RAS 5567 72-22-ISFSI - State Exhibit 108 - Recd 6/17/02

# CONDENSED TRANSCRIPT

DOCKETED
USNRC

2003 JAN 29 PM 3:11

OFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

| | | |
|---|---|---|
| In the Matter of | ) | Docket No. 72-22 |
| | ) | ASLPB No. 97-732-02-ISFSI |
| PRIVATE FUEL STORAGE L.L.C. | ) | DEPOSITION OF: |
| (Private Fuel Storage Facility) | ) | **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



Template = SECY-028 SECY-02

'CLEAR REGULATORY COMMISSION

Docket No. 72-22 Official Exh. No. 108

In the matter of PFS

Staff _____ IDENTIFIED ✓

Applicant _____ RECEIVED ✓

Intervenor ✓ REJECTED _____

Other _____ WITHDRAWN _____

DATE 6-17-02 Witness _____

Clerk Dmp

A. **That's response spectra, I believe.**

MR. TRAVIESO-DIAZ: Excuse me for interrupting. Do you mean 1160?

THE WITNESS: It's 1.165.

Q. (By Ms. Chancellor) No, you said 1.60?

A. **60, yeah. It might be 1. -- I don't know. I don't know whether --**

MR. TRAVIESO-DIAZ: That was the basis of my objection before. You know, it is very hard for the witness to remember without being presented a document, Are you familiar with it?

MS. CHANCELLOR: That's fine. If he's given me the name of the document and given me his best recollection of the reg guide. I'm not going to challenge if he relies on a document that he's got in his filing cabinet.

Q. I'm just trying to get a sense of what reg guides and what regulations you work with, in general, with respect to your geotechnical investigation. So we've got 1.567, 0800 and reg guide dealing with response spectra.

Anything else you'd like to add to the list?

A. **No.**

MS. CHANCELLOR: Okay. If I could have





this document marked as Exhibit 12.

(A discussion was held off the record.)

(Exhibit-12 was marked.)

Q. (By Ms. Chancellor) Mr. Trudeau, I've handed you a copy of PFS -- an excerpt from PFS's SAR, Revision 22, Section 2.6.4.11, Techniques to Improve Subsurface Conditions. Are you familiar with this section of the SAR?

A. **Yes.**

Q. Are you primarily responsible for authoring this section of the SAR?

A. **Yes.**

Q. And does this section, in general, deal with PFS's application of soil cement in its foundation design?

A. **Yes.**

Q. And what experience have you had in applying soil cement in foundation design in any other project?

A. **I have none.**

Q. Are you responsible for any other sections of the SAR where you've been basically the primary author?

A. **Chapter --**

Q. I've got a copy of Chapter 2 here and a





part of -- if you'd like to take a look at it. I don't have all of Chapter 2 but the first part of Chapter 2.

A. **But not the table of contents?**

Q. Oh, doesn't it have -- at the beginning of the chapter, doesn't it have the table of contents?

A. **Sorry. Found it.**

Q. I think that was a document control argument.

You can take the clip out.

A. **How detailed a list do you want here?**

Q. Oh, just the main general areas --

A. **2.6.1.5, Facility Plot Plan and Geologic Investigations, I co-authored or authored most of that, I would say.**

**Same with .6, Relationship of Major Foundations to Subsurface Materials, I authored that.**

**2.6.1.7, Excavations and Backfill, likely I wrote that --**

Q. Okay.

A. **-- back in '97.**

**I probably had input to the Site Groundwater Conditions in 2.6.1.9, but that may have been authored by someone else. Same with 2.6.1.10, Geophysical Surveys.**

**2.1.1.11, Static and Dynamic Rock**





**Properties at the Site, is largely going to be my work.**

**And 2.6.1.12, Stability of Foundations for Structures and Embankments, will be largely my work.**

**2.6.4, Stability of Subsurface Materials, was probably authored by me as well.**

**2.6.4.7, Response of Soil and Rock to Dynamic Loading.**

**2.6.4.8, Liquefaction Potential.**

**2.6.4.9, Design Basis Ground Motion, I probably authored, but it just refers to Geomatrix's work earlier in the SAR.**

**2.6.4.10, Static Analyses.**

Q. Going back to the design basis ground motion, would that be the way in which you reviewed and used -- an example of the way in which you used and reviewed the Geomatrix calculation to write up the --

A. **This section of the -- this section of the SAR just simply just defines what the design basis ground motion is, and it references back to Geomatrix's complete description in early sections of the SAR.**

Q. Okay.

A. **So this just gets that it's .117 g horizontal, .695 g vertical, and it refers to the Geomatrix reports.**

Q. Okay. I understand. Thank you.

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

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

**A. Correct.**

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

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

Q. And how will you demonstrate that?

**A. By testing.**

Q. When?

**A. As the project moves ahead.**

Q. And how --

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





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

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

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

Q. The pallet --

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

**(A discussion was held off the record.)**

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

(A discussion was held off the record.)

