the assumption that there would be quality
13 assurance people on-site, that there'd be sufficient
14 lab testing. That's based on your -- on the quality
15 of work that you would expect from yourself. Right?
16 If some other contractor -- if some other person did
17 this, such as AGECE, you don't know what they would
18 require.

19 DR. WISSA: They're not the design
20 engineers. They're a testing lab, so that isn't it up
21 to them to make a decision on this.

22 MS. CHANCELLOR: You're correct.

23 DR. WISSA: The person who makes the
24 decision is the owner. And usually, I don't know
25 about with NRC, but in other fields where we have to

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 get permitting, it becomes a requirement of the permit
2 condition, is to have this quality assurance program,
3 and quality control program as part of the conditions
4 of a permit, so I would assume that in this case you
5 would have conditions requiring these -- this type of
6 testing program.

7 MS. CHANCELLOR: You've used the term
8 "owner". Who are you referring to?

9 DR. WISSA: Well, the owner, I suppose, is
10 the applicant in this case.

11 MS. CHANCELLOR: Private Fuel Storage.

12 DR. WISSA: Right.

13 MS. CHANCELLOR: And are you aware of any
14 NRC requirements with respect to PFS' proposed Soil
15 Cement Program, not just testing, testing through
16 construction. Are you aware of any NRC requirements?

17 DR. WISSA: I'm not familiar with any of
18 the requirements of NRC.

19 MS. CHANCELLOR: Now in terms of how you
20 would actually prepare the site, would the first thing
21 you'd do would be to excavate the surficial layer. Is
22 that correct?

23 But that assumption is based on the
24 assumption that there would be quality assurance
25 people on site, that there would be sufficient lab

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 testing that's based on the quality of work that you
2 would expect from yourself. Right? If some other
3 person did this such as AGECC, you don't what they
4 would require.

5 DR. WISSA: They are not the design
6 engineers. They are testing that so that isn't up to
7 them to make a decision on this. The person who makes
8 the decision is the owner. Usually I don't know about
9 with the NRC but in other fields where we have to get
10 firmity it becomes a requirement of the firmite
11 condition to have this quality assurance program and
12 quality control program as part of the conditions of
13 a permit. So I would assume in this case you would
14 have conditions requiring this type of testing
15 program.

16 MS. CHANCELLOR: You have used the term
17 "owner." Who are you referring to?

18 DR. WISSA: The owner I suppose is the
19 Applicant in this case.

20 MS. CHANCELLOR: Private fuel storage.

21 DR. WISSA: Right.

22 MS. CHANCELLOR: Are you aware of any NRC
23 requirements with respect to PFS's proposed soil-
24 cement program? Not just testing but testing through
25 construction, are you aware of any NRC requirements?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 DR. WISSA: I'm not familiar with any of
2 the requirements of NRC.

3 MS. CHANCELLOR: Now in terms of how you
4 would actually prepare the site, the first thing you
5 would do would be to excavate the surficial layer. Is
6 that correct?

7 DR. WISSA: No.

8 MS. CHANCELLOR: Okay.

9 DR. WISSA: There are a lot of steps
10 involved. A lot of this is left to the discretion of
11 the contractor how he proceeds. The only area where
12 if I were an advisor or consultant on the program
13 would do is prevent a contractor from doing certain
14 things which may impair or promote performance at the
15 site.

16 The first thing you would do is remove any
17 vegetation at the surface. You would not expose the
18 whole site. You would do it in very small steps
19 because we're concerned about disturbing underlying
20 foundation soil. I think it can be left up to the
21 contractor to some extent but there would be a lot of
22 restrictions on what he could or could not do. I
23 would assume in the bidding process of selecting a
24 contractor the owner would give some of these
25 constraints on what he can and cannot do in general

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 terms. But if it would be up to the discretion of the
2 contractor on how he implements it.

3 MS. CHANCELLOR: What type of experience
4 would a contractor need to insure that the
5 specifications or performance that you would require
6 could be brought to fruition?

7 DR. WISSA: I think that any contractor
8 who has a lot of experience in earth moving, highway
9 contractors, would be able to implement a program like
10 this.

11 MS. CHANCELLOR: So what size area would
12 you begin excavating?

13 DR. WISSA: I cannot answer that question
14 because it's a function of all phases. It depends on
15 what is the production of soil-cement today would be.
16 I can't answer that question until I know how big I
17 assume it's going to be a central plant mixing what is
18 its capacity in producing soil-cement.

19 You wouldn't want to expose a lot of area
20 where you wouldn't be able to place a soil-cement down
21 in a reasonable amount of time. You wouldn't want to
22 leave several months open while you are producing the
23 soil-cement modified soil. It would be done in
24 stages. The bottleneck or the critical part I think
25 will depend on what equipment and what facilities the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 contractor has.

2 MS. CHANCELLOR: Why do you assume that
3 there would be a centralized plant?

4 DR. WISSA: I would think that it's the
5 most practical way to do it. It also helps with the
6 quality control because you would stock pile your
7 material. A lot of your concerns about variability
8 and so on, it gives you more lead time to be able to
9 stock pile suitable materials.

10 MS. CHANCELLOR: What do you mean by a
11 centralized plant?

12 DR. WISSA: You have two or three ways you
13 can produce soil-cement. One is what they call on-
14 site where you would take the soil, windrow it
15 possible, mix it with cement and then take that
16 windrow mixed with cement and put it back wherever you
17 want to stabilize it.

18 The other one is take material and take it
19 to a central plant, one area where you have a plant
20 which has control. The cement is in silos in the
21 plant. The feeding system is mechanical. It feeds
22 the amount of cement in and moisture count is
23 controlled.

24 So it's more automated. It's something
25 like a concrete plant where you produce concrete.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 There you would produce your soil-cement and then haul
2 it to where you want to place it. So it's a much more
3 controlled environment.

4 MS. CHANCELLOR: Would that be on-site or
5 off-site?

6 DR. WISSA: It would be on-site.

7 MS. CHANCELLOR: So your recommendation to
8 PFS would be to build a centralized or mechanized
9 plant?

10 DR. WISSA: I think the contractor would
11 opt to do that to be competitive.

12 MS. CHANCELLOR: So this would be left to
13 the bidding process.

14 DR. WISSA: It's left to the bidding but
15 I think any contractor would obviously look at the
16 option and probably take it. I don't think he would
17 be competitive. There are several reasons as far as
18 I'm concerned. It would pretty much definitely be an
19 on-site plant.

20 MS. CHANCELLOR: But if you were writing
21 the specifications for the construction program, would
22 you require a centralized plant?

23 DR. WISSA: No, I would leave it up to the
24 discretion of the contractor but we'd have to
25 determine what he's going to do and if he meets our

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 qualifications. He may want to use this as a batch
2 process rather than a continuous process.

3 There are a lot of flexibilities in how
4 you produce soil-cement. In this case a batch process
5 may be practical. By that is you put it in batches
6 rather continuous because they are relatively small
7 areas of stabilizing at one time.

8 So it's very difficult for me to
9 predetermine how he is going to do it. I think I'm of
10 the opinion that any contractor should be given the
11 flexibility to come up with the best solution to
12 achieving what we want.

13 MS. CHANCELLOR: Are you aware of how many
14 storage pads that will at PFS?

15 DR. WISSA: Not exact number but I know
16 there are a lot of them.

17 MS. CHANCELLOR: Let's just say for
18 argument sake there will be 500 of them. Do you know
19 whether PFS intends to construct those 500 pads
20 continuous?

21 DR. WISSA: No, I don't know that.

22 MS. CHANCELLOR: Would it make any
23 difference to you if the facility was constructed in
24 stages?

25 DR. WISSA: If you are going to construct

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 10 pads at a time, yes. But when you get to 50 or 100
2 pads at a time, I think that no the approach would
3 probably be the same.

4 MS. CHANCELLOR: How would you insure
5 consistency and quality over say a five or ten year
6 construction period?

7 DR. WISSA: I don't understand the
8 question as far as whether it's five years or ten
9 years. Can you explain that?

10 MS. CHANCELLOR: Let me preface it with
11 this. If PFS were to first construct a quarter of the
12 500 pads and wait until they got enough fuel to store
13 on those pads and then constructed a quarter more of
14 the 500 and then finally constructed the remainder of
15 the facility, assuming that were the case and you
16 really don't know how long that would take, it may
17 take five years, ten years, longer. Given the
18 uncertainty and the construction period for now, how
19 you would insure consistency and quality over such an
20 extended construction period?

21 DR. WISSA: I don't see the relevance.
22 Let me try and answer the question if I understand it.
23 You prepare a set of specifications. You qualify
24 contractors. Then you supervise the construction. I
25 assume you do this for each phase. The fact that you

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 may not have the same contractor for all phases should
2 not impair the quality of a product as long as you
3 have a quality assurance process or program which is
4 enforced.

5 I think if anything what you will find is
6 the first phase you are going to be debugging your
7 problems and by the time it goes around you will have
8 learned from it. By the third time I think it will go
9 very smoothly. I think you gain experience as you go
10 through it and make some improvements and
11 modifications as you proceed. I don't see the fact
12 that it's done in three or four phases that you would
13 jeopardize the quality of product.

14 MS. CHANCELLOR: In other words, the end
15 result or the converse of getting experience would
16 also change the job in phase one. Is that right?

17 DR. WISSA: Throughout phase one I'm sure
18 there is going to be times when the contractor is
19 going to be -- Let me back off a bit. In any project
20 there is always a learning period. Learning to work
21 together is one. Getting familiar with the soils.

