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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

OFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

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In the Matter of :
:
PRIVATE FUEL STORAGE : Docket No. 72-22
L.L.C. : ASLPB No. 97-732-02-ISFSI
:
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Washington, D.C.

Friday, March 15, 2002

Deposition of

JAMES K. MITCHELL

a witness, called for examination by counsel
for Private Fuel Storage, pursuant to notice
and agreement of counsel, beginning at
approximately 8:30 a.m., at the law offices
of Shaw Pittman, 2300 N Street, NW.,
Washington, D.C., before Barbara A. Huber of
Beta Reporting & Videography Services, notary
public in and for the District of Columbia,
when were present on behalf of the respective
parties:

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NUCLEAR REGULATORY COMMISSION

Docket No. 72-22 Official Exh. No. PFS Ex. 228
In the matter of Private Fuel Storage
Staff _____ IDENTIFIED ✓
Applicant ✓ RECEIVED _____
Intervenor _____ REJECTED _____
Other _____ WITHDRAWN _____
DATE JUNE 17, 2002 Witness Mitchell
Clerk _____

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P R O C E E D I N G S

Whereupon,

JAMES K. MITCHELL

was called as a witness and, having been
first duly sworn, was examined and testified
as follows:

EXAMINATION BY COUNSEL FOR PRIVATE

FUEL STORAGE

BY MR. TRAVIESO-DIAZ:

Q Good morning, Dr. Mitchell.

A Morning.

Q Would you please state your full
name for the record?

A James K. Mitchell.

Q My name is Matias Travieso-Diaz.
I'm an attorney representing PFS in this
proceeding. I will asking you some
questions today about what has been called
the Utah Contention QQ, which is now part of
what has become unified Contention L/QQ.
But we get underway, let me ask you.

Have you testified prior to today

1 in any legal proceedings?

2 A I have.

3 Q So you are somewhat familiar with
4 the process?

5 A I am.

6 Q Have you given depositions before?

7 A Yes.

8 Q In any event, just to refresh your
9 memory as to the most important thing, if
10 there is a question that I ask you that you
11 don't understand, is unclear, poorly
12 formulated or whatever, could you please ask
13 me to fix it in whichever way, refresh it,
14 ask it again, or whatever? Would you please
15 do that?

16 A I will.

17 Q Are you familiar with Contention
18 QQ?

19 A Generally, yes.

20 Q What is the basis for your
21 familiarity?

22 A I was asked to look at the issues

1 relating to the use of soil cement and
2 formulate some opinions.

3 Q Were you involved in the process
4 that led to the filing of Contention QQ?

5 A Yes.

6 Q When were you first involved with
7 that process?

8 A Oh, that was last spring, April or
9 May of 2001.

10 Q How did you become involved?

11 A I was called by the folks in Utah
12 who are working with the attorney general's
13 office there.

14 Q Who called you?

15 A The first contact I believe was
16 Steve Bartlett.

17 Q What did Mr. Bartlett talk to you
18 about?

19 A He talked to me about the project
20 in general, and the fact that they were
21 proposing to use soil cement, and that he
22 felt that they wanted someone to work with

1 them who was familiar with soil cement.

2 Q So at that point, you were engaged
3 to do that work?

4 A After some decision about what my
5 involvement would be and so on.

6 Q Who else did you talk to in
7 addition to Mr. Bartlett?

8 A I talked to Farhang Ostadon; and
9 at some point, Connie Nakahara and Denise
10 Chancellor.

11 Q I'm going to ask you -- I'm sure
12 your lawyer will, as well -- not to disclose
13 to me anything of your conversations with
14 either Connie or Denise, since they are
15 counsel.

16 So apart from whatever
17 conversations you had with counsel for Utah,
18 what was the nature of your disclosure?

19 MS. CURRAN: Just to interrupt you
20 for a minute. We would also consider any
21 conversation with another expert in which a
22 lawyer was present, subject to that

1 privilege. So we would instruct you not to
2 discuss those conversations.

3 MR. TRAVIESO-DIAZ: Well, we'll
4 take it as it comes, but the question that I
5 need to ask him is sufficiently general. So
6 it shouldn't be a problem.

7 BY MR. TRAVIESO-DIAZ:

8 Q What was the nature of your
9 conversation with Dr. Ostadon at that point?

10 A Well, I can't remember
11 specifically whether it was with Dr. Ostadon
12 or Dr. Bartlett, because they were both
13 involved, but it was generally related to
14 the proposal for uses of soil cement, and
15 the issues that they felt might be relevant.