Q. (By Ms. Chancellor) I was way off.

Do you plan to develop a grading plan to





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

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

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

**A. You mean 2.6?**

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

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

MR. TRAVIESO-DIAZ: Do you understand the





question?

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

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

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

Q. Which ones do you need?

**A. The one that cites the 1.7.**

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

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

What is the reason -- if we need to get the calculations, we can pick this up later, but what is the reason for the change in settlement from 3.3 inches 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**

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





freeze/thaw cycles, so it will not need to comply with the freeze/thaw durability test. It's below the frost zone in Skull Valley, which is only 30 inches below grade.
Q. So the soil cement program, is that limited to true soil cement which you will use around the CTB and around the pads?
A. That's -- that may be what this ESSOW says, but we realize that we need to have testing of the cement-treated soil as well. So I don't -- I don't recall that we have any specific discussion of the cement-treated soil in here, but we have to do the testing on the cement-treated soil. So it will be tested as part of this program, eventually.
Q. But the cement-treated soil will not be tested on the freeze/thaw ASTM test --
A. Correct. It will be tested for compressive strength and modules because those are the required parameters for design.
Q. Will it be tested for durability or is that only the freeze/thaw --
A. The freeze/thaw and the wet/dry tests are the durability tests.
Q. Well, will the cement-treated soil be "treated" for wet/dry tests?





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





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

PAGE 69

69

Q. So we're talking about true soil cement now?
A. That's correct.
Q. Okay.
A. So the Phase 4 testing of the true soil cement is the stuff around the Canister Transfer Building. That, we need to show the compressive strength exceeds 250 psi. So that's the Phase 4 testing for that material.
The testing of the cement-treated soil, in addition to the compressive strength requirement of 11.1 psi, which is insignificant for the cement-treated soil -- we're basing our design on 40 psi for that value that -- as the lower bound of the value. So -- for the cement-treated soil. So we need to demonstrate that our compressive strength is at least 40 psi to comply with what we state in the SAR for the cement-treated soil. But in addition to that strength requirement for the cement-treated soil, we have modulus limitation. So those specimens, we will measure the modulus of elasticity during compression --
Q. And that's only applicable to the cement-treated soil, the modulus limits?
A. Because of the cask tipover problem --
Q. Okay.

PAGE 70

70

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

PAGE 71

71

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

PAGE 72

72

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

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. AGEC.
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 AGEC, correct?
13 A. This whole ESSOW is AGEC.
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 AGEC shall conduct Atterberg
19 limits.
20 A. It says AGEC, 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 AGEC?
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 --

PAGE 85

85

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

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

A. We've had discussions of the Utah QQ --

MR. TRAVIESO-DIAZ: Excuse me. You are instructed not to refer to any conversations with or for counsel. So to the extent you describe what Dr. Wissa has done, his work on behalf of performance of the test program, as opposed to any litigation-related activities.

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

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

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

PAGE 86

86

itself, you can speak to that.

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

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

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

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

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

Q. This is the DeGroot-type --

A. Correct.

PAGE 87

87

Q. -- issues?

A. The bonding study stuff.

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

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

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

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

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

A. No.

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

A. Not clearly identified as phases that we've

PAGE 88

88

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

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

A. Correct.

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

MS. CHANCELLOR: I beg your pardon?

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

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

THE WITNESS: Beyond.

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

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

MR. TRAVIESO-DIAZ: Oh, okay.

Do you understand the question now?

THE WITNESS: The best description of the

soil cement testing and construction program is in the SAR.

Q. (By Ms. Chancellor) And to --

**A. Chapter 2.6. There may -- I think there's another section as well that discusses soil cement but --**

Q. Certainly.

(A discussion was held off the record.)

THE WITNESS: Certain aspects of the soil cement are also discussed in Section 2.6.1.12, Stability of Foundations for Structures.