22 So there is always a learning period
23 between a contractor and the engineer with
24 communications and so on no matter how well you
25 prepare for it. There is always going to be that

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 learning period. At the beginning of any project you
2 don't start construction at full efficiency your first
3 week on-site. It takes some time before everyone
4 works as a team.

5 MS. CHANCELLOR: Now isn't it true that
6 PFS is relying on the strength of the underlying
7 Bonneville clays to resist sliding of the pad?

8 DR. WISSA: I believe so, yes.

9 MS. CHANCELLOR: And in your deposition
10 you stated that you would be concerned about a loss of
11 strength and therefore the clay ability to have the
12 shear resistance for lack of movement that PFS is
13 relying on. Do you recall that testimony?

14 MR. TRAVIESO-DIAZ: Excuse me. I think
15 you have to show it to the witness. It's not as
16 simple as yes or no.

17 DR. WISSA: I'd like to see it.

18 MS. CHANCELLOR: Certainly. The reference
19 is in the transcript of your deposition dated March 15
20 on page 17. Actually it's on pages 17 and 18. Let me
21 quote from it. It's on page 18, line 9. "I think to
22 answer you first of all I'm not much concerned about
23 settlements as about loss of strength and therefore
24 its ability to have a shear resistance for this
25 lateral movement which we are relying upon."

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. TRAVIESO-DIAZ: Ms. Chancellor, will
2 you repeat the question as well?

3 MS. CHANCELLOR: Certainly. The question
4 that starts at line 5, page 18 "But in terms of about
5 why you would worry about this, is it because if you
6 were to disturb the subgrade that it might be less
7 resistant in an earthquake?"

8 DR. WISSA: All right. What is your
9 question now about this?

10 MS. CHANCELLOR: My question is in the
11 excavation of the surficial layer what happens if that
12 surficial layer dips down into the Bonneville clays
13 how are you going to fill the area of the clays that
14 you may have to excavate? Am I clear?

15 DR. WISSA: No, I'm sorry.

16 MS. CHANCELLOR: That's okay. The
17 surficial layer of maybe silts or whatever they are
18 have to be removed. Is that correct?

19 DR. WISSA: That's my understanding. They
20 will be removed.

21 MS. CHANCELLOR: Will be removed.
22 Underneath that surficial layer is the next layer down
23 which is the Bonneville clays.

24 DR. WISSA: That's correct.

25 MS. CHANCELLOR: And that surficial layer

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 is not a straight horizontal line across the side.
2 It's not a flat pancake layer.

3 DR. WISSA: That's what I understand.

4 MS. CHANCELLOR: So you will need to
5 remove all of that surficial layer whether it's one
6 foot or four feet thick. Is that correct?

7 DR. WISSA: That's what I understand.

8 MS. CHANCELLOR: And in some instances the
9 surficial layer may actually dip into the Bonneville
10 clays in some areas. Is that correct?

11 DR. WISSA: May be deeper in some areas.

12 MS. CHANCELLOR: May be deeper. Right.

13 DR. WISSA: Yes.

14 MS. CHANCELLOR: And you need a level
15 site, right?

16 DR. WISSA: I'm not sure you need a level
17 site. Why do you need a level site?

18 MS. CHANCELLOR: Let me ask you. Would it
19 be necessary to maintain a certain elevation level --
20 Let me strike that question. Isn't it true that
21 Holtec on its cast tip over analysis has put a
22 constraint of the depth of cement-treated soil under
23 the storage pad?

24 DR. WISSA: I think that's correct. You
25 may want to ask Paul Trudeau or somebody else but I

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 believe it's correct.

2 MS. CHANCELLOR: Mr. Trudeau, isn't it a
3 minimum of one foot and a maximum of two feet for
4 cement-treated soil under the storage pads.

5 MR. TRUDEAU: That's the design. Correct.

6 MS. CHANCELLOR: With respect to the
7 Bonneville clays, what is PFS's plan if the sufficient
8 material is deeper in some parts than the Bonneville
9 clays?

10 MR. TRUDEAU: There may be an area in the
11 southeastern corner of the site based on the
12 subsurface investigations that we've done today where
13 it may be necessary to fill in below one or more of
14 the pads to limit the cement-treated soil thickness to
15 two feet. In those areas we expect to place compacted
16 clay soils using a modified proctor compaction
17 requirement which is an increased compactive effort to
18 increase the density and decrease the void ratio of
19 these soils and hence increase their strengths. We
20 believe that we will be able to demonstrate in the
21 laboratory that we have strengths that exceed our
22 design value for that compacted clay soil.

23 MS. CHANCELLOR: Isn't it true that you
24 won't know the extent to which you will need to use
25 compacted clays until Dr. Wissa or somebody has

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 completed the index properties for the soils?

2 MR. TRUDEAU: The real proof is going to
3 be when we start excavating behind these pads and
4 where we find the upper Bonneville clay layer. If
5 it's deeper than two feet below the bottom of the pad
6 then that's an area where we will have to use this
7 compacted clay-soil.

8 MS. CHANCELLOR: Isn't it true that PFS
9 had not anticipated that there was some plastic salts
10 within the eolian silts?

11 MR. TRUDEAU: No, that's not true.

12 MS. CHANCELLOR: How will PFS use
13 compactive clays without disturbing the surrounding
14 clays?

15 MR. TRUDEAU: The surrounding clays would
16 be compacted when the compacted clay is placed on top
17 of it. These are soft Bonneville clays as applied
18 perhaps to some of the I-15 construction. These clays
19 are stiff clays. They're partially saturated. They
20 are 100 feet above the water table, 120 feet above the
21 water table up here in Skull Valley. So the potential
22 for remolding these due to this compaction effort is
23 very slight in my estimation not like would be the
24 case for a saturated soft clay.

25 MS. CHANCELLOR: So as part of PFS's

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 testing program is it correct then that you will
2 measure the strength and compressibility properties of
3 the remolded and compacted Bonneville deposits?

4 MR. TRUDEAU: That is correct.

5 MS. CHANCELLOR: Dr. Wissa, is that part
6 of any program that you are involved with or will be?

7 DR. WISSA: That doesn't have a direct
8 bearing on the source cement.

9 MS. CHANCELLOR: Whose program does this
10 come under, Mr. Trudeau?

11 MR. TRUDEAU: This is testing that needs
12 to be done. Logically it will be done as part of this
13 program that we're in discussion with Dr. Wissa about.

14 MS. CHANCELLOR: What else is there that
15 is not what Dr. Wissa would consider part of his slice
16 of this program? Are there other aspects of testing
17 other than the Bonneville deposits that need to be
18 tested?

19 MR. TRAVIESO-DIAZ: Does Dr. Wissa
20 understand the question?

21 MS. CHANCELLOR: I'm asking Mr. Trudeau.

22 MR. TRAVIESO-DIAZ: Yes, but I'm not sure
23 I understand the question myself. I wonder if the
24 witness does.

25 MS. CHANCELLOR: Do you understand the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 question, Mr. Trudeau?

2 MR. TRUDEAU: I understood you were asking
3 what types of tests are anticipated to be done yet.

4 MS. CHANCELLOR: Other than the ones that
5 Dr. Wissa has described and that I've described in the
6 essay with respect to the mixing of cement into soil.
7 Dr. Wissa stated that the compressibility properties
8 of remolded and compacted Bonneville deposits he
9 didn't anticipate that was part of his program. I'm
10 wondering if there is anything else --

11 DR. WISSA: Excuse me. I'm able to
12 correct that. I said that isn't a part of the soil-
13 cement program. I did give the owner some ideas about
14 evaluating the effects of what you are describing for
15 the clay soils for that stabilization as far as purely
16 testing.

17 MS. CHANCELLOR: Did you give the owner
18 ideas about anything else not relating to soil-cement
19 but anything else such as you did with the Bonneville
20 clays?

21 DR. WISSA: No, basically it's testing
22 programs.

23 MS. CHANCELLOR: So other than soil-cement
24 using that term generally and testing of the
25 Bonneville clays you haven't discussed any other test

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 with PFS. Is that correct?

2 DR. WISSA: To the best of my recollection
3 that is correct. Yes.

4 MR. TRUDEAU: May I add something to that?
5 We have discussed the possibility of doing some of
6 these rapid loading tests on these particular
7 compacted clay specimens as well just to demonstrate
8 this well known phenomenon that we've been discussing
9 in all these depositions and hearings. So that type
10 of testing is also discussed as part of these effort.

11 MS. CHANCELLOR: Does that include time
12 wise the compressibility of the Bonneville clays, the
13 rapid loading? Is the included in the six to eight
14 month program?

15 MR. TRUDEAU: Yes.

16 DR. WISSA: Yes.

17 MR. TRUDEAU: Compressibility is really
18 not the issue. It's the shear strength. It's the
19 compressive strength that we're concerned about. So
20 I'm not sure that it's fair to say yes to
21 compressibility but rather to the strength of the
22 test. The underling shear strength is what we're
23 trying to determine and especially for this particular
24 clay that may need to be compacted under one or more
25 of the paths perhaps demonstrating that we do indeed

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 have this dynamic component that we haven't measured
2 to date.

3 MS. CHANCELLOR: Dr. Wissa, in terms of
4 collecting soil samples, does the season of the year
5 make any difference when you start your program?

6 DR. WISSA: I'm not sure. I think if the
7 soils are frozen it will be hard to break up. But
8 since they are so dry it may be possible as a physical
9 problem. Other than that I don't think it should have
10 a major impact on soil.