16 Q So, essentially, they suggested to
17 you issues that they thought might be
18 relevant?

19 A They did.

20 Q Did you raise issues on your own?

21 A I believe I did.

22 Q We'll get to those in a minute.

1 I believe Contention QQ was filed
2 in May of 2001, almost a year ago?

3 A Yes.

4 Q What has been your involvement
5 with that contention since that time?

6 A None, until around the first of
7 this year. In fact, I've had no involvement
8 with the contention itself, other than
9 having been sent the -- I don't know what
10 you call it, the decisions that were made
11 about it, its admissibility and so on.

12 Q So they sent you various filings
13 that were made and decisions made by the
14 board, and so on?

15 A That's correct. That was sometime
16 after the first of the year.

17 Q I take it you had no other
18 involvement up to the beginning of the year
19 with the rest of the case, either?

20 A No. I have not.

21 Q Since the beginning of the year,
22 what has been your involvement?

1 A My involvement has been
2 essentially nil, until about a week ago when
3 I started to review the current information,
4 and when I was sent deposition transcripts
5 and so forth.

6 Q Would it be fair to say that from
7 the beginning of the year until about a week
8 ago, all that was happening was they were
9 sending you materials for your information
10 as to what was going on?

11 A I had a brief meeting with Denise
12 and Connie Nakahara sometime in mid January,
13 when I was in Salt Lake City for other
14 reasons. That was simply to talk about
15 schedule and availability and do what I'm
16 doing here today.

17 Q What documents have you prepared
18 in connection with this case?

19 A What documents have I prepared?

20 Q Yes.

21 A I prepared a declaration, I
22 believe, last spring. That's the only

1 document, other than making some notes as I
2 went along.

3 Q So you have prepared no other
4 documents, written material since that time?

5 A For submission?

6 Q Yes. Or for any other purpose?

7 A No. Only the notes that I write
8 down maybe in a phone call or as I read
9 something.

10 Q Is it your understanding that
11 you're going to be a witness on behalf of
12 the state with respect to Contention QQ?

13 A Yes.

14 Q What aspects of Contention QQ is
15 it your understanding you're going to
16 testify about?

17 A Soil cement.

18 Q Is that it?

19 A Yes.

20 Q Since this was a year ago, and not
21 to test your memory, I'm going to give you
22 at this point what has been marked as

1 Exhibit 1. I will describe what it is for
2 the record.

3 Exhibit 1, which was introduced in
4 earlier depositions in this round, is
5 called, Joint submittal of united
6 geotechnical contention, Utah L and Utah QQ.
7 It's dated January 16, 2002. It's the cover
8 page. It's signed by Denise Chancellor,
9 Assistant Attorney General.

10 I understand that starting on the
11 fourth page, which is actually number
12 page 1, there is what I believe is the
13 description of what now is become --

14 A I don't have a page 1.

15 MS. CURRAN: Page 1 is this one.
16 Wait a minute his copy is --

17 MR. TRAVIESO-DIAZ: Is it
18 defective?

19 MS. CURRAN: I think so.

20 THE WITNESS: I don't know.

21 MS. CURRAN: Let me take a look.

22 MR. TRAVIESO-DIAZ: Let's go off

1 the record a second.

2 (Discussion off the record)

3 BY MR. TRAVIESO-DIAZ:

4 Q As I was saying, this document is
5 what the parties have agreed is the text of
6 Contention L/QQ.

7 Have you seen this document
8 before?

9 A Yes, I have seen it, just
10 recently.

11 Q Was that part of the documents you
12 started reviewing last week?

13 A Yes.

14 Q Now, my understanding is what used
15 to be Contention QQ has now become
16 subsection C-3-B, C, D, and E, on page 2
17 and 3, and subsection D on page 3, 4, and 5.
18 Actually, going on to the very first line of
19 page 6.

20 Does that agree with your
21 understanding?

22 A I don't know the details of how

1 they consolidated the two contentions.

2 Q I ask you to keep that document
3 handy because we're going to be referring to
4 it quite frequently.

5 Since you became involved --
6 again, I take it in this case early this
7 year -- apart from counsel for the state,
8 who else have you spoken to?