Q. (By Ms. Chancellor) Could you give me that cite again?

**A. 2.6.1.12. But the best description is this 2.6.4.11.**

Q. In response to Interrogatory No. 3, you state that you've retained Dr. Wissa as a consultant to assist in the soil cement program. Is there an engineering services scope of work for Dr. Wissa?

**A. Not at this point, but we expect that his firm will be doing some of the -- like the interface strength tests for us, so there will be an ESSOW to lay out that program. And we're -- at this point we're expecting that his company is going to be doing that testing.**





Q. But is it correct that the testing that Dr. Wissa will do would follow Phase 4 of the AGEC's soil cement test program?

**A. That's -- that's correct. He may do the Phase 3 work on the cement-treated soil. I don't know yet. That was the modulus testing, you know, the --**

Q. We called that Phase 4, but it's really Phase 3.

**A. For the cement-treated soil. It's the next phase for the cement-treated soil.**

Q. Cement-treated soil?

**A. If you're more comfortable with Phase 4 --**

Q. No, that's fine. I just didn't want the record to be unclear.

So that's the modulus and the --

**A. Compression --**

Q. Compression --

**A. -- testing of the cement-treated soil, because that's the same material that we're going to be running these interface strength tests on that we're anticipating he will be doing for us.**

Q. Will Dr. Wissa also be doing direct shear tests?

**A. It remains to be determined what the interface strength test is going to look like, but I**





**think it wants to be a direct shear test because we want to force failure along that plane. So I think, yes, they will be direct shear tests.**

Q. So is it correct to say that the direct shear test and this DeGroot-type testing, we're only talking about the cement-treated soil under the pads?

**A. Correct.**

Q. Once you go through all this testing, the way in which the construction is done of the soil cement, will that have an effect on whether the soil cement will perform as intended or the cement-treated --

**A. Well, construction techniques can have effects that would be detrimental to the performance of soil cement, but those need to be controlled during construction so that we produce the interface strengths that we're looking for, that we're relying on.**

Q. And do you anticipate that you'll use Dr. Wissa to develop any construction procedures or QA/QC measures?

**A. I expect he will participate in the development of those.**

Q. And when do you anticipate that those procedures will be written up?

**A. Following this laboratory testing work.**





**It's further down the road.**

Q. And are any of these -- any of the general outlines of the construction procedures and QA/QC measures for the placement and construction of the soil cement, are any of these found in the SAR? Is there any discussion at all of construction procedures or QA/QC measures for construction?

**A. I suspect there is in 2.6.4.11, but I don't know. I will check.**

**Construction techniques are described somewhere in here. Whether the QA aspects of it are clearly delineated, I'm not sure.**

**It says on page 12.6-118, for instance, Procedures required for placement and treatment of the soil cement lift surfaces and foundation contact will be established in accordance with the recommendations of ACI 1998 during the mix design and testing process. Specific construction techniques and field quality control requirements will be identified in the construction specifications developed by PFS during this detailed design phase of the project.**

Q. And on page 2.6-113 of the SAR, the last paragraph, it mentions that soil cement has been used extensively. Is this true soil cement or are we talking about cement-treated soil, do you know, in

PAGE 93

93

this --

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

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

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

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

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

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

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

**A. No.**

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

(Lunch recess was taken.)

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

PAGE 94

94

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

**A. Correct.**

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

**A. Yes.**

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

**A. Correct.**

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

**A. Yes.**

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

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

Q. Especially for the court reporter.

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

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

PAGE 95

95

**the pads in place.**

Q. Is adhesion and cohesion important, then?

**A. Yes.**

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

**A. Yes.**

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

**A. Yes.**

Q. And what is that opinion?

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

PAGE 96

96

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

**A. Yes.**

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

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

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

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

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

**A. It's both.**

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

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

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

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





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

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

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

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





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

Q. How --

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

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

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





Q. Okay.

A. Okay?

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

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

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

Q. Adhesion.

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

Q. And will the strength be less?

A. Less, yes.

Q. And the adhesion will be less?

PAGE 109

109

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

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

Q. Oh, the upper Bonneville.

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

Q. I thought you said both.

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

Q. Okay.

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

Q. Okay.

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

(A discussion was held off the record.)

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

A. Yes.

Q. And when and to what extent?

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

PAGE 110

110

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

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

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

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

(A discussion was held off the record.)

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

PAGE 111

111

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

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

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

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

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

PAGE 112

112

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

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

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

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

A. It is a reinforced concrete pad --

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

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

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

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