11 MS. CHANCELLOR: Will the soils exhibit
12 different properties if you take samples in the winter
13 as opposed to the summer?

14 DR. WISSA: The surface soil, different
15 properties, no. Not different properties. When I say
16 properties let me correct what you mean by properties.
17 Can you define what you mean by properties?

18 MS. CHANCELLOR: Different shear strength
19 values.

20 DR. WISSA: At different times of the
21 year, yes. The surface soils in particular whether
22 let's say it's at the surface and it's just rained.
23 It's going to have a much weaker strength or it's
24 going to have a higher water content and so one. If
25 that rain now freezes, you are going to get soil which

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 is like a piece of rock, a piece of ice. So depending
2 on the time of the year and so on, yes you would have
3 a problem with it and its properties.

4 But when you take it back to the lab, most
5 of the soil samples would be collected and they would
6 be disturbed and mixed up so you aren't interested in
7 the existing properties on-site as far as the surface
8 soils. When you go down to depth at three feet or
9 more, the effect of different times of the year
10 probably would not have an effect because it isn't
11 susceptible to weather or the effect of climate.

12 In other words, as you go down deeper
13 climatic conditions do not change so if you go down
14 five feet, you would not find that your soil
15 conditions are going to change with seasonal times of
16 the year.

17 MS. CHANCELLOR: For the zero to two feet
18 surficial soils, will you have to collect samples at
19 different times of the year?

20 DR. WISSA: No, because those are the
21 soils which would be removed and reworked.

22 MS. CHANCELLOR: But you need to find out
23 the properties of those soils and test those soils
24 where you saw cement-treated soil program?

25 DR. WISSA: That's correct, yes. But

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 let's start by the index properties. Other than the
2 moisture content which is really not an index
3 property, the properties do not change. Let's say the
4 plasticity, the atomic limits and so on by what the
5 conditions of the soil are when you obtain it in the
6 field. So physical properties are inherent to the
7 soil independent of the season.

8 To answer your question, collecting those
9 samples when you collect them is irrelevant to the
10 results you are going to get from your index testing.
11 It has no bearing other than the natural moisture
12 content of the soil at the time you collected. That
13 has no real bearing on what you are trying to do.

14 MR. TRUDEAU: Might I add?

15 MS. CHANCELLOR: Certainly, Mr. Trudeau.

16 MR. TRUDEAU: The moisture content of the
17 near surface soils may indeed change through the
18 course of the year due to different climactic
19 conditions that prevail in Skull Valley. However any
20 differences in the moisture content of the soils as
21 received from the site whenever as part of the soil-
22 cement testing program will be measured. The mix will
23 have a certain optimum moisture content that needs to
24 be achieved.

25 When we get to the field and start

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 constructing the soil-cement, the moisture content of
2 the soils at that time needs to be measured and
3 factored into the optimum moisture content used to
4 compact these soils. Therein lies the efficacy of
5 having a batch plant to help control the resulting
6 product to make sure that we have the right amount of
7 moisture because it is important to the soil-cement
8 recipe so to speak.

9 MS. CHANCELLOR: Do you know Mr. Trudeau
10 whether PFS is committed to have a centralized batch
11 plant on-site at the PFS site?

12 MR. TRUDEAU: It is not my understanding
13 that there is a commitment to have a batch plant at
14 this time. But all of the discussions that I have
15 been party to, it's been clearly recognized that this
16 is likely to be the outcome for the reasons that Dr.
17 Wissa said earlier.

18 MS. CHANCELLOR: Dr. Wissa, how will
19 samples collected from the site be stored and
20 processed prior to lab testing?

21 DR. WISSA: How will they be stored and
22 processed?

23 MS. CHANCELLOR: Yes.

24 DR. WISSA: I would assume that they would
25 be processed if they come to us to our laboratory. As

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 far as how to handle it for the soil-cement treatment,
2 you would probably put them in containers and ship
3 them. I'm not sure how they would be shipped if it
4 would be by truck or whatever method.

5 So we would probably also take samples in
6 jars to prevent moisture contents change so as to get
7 a natural and situ moisture content. The bulk of the
8 sample would be sent probably without sealing it or
9 you may put them in plastic bags but you would
10 definitely take a small sample or several small
11 samples to determine moisture content with depth and
12 with location.

13 So you would have also these samples which
14 is standard procedure by the way when you do a program
15 especially when you seal up small samples. I'm
16 speaking about a glass container which is sealed with
17 a cap and may be three inches long and two inches in
18 diameter or something like that.

19 MR. TRUDEAU: Might I add that that's
20 exactly what we did on the test pits samples that we
21 took in the 16 test pits that we dug on-site. The
22 bulks of the samples went into five gallon buckets
23 that did have a cover but we weren't relying on that
24 cover to seal moisture into those samples.

25 We did also take a water content specimen

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 and seal it in a standard eight ounce olive type jar
2 that has a gasket on the cap to seal in the moisture.
3 We taped those caps to make sure that the moisture
4 stayed in the jar. And we tested those quickly upon
5 return to the lab.

6 MS. CHANCELLOR: So it's fair to say that
7 sample collection and handling and the procedures you
8 used are important with respect to the testing
9 program?

10 MR. TRUDEAU: I don't think that it's fair
11 to say that they are important in that regard because
12 the soil-cement mix doesn't depend on the condition of
13 the sample that it received that gets to the lab.
14 It's really a disturbed sample at that point. It gets
15 brought to the lab and gets mixed up as a bulk sample.

16 We measure gradations which are clearly
17 not affected by disturbance of these samples. The
18 only thing that's perhaps of interest to warrant some
19 additional handling is this moisture content thing.
20 That's not really part of the soil-cement design. But
21 as I said earlier whatever the moisture is in the soil
22 at the time that we mix the soil-cement needs to be
23 adjusted whether it's up or down to meet the optimum
24 moisture content that's being measured in the lab as
25 the correct soil-cement recipe.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MS. CHANCELLOR: Dr. Wissa, are samples
2 ever dried before index and compaction tests?

3 DR. WISSA: What we usually do is we do
4 both. We do them at natural moisture content and we
5 do them after drying. We don't oven dry. We air dry.
6 From that you run an the Atteberg limits at both. If
7 there is a difference due to dry then you would not
8 dry your samples.

9 So you always are concerned about the
10 possibility that drying may have an effect. In this
11 case where you have a very arid climate, the
12 probability of drying and I'm not speaking of oven
13 drying here because we wouldn't oven dry the samples,
14 air drying the samples having an influence on their
15 properties is unlikely. From the impression I get
16 this is not the case but we do always check that out.

17 MS. CHANCELLOR: On question 48 of your
18 testimony, you state that PFS will place cement-
19 treated soil in six inch lifts. Is that correct?

20 DR. WISSA: On page 48?

21 MS. CHANCELLOR: Question 48.

22 MR. TRUDEAU: It says approximately six
23 inches that's not --

24 DR. WISSA: Yes.

25 MS. CHANCELLOR: That's fine. Just

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 looking at this diagram on State's Exhibit 212, the
2 first thing in terms of this layering of cement-
3 treated soil, you will have the Bonneville clays at
4 the base. Correct?

5 DR. WISSA: Correct.

6 MS. CHANCELLOR: Then you need to, Dr.
7 Wissa, I believe you said use an epoxy bond in your
8 testimony responding to Mr. O'Neill. You said
9 something about epoxy bonds.

10 DR. WISSA: No, I was trying to explain
11 the difference between cohesion and friction.

12 MS. CHANCELLOR: I see.

13 DR. WISSA: When I spoke about the epoxy
14 bond.

15 MS. CHANCELLOR: How would you achieve a
16 bond between the Bonneville clays and the first six
17 inches compacted cement-treated soil?

18 DR. WISSA: That would established during
19 the laboratory testing program. In actual fact, you
20 may not need to treat. But if you do you have several
21 options. One would be to put either a dry cement or
22 either a cement slurry depending and this will be
23 determined during the laboratory program to get the
24 bonding you require.

25 The way you do that is you take a sample

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 of the clay. You would build a model if you want
2 having the top being the soil cement to modified soil
3 and in between the two you would do one test where you
4 would have no treatment on it. You may try dry
5 cement. On the third one you may use a cement slurry.
6 You shear these samples and make sure that if they all
7 failed through the parent material rather than at the
8 bond at the interface then they are acceptable. If
9 not, you would choose where the failure occurs within
10 the parent material rather than at the interface.

11 MS. CHANCELLOR: And anything that you use
12 for bonding couldn't change the Young's modulus of the
13 material to exceed 75,000 psi. Is that correct?

14 DR. WISSA: It is such a thin layer that
15 you are speaking about less than a millimeter a very
16 thin layer. It would have no measurable effect.

17 MS. CHANCELLOR: The second and third six
18 inch lifts would be less of cement-treated soil. Is
19 that correct? So you would then be up to eight
20 inches? If you are starting at the bottom and you
21 have the Bonneville clay and then you have three
22 widths of cement-treated soil, would you need to
23 establish a bond working from the bottom up between
24 the second and third lifts?

25 DR. WISSA: Yes. The program in vision

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 would look at the bonding between the clay foundation
2 and the soil cement or the modified soil cement.

3 MS. CHANCELLOR: The cement-treated soil?

4 DR. WISSA: The cement-treated soil. The
5 layer between the cement-treated soil layers, the
6 interface there and then finally between the cement-
7 treated soil layer and the concrete layer.