9 A Since I became involved in the
10 case?

11 Q Well, okay. All right. If I
12 recall what you said a moment ago, you
13 essentially provided a declaration in May
14 last year?

15 A That's correct.

16 Q Then essentially had no
17 involvement until January, when you had a
18 brief meeting with Denise Chancellor and
19 Connie Nakahara?

20 A That's correct.

21 Q You really had no further
22 involvement until about a week or so when

1 you began preparing for this deposition?

2 A Yes.

3 Q Now, my question is: Since
4 January of this year, apart from counsel for
5 the state of Utah, who else have you spoken
6 to in connection with this case?

7 A I've spoken with Steve Bartlett,
8 and Farhang Ostadon.

9 Q What was the nature of your
10 conversations, these more recent
11 conversations, you had with Mr. Bartlett?

12 A They were discussing the
13 depositions, I believe, of Paul Trudeau; and
14 some points that they were they thought were
15 relevant to this particular case with soil
16 cement.

17 Q What did they tell you, as far as
18 you can recall?

19 MS. CHANCELLOR: This is Denise
20 Chancellor. I would like to caution
21 Dr. Mitchell that I was on that phone
22 conversation, too.

1 THE WITNESS: Oh, you were.

2 That's correct.

3 So that is something that I don't
4 respond to; is that correct?

5 MR. TRAVIESO-DIAZ: Well, you tell
6 me.

7 Are you instructing the witness
8 not to tell me what Dr. Bartlett told you?

9 MS. CURRAN: Yes.

10 MR. TRAVIESO-DIAZ: On the basis
11 that it was part of a conversation with
12 counsel for the state?

13 THE WITNESS: Yes. Thank you for
14 refreshing my memory, but Denise Chancellor
15 set up that call.

16 BY MR. TRAVIESO-DIAZ:

17 Q So it was a conference call?

18 A Yes, it was.

19 Q Apart from that conference call,
20 have you had any other conversations with
21 anyone else?

22 A I don't recall any conversations,

1 no.

2 Q What materials, what written
3 documents did you review in preparing for
4 this deposition today?

5 A I reviewed very, very briefly Paul
6 Trudeau's deposition transcript. I've
7 reviewed or read through these contentions.
8 I refreshed my memory of some past documents
9 on this, looked at a couple of things in the
10 SAR. I looked at the ACI document on soil
11 cement, sort of the state-of-the-art
12 document. I looked at my prior declaration.
13 I'm trying to think. My memory's bad. It
14 was those kinds of documents, all related to
15 this particular issue.

16 MR. TRAVIESO-DIAZ: All right.
17 Let me show you and give you a document
18 that's going to be marked by the reporter as
19 Exhibit 36.

20 (Deposition Exhibit No. 36 was
21 marked for identification.)

22 BY MR. TRAVIESO-DIAZ:

1 Q Dr. Mitchell, I have introduced
2 and marked as Exhibit 36, a document
3 entitled, Declaration of Dr. James K.
4 Mitchell, dated May 15, 2001.

5 Is this the declaration that you
6 were referring to a moment ago as preparing
7 at the time Contention QQ was filed?

8 A It is.

9 Q Did you prepare this document?

10 A Yes.

11 Q I see also that attached to this
12 document -- so I take it that's your
13 signature on page 5?

14 A Yes.

15 Q Attached to that signature page,
16 there is a two-page document dated
17 April 2001, which, as I read it, appears to
18 be a summary of your qualifications and
19 experience; is that correct?

20 A Yes.

21 Q You prepared that, as well?

22 A Yes. I don't know if it's been

1 edited any since I submitted some
2 information or not. But it looks pretty
3 much like what I've been using.

4 Q I would like you to take a moment,
5 given that you prepared this document a year
6 ago, and review the declaration first. Then
7 we'll talk about the qualifications later.
8 But starting with the declaration itself, to
9 see if based on what you have learned, if
10 anything, over last year there is any change
11 you want to make, or any addition,
12 correction or modification to what you say
13 in the declaration.

14 A There is.

15 Q Could you tell us what there is?

16 A There may be more than this, if I
17 read it very, very fairly. But in
18 paragraph 11, in my subsequent review the
19 past few days, I realize that I
20 misinterpreted the nature of the
21 cross-section under the pads.

22 Q Could you explain?

1 A When I prepared this, I had
2 misunderstood, as I indicated, the
3 cross-section; and had been under the
4 impression that the cast themselves would be
5 sitting directly on the layer of soil cement
6 in the pad area.