8 MS. CHANCELLOR: But would you have to
9 establish bonds at the interface between the various
10 six inch lifts of cement-treated soil? We've have a
11 sandwich. You have a bond between the Bonneville clay
12 and the first six inch layer. Then you have a bond is
13 that correct between the first and second six inch
14 layer of cement-treated soil?

15 DR. WISSA: That's correct and you go up
16 to --

17 MS. CHANCELLOR: Until you get to bottom
18 of the pad.

19 DR. WISSA: And at the bottom of the pad
20 you still need a bond between the bottom of the pad
21 and the cement-treated soil below it.

22 MS. CHANCELLOR: So you have three
23 different types of bonds that you need to test for and
24 determine whether they will perform to resist sliding
25 at the PFS site and still stay with in the 75,000 psi

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 Young's modulus.

2 DR. WISSA: Let me correct that. The bond
3 is going to have no effect on the Young's modulus
4 because it's such a thin layer that it's going to have
5 essentially no measurable effect on the Young's
6 modulus. What you are concerned about is the ability
7 to transmit shear stresses to prevent sliding between
8 those layers. So that's what you are mainly
9 interested in. I think the effect of having that thin
10 layer between is not going to affect the modulus's
11 plasticity or Young's modulus. I should mention that
12 during construction you will be able to still check
13 that you are still achieving a bond.

14 MS. CHANCELLOR: Now with respect to the
15 soil cement at the side of the pad, would you need to
16 establish a bond between the cement-treated soil that
17 extends out from under the pad and the bottom layer of
18 soil cement around the pad?

19 DR. WISSA: To my knowledge, no because
20 they are not relying on any lateral confinement due to
21 the stabilized soil-cement and the concrete pad.

22 MS. CHANCELLOR: Would you need to
23 establish a bond at the interface between the edge of
24 the three foot thick concrete pad and the soil cement
25 around the pad?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 DR. WISSA: Not to my knowledge, no.

2 MS. CHANCELLOR: How do you anticipate
3 that the cement-treated soil can be created that has
4 a maximum Young's modulus of 75,000 psi?

5 DR. WISSA: Can you repeat that question
6 please?

7 MS. CHANCELLOR: Could you read back the
8 question please?

9 (Question repeated.)

10 MS. CHANCELLOR: And I would like to add
11 and a compressive strength of 40 psi.

12 DR. WISSA: The way it's done is by trial
13 and error. What you do is you make up mixed design of
14 the cement and the soils and you measure the strength.
15 Then you measure the modulus until you get a
16 combination that gives you what you require. Here you
17 have flexibility and density control and moisture
18 control in cement. You have three variables that you
19 would have to play with to come with a value that
20 meets that criteria.

21 It is a reasonable requirement because
22 here you are speaking about a relatively low strength
23 and a relatively low modulus. Had you told me that
24 you wanted a high modulus and a low strength or a low
25 modulus and a high strength then I would have had a

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 problem in trying to meet the criteria, more than one.
2 In this case it's consistent with the performance of
3 soil-cement and cement-modified soil.

4 MS. CHANCELLOR: Is the modulus a dynamic
5 or a static modulus?

6 DR. WISSA: I'm looking at it as a static
7 modulus.

8 MS. CHANCELLOR: Is the modulus a high
9 strain or a low strain modulus?

10 DR. WISSA: I think it's a Young modulus.
11 When you say low strain it's an initial type of
12 tangent modulus we're talking about.

13 MS. CHANCELLOR: Yes. That's correct.

14 MR. TRUDEAU: May I add something?

15 MS. CHANCELLOR: Certainly.

16 MR. TRUDEAU: That applicable modulus is
17 a large strain modulus as indicated in I don't
18 remember the particular Holtec report number but in
19 the vicinity of the cask tip over where the cask hits
20 the pad the strains in the soil-cement or the soil
21 right below the soil-cement are in the order of two
22 percent which is clearly a large strain modulus.

23 MS. CHANCELLOR: Is this from Appendix B
24 of the Holtec Tip Over analysis? Do you know?

25 MR. TRUDEAU: That sounds like the right

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 report, yes.

2 DR. WISSA: I must correct myself then
3 because the initial tangent modulus is at a much lower
4 strain than that so it isn't the initial tangent
5 modulus. But you would get a stress strain and from
6 that you could select whatever modulus is appropriate
7 for the analysis.

8 MR. TRAVIESO-DIAZ: Mr. Chairman, I'm not
9 objecting to this line of questioning but I would like
10 to remind the Board that we discussed this issue as
11 part of Section D at quite some length in the last set
12 of hearings. I'm concerned that we are going back to
13 repeat this again. We may become inefficient.

14 MS. CHANCELLOR: Your Honor, this is an
15 area that caps across both C and D. I notice a stop
16 in that testimony addresses specifically in the soil-
17 cement testimony. Part of the State's testimony also
18 addresses Young's modulus and soil-cement so I think
19 it accounts across both.

20 MR. TRAVIESO-DIAZ: But if I might clarify
21 the issue here I believe on Section C is whether the
22 requirements can be met in the soil-cement mix not how
23 the requirements are set, how you test for them or how
24 you obtain them. In other words, what the modulus is
25 and how it is obtained is outside the scope of Section

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 C and we already talked about that. That's my point.
2 You can ask I think as much as you want as to whether
3 this can be achieved in your proper soil-cement mix
4 but that's a different issue.

5 MS. CHANCELLOR: Your Honor, I think we
6 should proceed with questioning and that if Mr.
7 Travieso-Diaz has an objection, we will go to bat
8 then.

9 CHAIRMAN FARRAR: All right. He was
10 careful to say that he was not objecting at this
11 point. Nonetheless he will at some point have it. So
12 if you will try to be conscious of the line existing
13 somewhere as you go through your questioning.

14 MS. CHANCELLOR: Yes, Your Honor.

15 MR. O'NEILL: I just wanted to make one
16 statement. I know the Staff does address it to some
17 extent and that's in response to portion of the
18 contention in Part C. It's that final paragraph e.
19 It states the Applicant is unconservatively
20 underestimating the dynamic Young's modulus, the
21 untreated soil, etc.

22 MR. TRAVIESO-DIAZ: If I may clarify. If
23 you recall the parties had agreed that although even
24 though this particular issue was part of Subsection C
25 it would discussed and it was discussed as part of

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 Subsection D last set of hearing.

2 CHAIRMAN FARRAR: Let me say this. This
3 is an enormously complicated issue. We are taking
4 witnesses in different order. This is the fifth week
5 of seismic hearings so it may not be possible to draw
6 sharp line or clear lines but yet we do need to avoid
7 in these next two weeks getting into matters that are
8 clearly duplicative of other sessions. Given the
9 somewhat disjointed nature of the hearings in terms of
10 time and space we could use everyone's help in
11 adhering to that principle.

12 Ms. Chancellor, at any point in the next
13 few minutes if you could come to a good point let us
14 know and we'll take lunch.

15 MS. CHANCELLOR: Right now, Your Honor.

16 CHAIRMAN FARRAR: Sold. It's almost 12:30
17 p.m. Let's be back at 1:30 p.m. Those people who are
18 not members of the NRC staff you will have to stick
19 together with your escorts and not straggle all over
20 the place. Off the record.

21 (Whereupon, at 12:28 p.m., the above-
22 entitled matter recessed to reconvene at
23 1:30 p.m. the same day.)

24 CHAIRMAN FARRAR: We are back on the
25 record for the afternoon session. Any preliminary

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 matters before the State continues?

2 MS. CHANCELLOR: No, Your Honor.

3 CHAIRMAN FARRAR: We had talked about
4 debating tomorrow's proceedings. Let's wait on that.
5 Jack, do we have a video conference capability for
6 tomorrow?

7 PARTICIPANT (JACK): Away from microphone.

8 CHAIRMAN FARRAR: We do. Do we have a
9 reservation?

10 PARTICIPANT (JACK): Yes.

11 CHAIRMAN FARRAR: Okay. Then, Ms.
12 Chancellor, go ahead with your cross examination.

13 MS. CHANCELLOR: Thank you, Your Honor.
14 Mr. Trudeau, I believe earlier this morning you
15 mentioned a two percent strain in the soil from the
16 cask tip over.

17 MR. TRUDEAU: Yes.

18 MS. CHANCELLOR: What layer is that two
19 percent strain in?

20 MR. TRUDEAU: I don't recall where it
21 whether it was in the cement treated soil or just in
22 the Bonneville clay right below the cement treated
23 soil.

24 MS. CHANCELLOR: What effect would this
25 two percent strain have on the cement treated soil?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 Would it crash it?

2 MR. TRUDEAU: I couldn't say.

3 MS. CHANCELLOR: Dr. Wissa, do you have
4 any opinion on two percent strain and cement treated
5 soil?

6 DR. WISSA: As far as the modulus? I'm
7 missing the question.

8 MS. CHANCELLOR: What would happen to the
9 cement treated soil if in a tip over there was a two
10 percent strain in the sediments measured in the top of
11 the Bonneville clay. What effect would that have on
12 say the bending stresses in the cement treated soil?

13 DR. WISSA: I'm still having a little bit
14 of difficulty because what you have is a pad which is
15 heavily enforced. So you would not have the
16 underlying, the pad itself. The reinforced concrete
17 pad itself would be taking the impact of the loads.
18 The underlying cement treated soil would not be what's
19 carrying the bending forces. It would be the concrete
20 pad itself. So I'm not sure I understand your
21 question.

22 MS. CHANCELLOR: Could the cement pad
23 crack for example with that level of strain?

24 MR. TRAVIESO-DIAZ: Excuse me. You said
25 "cement pad."

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealrgross.com

1 MS. CHANCELLOR: Right.

2 MR. TRAVIESO-DIAZ: I don't think we have
3 any cement pads here. We have a concrete pad.

4 MS. CHANCELLOR: Oh. Isn't concrete the
5 same as cement? Okay.

6 MR. TRAVIESO-DIAZ: Sorry.

7 MS. CHANCELLOR: Concrete pad.

8 DR. WISSA: I didn't design the concrete
9 pad, but it's certainly reinforced. I think you'd
10 have to ask the structure of engineers who designed
11 the pad on what would happen to the pad.

12 MS. CHANCELLOR: If the two percent strain
13 in the soils included the pad where this two percent
14 strain was calculated, would that change your answer
15 with respect to the stresses, or the bending stresses,
16 or the effect on the cement treated soil?

17 DR. WISSA: Again, I'm having a lot of
18 difficulty. A two percent strain to determine
19 deformations, you want to me to know over what
20 thickness or what layer you're talking about. The two
21 percent strain, I'm not sure I know where it's
22 occurring. If you can tell me where it's occurring,
23 I can --

24 MS. CHANCELLOR: Assume that it's 24
25 inches deep.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealrgross.com

1 DR. WISSA: Two percent strain at 24
2 inches?

3 MS. CHANCELLOR: Below the pad. Right.

4 DR. WISSA: If it's a uniform deformation?
5 I'm not sure how you achieve this. You have a
6 concrete layer. You have a soil cement, cement-
7 treated soil below it. It's acting as a unit now.
8 The control of the deformations is essentially the
9 most rigid part of it primarily which is now a very
10 thick -- dimensions heavily reinforced concrete mat.
11 Therefore, all the deformations are going to be
12 controlled by the mat rather than by the underlying
13 soil cement, cement of bonafide soil. So I'm having
14 a hard time understanding your model.

15 MS. CHANCELLOR: Dr. Wissa, let me hand
16 you a document entitled "PFSF site specific high storm
17 drop tip over analysis, Holtec report HI2012653
18 attachment B page B-1."

19 MR. TRAVIESO-DIAZ: Ms. Chancellor, is
20 this an exhibit already?

21 MS. CHANCELLOR: I don't think it is. If
22 you would review page B-1 of the Holtec drop tip over
23 analysis report, Dr. Wissa, and see where it refers to
24 two percent strain or 1.93.

25 DR. WISSA: Can you give me a minute to

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 read?

2 MS. CHANCELLOR: Absolutely.

3 MR. TRAVIESO-DIAZ: While he's reading,
4 I'm going to raise an objection to this line of
5 questioning. It's totally beyond the scope of the
6 testimony of this witness. It deals with the
7 hypothetical tip over analysis in which a cask drops
8 and the potential impact that it may have on the cask,
9 the concrete pad, it's all cement. None of that has
10 to do with the design of the soil cement itself.

11 He doesn't refer to any of this in his
12 testimony. He wasn't referred to up to this point by
13 anyone. So I do think this is clearly outside of his
14 scope. I have been very patient with these kinds of
15 questions. If we're going to start looking at these
16 documents here, we are wasting time and not getting
17 anything of this witness --

18 MS. CHANCELLOR: That is incorrect. Mr.
19 Trudeau mentioned the two percent strain and the
20 Bonneville clays. This does relate to cement treated
21 soil because if there's a two percent strain in the
22 Bonneville clays, then we need to know what effect
23 those strain rates are going to have on the cement
24 treated soil immediately above the Bonneville clays.
25 So I'm looking at this from a point of view of whether

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 this is going to be part of PFS's design and how that
2 design for the cement treated soil is going to
3 withstand that effect.

4 CHAIRMAN FARRAR: What I think Counsel for
5 the Applicant's point is we can talk to these
6 witnesses about what it might do to the cement treated
7 soil. Then when you go beyond that into what will
8 happen to the casks because of that, isn't that
9 something that we've already covered?

10 MS. CHANCELLOR: I'm not going there, Your
11 Honor. I'm not going to what happens to the cask. I
12 just simply gave Dr. Wissa an attachment to the Holtec
13 report because he couldn't understand this two
14 percent. I'm focusing on the cement treated soil and
15 what's going to happen in the event of a potential tip
16 over in an earthquake.

17 MR. TRAVIESO-DIAZ: I'm going to make this
18 brief because arguments take longer than asking the
19 question. My point is very simple. She can ask Dr.
20 Wissa if he can or Mr. Trudeau what effect a two
21 percent strain on the cement treated soil will have on
22 the performance of the soil. That could considerably
23 be within the scope. But going into a cask tip over
24 analysis in any form, I think it is unnecessary and
25 it's beyond the scope.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MS. CHANCELLOR: It was necessary, Mr.
2 Travieso-Diaz because Dr. Wissa couldn't understand
3 how you could get two percent strain in the soils when
4 you got a cement pad on top. I don't want to put
5 words in his mouth, but that's the reason I showed him
6 the calculation.

7 CHAIRMAN FARRAR: Does staff have a
8 position?

9 MR. O'NEILL: I wouldn't state a formal
10 objections at this point. I mean, I agree to the
11 extent that we're focusing on possible effects and
12 integrity of the soil cement. That's fine.

13 MR. TRAVIESO-DIAZ: I will withdraw my
14 objection for the moment in the interest of time.

15 CHAIRMAN FARRAR: Good. Thank you.

16 DR. WISSA: I think I understand the
17 question now. Looking at this clarified it in as much
18 as the strains we're talking about of the deformations
19 in the underlying clay. The clay is going to settle
20 up to two percent apparently. This is an assumption.
21 You're asking the question here what happens to the
22 soil cement above the clay as a result of a clay
23 settling by or moving by a two percent strain. Is
24 that right?

25 MS. CHANCELLOR: That's correct.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 DR. WISSA: All right. In this case, the
2 soil cement will follow the clay. If the clay drops,
3 the soil cement will drop by that two percent,
4 whatever that corresponds to in movement. It will
5 drop as a single unit because you have above it a very
6 rigid concrete unit which will follow too. If you
7 look at compatibility of movements, the controlling
8 one will be the concrete. As long as the concrete can
9 take the movement of bending stresses, the soil cement
10 will not be affected by that movement.

11 You have a compatibility of movements of
12 strains, so the soil cement to try and clarify follows
13 the concrete. The concrete is a controlling membrane,
14 the strong stiff material on top of a soil cement.
15 It's like a sandwich. If the toast if you want to
16 think that had ham in it. If the toast is rigid, the
17 ham will just follow the toast. In this case you have
18 the soil cement as a softer layer, the weaker layer
19 and you have a very rigid pad above it. It will just
20 follow the pad. It should have no effect on the
21 performance of the soil cement.

22 MS. CHANCELLOR: What about the mustard
23 between the ham and the toast; the bond at the
24 interface of the soil cement, cement-treated soil and
25 the pad?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 DR. WISSA: Okay. I was going to say the
2 mustard is the treatment between the two layers. That
3 one would just follow too. It has no effect on the
4 performance of the soil cement.

5 MR. TRUDEAU: Might I add that this is a
6 hypothetical case that needs to be addressed per
7 regulations. This is not a design case. We don't
8 expect that we're going to be dropping any casks out
9 on these pads.

10 MS. CHANCELLOR: Good. Is attachment B to
11 the Holtec report that I showed you the analysis that
12 set the modulus for Young's modulus?

13 MR. TRUDEAU: I am not sure that this is
14 the analysis that set the modulus. This one
15 demonstrated that the strains involved are
16 appropriately characterized as being large strains so
17 that the moduli that we are talking about are not
18 dynamic moduli, large strain moduli.

19 These are the same moduli that the study
20 by Lawrence Livermore Labs table 13 refers to from --
21 that those are static moduli of elasticity that this
22 Lawrence Livermore billet drop study that this cast
23 tip over analysis is based on is derived from. This
24 attachment B was put together to demonstrate why the
25 large strain moduli are applicable rather than the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 dynamic moduli that we've heard in various filed
2 documents.

3 MS. CHANCELLOR: I'd like to move on. Mr.
4 Trudeau, it's correct that in the PFS base case for
5 the sliding analysis that PFS takes no credit for the
6 passive resistance of cement-treated soil. Correct?

7 MR. TRUDEAU: Of the soil cement?

8 MS. CHANCELLOR: Soil cement. Correct.

9 MR. TRUDEAU: Correct.

10 MS. CHANCELLOR: But in some of the other
11 cases in that analysis that you do at times take
12 credit for that passive resistance.

13 MR. TRUDEAU: In the analysis of multiple
14 paths in a long row, north-south, I believe that the
15 analysis did include the passive resistance at the far
16 end of that. We're relying on the compressive
17 strength of the soil cement between the pads.

18 MS. CHANCELLOR: Isn't it true that PFS
19 cannot lead a factor of safety of 1.1 if it just used
20 structural fill, if it didn't have cement-treated soil
21 under the pads?

22 MR. TRUDEAU: That is correct. We need
23 the cohesion of the cement-treated soil that's not
24 provided by a typical granular structural fill.

25 MS. CHANCELLOR: Is it your position that

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 PFS must meet a factor of safety of 1.1 to ensure
2 safety?

3 MR. TRAVIESO-DIAZ: Objection. That calls
4 for a legal conclusion.

5 MS. CHANCELLOR: I'll withdraw the last
6 couple of sentences.

7 MS. CHANCELLOR: Is it your position that
8 PFS must meet a factor of safety of 1.1 to resist
9 sliding?

10 MR. TRUDEAU: 1.1 is the typical target
11 used for sliding stability analyses due to earthquake
12 loadings. That's the number that is found to be
13 acceptable according to regulatory guidance provided
14 by NUREG 0800 for nuclear power plant structures.

15 These pads are not typical nuclear power
16 plant structures. We have seen and heard testimony
17 that if the pads were to slide the amount of movement
18 that the casks experience atop those pads is actually
19 diminished by that sliding pad. In this case, it
20 clearly is better not to meet a factor of safety
21 against sliding of 1.1. This is all driven by the
22 fact that there are no safety related connections to
23 these pads.

24 MS. CHANCELLOR: Is it good engineering
25 practice to design a structure that will slide?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. TRAVIESO-DIAZ: Ms. Chancellor, is
2 your question intended to be all circumstances? It
3 seems to me that I could if I wish interpose an
4 objection as being too broad.

5 CHAIRMAN FARRAR: If you did, you'd lose.

6 MR. TRAVIESO-DIAZ: That's why I didn't
7 raise it.

8 MR. TRUDEAU: As I just said, it would
9 benefit the performance of the casks atop these pads
10 if we permitted them to slide. So the answer would be
11 no to your question here. We've heard Dr. Ostadon
12 (PH) speak about base isolated structures. Those are
13 clearly designed to have sliding occur underneath
14 their foundation. So the answer to your question is
15 no.

16 MS. CHANCELLOR: Isn't it true that for
17 base isolation structures only 25 percent credit is
18 taken for sliding?

19 MR. TRUDEAU: I have never designed a base
20 isolation system structure, so I don't know all of the
21 details.

22 MS. CHANCELLOR: I think we're beating
23 this horse in Salt Lake City.

24 MR. TRUDEAU: Thank you.

25 MS. CHANCELLOR: PFS is using the buttress

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 effect of soil cement around the CTB to meet the 1.1
2 factor of safety. Is that correct?

3 MR. TRUDEAU: That is correct based on
4 other conservative assumptions for the strength of the
5 clay underlaying that building. One of those
6 assumptions is it's based on the static, the strength
7 measured in static tests in spite of the fact that we
8 understand and expect that these clays will exhibit
9 increased strength due to the dynamic loading
10 associated with the earthquake.

11 MS. CHANCELLOR: Now going back to the
12 pads, it's true that the buttress effect as you said
13 was not included in the sliding calculations. Right?

14 MR. TRUDEAU: Of our base case, that's
15 correct.

16 MS. CHANCELLOR: Do you mean to imply that
17 there will be no passive resistance provided by the
18 soil cement during an earthquake?

19 MR. TRUDEAU: No. I just mean to indicate
20 that the resistance that can be provided by that
21 material is conservatively ignored so that if you were
22 to include it the factor of safety would be higher.

23 MS. CHANCELLOR: So practically you could
24 get passive resistance from soil cement around the
25 pads during an earthquake. Right?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. TRUDEAU: Yes.

2 MS. CHANCELLOR: If passive resistance is
3 provided by soil cement adjacent to the pads, where
4 does the force that is mobilized go?

5 MR. TRAVIESO-DIAZ: Mr. Chairman, I have
6 to object here. Dr. Ostadon (PH) and I talked about
7 this for hours in Salt Lake City. This is dynamic
8 analysis, part to part interaction. I don't know you
9 but I'm really sick and tired of hearing about it.
10 This hearing is not all that.

11 MS. CHANCELLOR: Well, I wouldn't say
12 we're sick and tired of it Mr. Travieso-Diaz, but I
13 shall move on.

14 MR. TRAVIESO-DIAZ: I apologize.

15 MS. CHANCELLOR: Some things just never go
16 away.

17 CHAIRMAN FARRAR: I will say that was
18 going to give me a rare opportunity to rule on the
19 legitimacy of the previously unheard of objection that
20 you're "sick and tired."

21 MR. TRAVIESO-DIAZ: In this case, I think
22 it would be a valid objection.

23 MS. CHANCELLOR: Sorry, Your Honor, I
24 won't be a moment. I have a jigsaw puzzle here.

25 CHAIRMAN FARRAR: That is quite all right.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MS. CHANCELLOR: Mr. Trudeau, you
2 mentioned cracks occurring in the cement-treated soil
3 due to shrinking and other phenomenon. I remember you
4 saying they don't all line up in a neat little row.
5 What are the consequences to the tensile capacity of
6 the soil cement and cement-treated soil if there are
7 vertical cracks due to shrinkage or other phenomenon?

8 MR. TRUDEAU: We don't rely on the tensile
9 strength of the soil cement so it's immaterial.

10 MS. CHANCELLOR: So you don't believe that
11 vertical cracks if they exist would have any effect on
12 shear resistance.

13 MR. TRUDEAU: I do not believe that the
14 presence of vertical cracks will effect the shear
15 resistance available under the pads, no.

16 MS. CHANCELLOR: Would your answer by the
17 same for the soil cement around the CTB?

18 MR. TRUDEAU: Yes it would because the
19 shear strength that we're talking about is the bond
20 between the soil cement and the underlying clay. That
21 won't be affected by any measurable amount by the
22 presence of a vertical crack.

23 MS. CHANCELLOR: In your testimony, you
24 refer to precedent for using cement-treatment and you
25 mention the South African Nuclear Power Plant at

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 Koeberg, South Africa.

2 MR. TRUDEAU: Yes.

3 MS. CHANCELLOR: Isn't it true that at the
4 Koeberg site there were low saturated sands?

5 MR. TRUDEAU: Yes. That is correct.

6 MS. CHANCELLOR: They were potentially
7 liquefiable.

8 MR. TRUDEAU: That's my understanding.

9 MS. CHANCELLOR: And at PFS, the plastic
10 fine-grain material.

11 MR. TRUDEAU: That is correct.

12 MS. CHANCELLOR: And the PFS -- are not
13 susceptible to liquefaction.

14 MR. TRUDEAU: That is correct.

15 MS. CHANCELLOR: Isn't it true in South
16 Africa they removed a thick layer of sand
17 approximately 24 meters deep?

18 MR. TRUDEAU: That's my understanding.

19 MS. CHANCELLOR: Then they treated with
20 cement and replaced and compacted it.

21 MR. TRUDEAU: Yes. They did in order to
22 increase or enhance its shear strength so that it
23 would be strong enough to resist the cyclic shear
24 stresses from the earthquake.

25 MS. CHANCELLOR: PFS's application is for

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 a shallow condition. Correct?

2 MR. TRUDEAU: That's correct.

3 MS. CHANCELLOR: Not liquefiable.

4 MR. TRUDEAU: . That is correct.

5 MS. CHANCELLOR: The purpose is to provide
6 resistance to sliding during an earthquake.

7 MR. TRUDEAU: That is correct. We are
8 using the cement to impart a cohesion, an undering
9 strength to the eolian silts.

10 MS. CHANCELLOR: If I could take just a
11 second, Your Honor, I think I'm done. I'm finished,
12 Your Honor.

13 CHAIRMAN FARRAR: Thank you, Ms.
14 Chancellor.

15 MS. CHANCELLOR: Could I just go retrieve
16 the document from the witness?

17 CHAIRMAN FARRAR: Yes. Go ahead. My
18 colleagues have some questions.

19 JUDGE KLINE: I just want to refer you
20 generally to your question and answer 48 on page 31.
21 You refer there to certain specifications that the
22 soil cement must meet specifically either 250 PSI or
23 40 PSI. I know elsewhere you referred to Young's
24 modulus of 75,000. My understanding from your
25 testimony is that you don't believe there's any

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 trouble meeting these as a practical matter.

2 MR. TRUDEAU: That is correct.

3 JUDGE KLINE: My question then is how much
4 practical latitude do you have in meeting these
5 targets, that is, when you're actually out in the
6 field and you have people in the field, contractors
7 and all making engineering judgements and feeling the
8 soil and that sort of thing. How much latitude do you
9 feel you have when you know you're going to be dealing
10 with variable material and variable judgements and
11 that sort of thing? For example, on a 250 PSI
12 specification, what would be the practical limits up
13 and down from that that you'd allow yourself?

14 MR. TRUDEAU: The 250 is a minimum here.

15 JUDGE KLINE: Okay.

16 MR. TRUDEAU: This is an extremely
17 comfortable lower bound value. It's my expectation
18 that the soil cement that we're going to be building
19 out there that will pass the durability test, the
20 freeze-thaw, and the wet-drying test that the
21 unconfined compressive strengths of that material are
22 more likely to be 400 PSI than 250 PSI. Our analyses
23 are based on this lower value just to demonstrate that
24 this is a readily achievable value that we won't have
25 any problem achieving in the field.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 JUDGE KLINE: And I'm not talking about
2 achieving it in the laboratory. I'm talking about
3 achieving it under the practical field conditions when
4 there are a lot of different judgements and a lot of
5 different soil textures and variable conditions that
6 you'd encounter in the field.

7 MR. TRUDEAU: There again, the key is the
8 control that you have and putting the recipe together.
9 That's why as I said all of the discussions today we
10 fully expect that we're going to have a batch plan on-
11 site to permit that control to be exercised; to get
12 the right proportion of moisture, the right proportion
13 of cement with the soils. Perhaps to address your
14 concern a little more directly, it's my understanding
15 that typically when you go to a field mix you even add
16 a couple of percent cement just to make sure you get
17 there.

18 JUDGE KLINE: Okay. I am getting at
19 really whatever comments you have on the practical
20 constraints that occur in the field. I understand you
21 can meet standards in the lab, but when you're in the
22 field and you're dealing with variable judgements and
23 variable textures, at that point, are you still
24 confident you can meet these standards.

25 MR. TRUDEAU: Yes.

1 JUDGE KLINE: Or meet them within a fair
2 approximation.

3 MR. TRUDEAU: We're committed to testing
4 the as constructed material. We have to demonstrate
5 that we have these bond strengths constructed in the
6 field. We have to deal with those issues. If we're
7 not meeting those strength requirements, then clearly
8 we have to do something different to get better
9 control over the materials, whatever. The tests will
10 demonstrate that we're there or we're not there.

11 JUDGE KLINE: What contingencies do you
12 have in mind for materials that happen to fail a test?
13 I mean, if you made a big pore and then find that it
14 doesn't meet the test, do you have to tear it all out
15 again and start over? What do you do? Is there a
16 plan for that at all?

17 MR. TRUDEAU: That eventuality would have
18 to be dealt with if it occurred. The process as I
19 envision it would be to do everything that we can up
20 front, to do some field testing when we get permission
21 to go actually build something out there.

22 JUDGE KLINE: I understand you'd rather do
23 it right the first time. The issue is what happens
24 when that doesn't work.

25 MR. TRUDEAU: I would expect that we would

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 then go and core some more samples and run some more
2 tests on those samples to try to get a handle on the
3 extent of the problem area. Then that material would
4 have to be ripped out in my estimation.

5 JUDGE KLINE: Okay. All right. Does the
6 same thing hold for meeting the standards of the
7 Young's modulus? Do you feel you can hit that in the
8 field under the constraints of practical field
9 conditions?

10 MR. TRUDEAU: I believe we can get there.
11 I haven't got any test data to show it yet.

12 JUDGE KLINE: Okay.

13 MR. TRUDEAU: But that certainly will be
14 determined in the lab testing.

15 JUDGE KLINE: I am inquiring into how
16 field conditions differ from the more or less ideal
17 conditions of the lab and what you can do as a
18 practical matter dealing with the major construction
19 not just with lab tests.

20 MR. TRUDEAU: The lab testing will vary
21 the percentages of cement, the percentage of moisture,
22 and we will develop more or less a parametric study of
23 how much we can use to get and still meet the 75,000
24 limit along with the 40,000 PSI compressive strength
25 to determine what kind of latitude we actually have

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 out in the field. We do have the opportunity to
2 segregate different materials. As I said earlier,
3 it's easier to get a better quality soil cement
4 product with non-plastic silts than it is with clayey
5 silts. We can reserve those materials for use in this
6 one to two foot thick layer directly underneath the
7 pads where it's relied on for those key design
8 properties.

9 JUDGE KLINE: Okay. Thank you.

10 CHAIRMAN FARRAR: In response to Judge
11 Kline's questioning about the hypothetical pore that
12 doesn't meet this test, you said you'd deal with that
13 contingency. Then you said in your judgement you'd
14 have to rip it out or you might have to rip it out.

15 MR. TRUDEAU: If it didn't meet the
16 strength requirements, for instance, definitely.

17 CHAIRMAN FARRAR: Or is there a
18 possibility that someone in the organization would say
19 we have layers of conservatism here and let's redo the
20 calculations and let's leave it in place.

21 MR. TRUDEAU: I suppose that could be part
22 of the analysis of where we were depending on how wide
23 spread the problem was.

24 CHAIRMAN FARRAR: In your understanding of
25 the system and if you don't know the answer say so,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 are these tests something you report regularly to the
2 NRC staff?

3 MR. TRUDEAU: I don't know the details of
4 that. I just know that we will be having field
5 quality control that will be I'm sure audited by NRC
6 staff on some kind of a regular basis. Typically I
7 would expect that passing tests would just be
8 routinely fit into a schedule, that they'd be looked
9 at on a routine basis, but there could be some
10 mechanism perhaps for a failed test to draw some
11 attention to itself and people would get involved much
12 sooner than they would otherwise have on a routine
13 basis.

14 The 250 PSI is really an easy number to
15 meet. There is no question in my mind based on the
16 ACI report, all of the Portland Cement Association
17 reports on soil cement that I've read for this
18 project. This 250 PSI is really an easy thing to
19 achieve. I'm not at all concerned about that number.

20 JUDGE LAM: Therefore, one would assume
21 when you are mixing the soil cement you would just add
22 a little bit more cement to make sure you meet the
23 250. Isn't it?

24 MR. TRUDEAU: That is correct.

25 JUDGE LAM: Because a typical range to

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 achieve 250 would be what, a few percentage in the
2 form of Portland cement.

3 MR. TRUDEAU: It could be maybe even nine
4 percent for these finer grain soils, maybe even 12
5 percent. We don't know that yet because we haven't
6 gotten past the durability test yet. That's what is
7 going to drive it, not the strength. To get to 250
8 PSI, I think we only needed about six percent cement
9 to get to there based on 40 times the compressive
10 strength.

11 JUDGE LAM: So the Young's modulus is the
12 one that drives your --

13 DR. WISSA: The Young's modulus as far as
14 the soil cement, it has no bearing. It's a
15 compressive strength. In fact to answer your question
16 generally you do the lab work. Then as you said, you
17 add extra cement to compensate for variability in the
18 field and for control in the field. That's common
19 practice. Two percent is by the way not a bad
20 addition of two percent cement as far as strength.

21 But as Paul said, the probability will be
22 that the durability testing will control it. In other
23 words, you're going to be adding more cement not to
24 achieve a strength but to achieve a durability. So
25 you'll probably have four or five hundred and even

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 possibly higher strength. So strength will not be the
2 limiting factor but rather the durability as far as
3 effect of cycles of wet-dry and freezing-thawing.

4 You would add that extra cement anyway
5 even with durability. Let's say you need ten percent
6 cement for durability in the lab. You may add another
7 two percent to make sure you have a durable product in
8 the field too.

9 MR. TURK: May I inquire for clarification
10 about the last answer that had to do with the soil
11 between the pads? You're talking about compressive
12 strength.

13 MR. TRUDEAU: Yes, and around the canister
14 transfer building.

15 JUDGE LAM: Dr. Wissa, if I may ask you to
16 look at your prefiled testimony answer to question 45.

17 MR. TRUDEAU: Was that number 45?

18 JUDGE LAM: Right. Dr. Wissa?

19 DR. WISSA: Yes.

20 JUDGE LAM: You indicated it is your
21 opinion that this soil testing program if properly
22 implemented would be adequate for this facility. My
23 question to you is what do you consider a proper
24 implementation?

25 DR. WISSA: I assume you're speaking about

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 implementation in the field. There is in the ESSOQ an
2 outline of what kind of QA/QC program will be applied
3 during construction. That's the type of program I'm
4 talking about as far as implementation. There is a
5 section I believe which speaks about QA/QC joint
6 construction; Quality Control and Quality Assurance.
7 That's the type of program I'm talking about to make
8 sure it's properly implemented in the field.

9 MR. TRAVIESO-DIAZ: For clarification,
10 when he's talking about ESSOQ, he's referring to
11 Applicant's Exhibit GGG which you have in front of
12 you.

13 JUDGE LAM: Okay. Dr. Wissa, the reason
14 I asked you this question is --

15 DR. WISSA: And as I mentioned earlier,
16 the SAR has information on it too.

17 JUDGE LAM: Yes. But the reason I asked
18 you this question is while Ms. Chancellor was
19 questioning you earlier she conveyed a sense of
20 complexity about implementation. Her questioning
21 relayed to me a sense of this is going to be a long
22 program of building soil cement. This is going to be
23 a program that has to deal with a wide range of
24 variable properties of soil. It's in that context
25 that I'd like to hear from you about what is the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 proper implementation of the soil testing program.
2 Can you elaborate on that?

3 DR. WISSA: Maybe I can clarify it by
4 during the laboratory portion as Paul mentioned, we're
5 going to be looking at the range of potential soils
6 that will be used and the sensitivity of those soils
7 to stabilization as far as moisture content, cement
8 content, and other factors density. Based on that,
9 you will be able to develop a range that you can live
10 with in the field. You can't say I want a fixed
11 thing. You can say as long as it doesn't fall below
12 or above a certain number you will achieve your
13 objectives.

14 Then you confirm this by the testing
15 program in the field. So you have flexibility. You
16 cannot be rigid by saying I want seven percent cement
17 in this soil. When you test for cement content let's
18 say you may find it at 7.1 or 6.9 percent. How
19 sensitive is the soil to that variability is what you
20 have to establish. It is unreasonable to put a spec
21 saying that it should be 7.0. You have to give a
22 range. It can be 7 plus or minus 0.1. Or 7 plus but
23 minus nothing, so the contract in that place would
24 instead of putting 7 he put seven and a half so he's
25 never below the minimum requirement.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 What you do there is you bracket what's
2 permissible in advance. Then the contractor has the
3 range you allow him to work with. Does that help you?

4 JUDGE LAM: Yes. Are we dealing with a
5 great deal of precision here, Dr. Wissa?

6 DR. WISSA: No. That's the whole point.
7 The precision here is that you have to have
8 flexibility. You're working with a variable, a
9 complex thing. The actual tests can be fairly
10 precise, the measurement in a lab. You can get pretty
11 good precision in measuring the strength. Not as good
12 maybe with cement content, but what you're really
13 interested in is the impressive and shear strength.
14 That can be measured with a lot of precision.

15 JUDGE LAM: So the system that you
16 described to me is reasonably tolerant on errors?

17 DR. WISSA: Yes. It has to be by
18 definition. The tolerance is part of what we're going
19 to find out during the laboratory investigation. I
20 think in general soil cement is very flexible because
21 you have several variables that you can play with or
22 vary.

23 Moisture content is one. Density is
24 another one. Cement content is a third. Obviously
25 the last one is soil type. You may want to eliminate

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 certain soils if they're going to be difficult to
2 control.

3 JUDGE LAM: Thank you.

4 CHAIRMAN FARRAR: Let me ask Counsel. In
5 terms of the extent of NRC staff review of the tests
6 of the emplacement of the cement-treated soil and soil
7 cement and the pad itself in terms of staff review
8 enforcement, is this a matter for presentation of
9 evidence, argumentation of Counsel, stipulation of the
10 parties or notice by the Board of what this system is?

11 MR. O'NEILL: I have some thoughts on the
12 matter. I would strongly prefer to defer to Mr. Turk
13 on this particular issue.

14 MR. TURK: Your Honor, my understanding is
15 that the staff will have inspectors at the site at
16 various times during the construction of the
17 facilities post-licensing. They will not be at the
18 site constantly, but they will be conducting
19 inspections at the site. All documentation is
20 available for review at that time which will include
21 documentation of tests that were conducting when they
22 were not present.

23 I personally spoke with the region IV
24 civil engineering inspection chief. He's the chief of
25 the section that does civil engineering inspection.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 He confirmed to me that that's what they would be
2 doing during construction.

3 CHAIRMAN FARRAR: Is there anyone who
4 wants to take issue with Mr. Turk's representation?

5 MR. TRAVIESO-DIAZ: No.

6 MS. CHANCELLOR: Yes, Your Honor. Whether
7 or not NRC does inspections post-licensing does not
8 give the State any ability to challenge the tests and
9 whether PFS has met those tests. As you can see the
10 staff has already signed off on this concept. The
11 State is challenging it. So to say that we can rely
12 on the staff is not a substitute to addressing the
13 issues here.

14 CHAIRMAN FARRAR: Well, what I meant by a
15 question of course is there's three levels. The
16 system could say we rely simply on the Applicant and
17 no one will check it. Step two is we won't rely on
18 that. The staff will be checking. Then third would
19 be have you involved.

20 MS. CHANCELLOR: I think it gets down to
21 the question of is this merely a procedure that PFS is
22 implementing or does this go to the fundamental
23 question of a finding that the commission must make to
24 issue a license. We come down on the latter side and
25 nothing short of addressing it in this proceeding will

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 satisfy the State.

2 MR. TRAVIESO-DIAZ: Mr. Chairman, I will
3 say this. First, I don't believe there's anywhere in
4 the regulations and I say this with all due respect a
5 provision that gives the State the right to win this
6 approve or pass on the -- That is uniquely the
7 function of the staff. That is their function under
8 the regulations.

9 I also will say that it's typical practice
10 in the construction facilities that the staff will be
11 present whenever they think a test is important to
12 review the acts of conduct. All the test results are
13 supposed particularly as to quality assurance. Under
14 the quality assurance programs, all the test results
15 are available for the staff to inspect. So there is
16 no bar for impediment of the staff discharging this
17 function on the regulations. Nor is there a
18 requirement that the conduct of the laboratory tests
19 or -- the facility be witnessed by anybody else.

20 CHAIRMAN FARRAR: All right. The first
21 part I wanted to clarify Ms. Chancellor. You're not
22 disagreeing with Mr. Turk's representation that this
23 is a function the staff will carry out.

24 MS. CHANCELLOR: I don't know, Your Honor.
25 Region IV I think is in Grand Junction, Texas. We

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 don't know how often the staff is going to go there.
2 We don't know the competence of the staff inspector
3 who will go out and whether that person has any
4 knowledge of soils. How they will do it and whether
5 they are competent to do it, I'm not going to agree to
6 that.

7 CHAIRMAN FARRAR: Okay. We certainly
8 don't want to try that issue in this proceeding.
9 That's a matter for argumentation as is I think the
10 matter of the disagreement between you and Mr.
11 Travieso-Diaz as to whether the staff's ordinary
12 functioning is sufficient or whether State has some
13 right to be involved. I just want to make sure there
14 wasn't anything more we need to get out of these
15 particular witnesses on this point.

16 MR. TRAVIESO-DIAZ: If I can make a five
17 second commentary. I think Ms. Chancellor raised
18 something that is very important to have clear. It is
19 not an appropriate claim to be made by a -- licensed
20 proceeding that the staff won't do its job. That is
21 not an appropriate concession to raise. You have to
22 presume that the staff will do whatever is required.
23 Assuming to the contrary is not a valid contention.
24 I know Mr. Turk will agree with me there.

25 MS. CHANCELLOR: Your Honor, I would just

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 like to say that the qualification of the soil cement,
2 cement-treated soil in this new application to meet
3 seismic design criteria is covered by the regulations.
4 Site specific investigations and laboratory analysis
5 must show that soil conditions are adequate for
6 proposed foundation loading.

7 By deferring this issue to a testing
8 program that will last eight months long that has a
9 narrow window for whether PFS can meet the 75,000 PSI
10 Young's modulus because they can't add more cement to
11 the cement-treated soil mix under the pads, that is a
12 very narrow window that requires judgement.
13 Therefore, the cement-treated soils, the soils
14 conditions would not be adequate for the proposed
15 foundation loading. The State's position is that this
16 is squarely within the regulations and it is squarely
17 part of this proceeding.

18 CHAIRMAN FARRAR: Let me ask Mr. Turk a
19 question. 25 years ago when I was doing this for
20 reactors, we had construction permit proceedings and
21 then operating permit proceedings. The purpose of the
22 latter was to make sure that the company had done what
23 it had promised in the construction permit. What if
24 any is the analogy here? There's going to be no
25 construction permit phase assuming that -- gets what

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 they're asking for now. There's no operating permit
2 phase. Correct?

3 MR. TURK: There's a single phase of
4 licensing. There's not the dual stage that existed in
5 the Nuclear Power Plant Licensing. You would note
6 that probably the new applications conceive of a
7 single stage of licensing. There are applications to
8 come in the future.

9 CHAIRMAN FARRAR: All right.

10 MR. TURK: May I respond to Ms.
11 Chancellor?

12 CHAIRMAN FARRAR: Yes.

13 MR. TURK: First of all let me say that I
14 agree with Mr. Travieso-Diaz that what's proposed here
15 for staff inspections is the same type of inspections
16 that would exist during nuclear power plant
17 construction. The staff does employ a qualified civil
18 engineering staff to inspect the construction of
19 concrete structures as well as other structures at
20 nuclear facilities. So I'm not troubled by the
21 question of whether the staff has the qualifications.
22 I think the Commission ensures through its funding of
23 staff programs that whatever qualifications are
24 required can be obtained and are used in post-
25 licensing inspection of nuclear facilities.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealrgross.com

1 Second, I think the applicable test is not
2 is there something that's been identified by the
3 Applicant that's necessary for its facility, such as
4 the applicable Young's modulus or the applicable
5 strength of the underlying cement-treated soil. The
6 Applicant has established the criteria that it must
7 achieve through its construction, testing and
8 placement of materials. Those are easily verifiable.
9 Those are matters that can be determined both as a
10 result of lab testing and based upon field inspections
11 and testing of materials placed at the facility.

12 There is no judgement involved contrary to
13 what Ms. Chancellor has indicated but rather these are
14 verifiable matters that are the same type of matters
15 that are subject to what is referred to as ITAC,
16 inspections testing and acceptance criteria, matters
17 which can be left for verification post-licensing as
18 long as the well defined standards have been
19 established, the methods of testing have been
20 explained, or the test program has been explained --

21 CHAIRMAN FARRAR: Let me interrupt you.
22 I can follow the argument. If the standard is 250
23 PSI, then the test comes out 300. They have it
24 documented. Then your inspector comes. There's no
25 problem. That's almost ministerial. But if the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 standard is 250 and it comes out 240 and somebody
2 makes a judgement well with all the conservatism
3 that's okay, that's not ministerial.

4 How if at all do we get at that or is that
5 not for us to get at? Once the actual licensing
6 proceeding is over, that's not a matter for the Board.
7 That's not a matter for an intervenor. That's just
8 the staff and the Applicant.

9 MR. TURK: The test results would not
10 involve judgement. Whatever the test results are,
11 they are.

12 CHAIRMAN FARRAR: Right. The test says
13 240 but the Applicant's people got together and said
14 we're going to go ahead anyhow. You come on the scene
15 three months later and review that. You find the 240.
16 Now you caucus and say it seems okay to us or it
17 doesn't seem okay to us. That's anything but
18 ministerial.

19 JUDGE LAM: And for that matter if Dr. Kam
20 (PH) is here, if he imposed the order to estimate
21 interpretation of the 250 then 125 PSI would be
22 adequate.

23 MR. TURK: I don't understand the comment,
24 Judge Lam. Dr. Kam (PH)?

25 JUDGE LAM: Dr. Kam (PH).

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701