7 I start talking in here about the
8 general characteristics of Portland cement
9 concrete and asphalt concrete, pavement
10 structures; and the similarity of what is
11 being proposed at the site here with
12 pavements, and the fact that there was no
13 structural layer present.

14 In fact, I was wrong. There
15 certainly is. There is a three-foot thick
16 reinforced concrete structural layer that's
17 between the casts from the -- the bottom of
18 the casts and the soil cement. So that
19 changes what the loading and stress
20 conditions will be in the soil cement.

21 Q I was going to later ask you
22 questions, because I had the sense that you

1 made that misunderstanding.

2 What change would you propose to
3 make to paragraph 11 to make it correct,
4 based to your understanding?

5 A I would suspect that freeze/thaw
6 will probably not be a major issue at that
7 depth, at least to the same extent that it
8 would be if the material were exposed. The
9 second sentence about the tensile strength
10 is still valid.

11 It's still true that in heavy-duty
12 pavements with soil cement bases there's
13 usually a structural asphalt concrete or
14 Portland cement concrete pavement layer
15 of 16 inches, but that's not relevant in
16 this case. Because we're looking at
17 a 36-inch thick reinforced concrete layer.
18 So we would need to strike the sentence that
19 this structural layer is absent in the
20 applicant's proposed design.

21 The bending stresses and their
22 consequences will be much less in the actual

1 design than I had been presuming. It would
2 mean that the last sentence of this
3 paragraph perhaps would be modified some. I
4 still have not found -- and maybe the
5 information is there in the SAR or other
6 calculations -- I have not seen a -- I've
7 not personally seen the calculation of the
8 magnitude of the bending stresses at the
9 bottom of the soil cement layer.

10 Q Not to put words in your mouth,
11 but how would you propose to reword the last
12 sentence of paragraph 11?

13 A I would say that I have not seen
14 the results of calculations of the stresses
15 in the treated soil cement layer beneath the
16 reinforced concrete pad.

17 Q You mean the bending stresses?

18 A The bending stresses would be the
19 most critical in this case, I think, yes.

20 MR. TRAVIESO-DIAZ: Would you read
21 the last part of his answer?

22 (The reporter read the record as

requested.)

MR. TRAVIESO-DIAZ: Would you take
a moment to go off the record?

(Discussion off the record)

BY MR. TRAVIESO-DIAZ:

Q Dr. Mitchell, apart from those
changes that you're suggesting in
paragraph 11, is there any other part of
your declaration that you think it may be
appropriate to change, based on what you
know now?

Take a couple of minutes to look
through it.

A Paragraph 14 perhaps needs some
modification, simply to indicate that
placement of the pads, the reinforced
concrete pads themselves, will have the
effect of causing some changes in moisture
content of the underlying soil.

Q Where will you make that change?

A Well, let's see. The first
sentence might say, placing the reinforced

1 concrete storage pads and the soil cement
2 layer beneath them will lead to an increase
3 in the water content, the partly saturated
4 silty clay and clay silt soils beneath them.

5 Q Any other changes?

6 A I think that's all right.

7 Q Very good. Before I ask you to
8 look at the declaration, you were telling me
9 that attached to it is a statement of your
10 qualifications and experience; is that
11 right?

12 Would you turn to that?

13 A This one?

14 Q Yes.

15 A Yes.

16 Q It's clear that you have quite an
17 extensive record here. Rather than my
18 characterizing it for you, could you in your
19 own words describe to me what you believe to
20 be your areas of expertise?

21 A Well, my overall area of expertise
22 is geotechnical engineering. Within it, in

1 my research, my teaching, and my consulting
2 activities, I have focused on soil
3 stabilization and ground improvement, and on
4 the engineering properties of soils, on
5 aspects of geoenvironmental engineering, and
6 more recently on geotechnical earthquake
7 engineering.

8 Q You don't consider yourself in an
9 expert in what I think is called structural
10 engineering; that is to say, the design of
11 structures?

12 A I am not.

13 Q How about, for lack of a better
14 word, the specialized analysis that go with
15 the design such as soil structure
16 interaction? Are you an expert in that?

17 A I am not expert on the analysis of
18 soil structure interaction. I work with
19 experts in those areas as I appropriate.

20 Q Like Dr. Ostadon, for example?

21 A Yes.

22 Q Now, a moment ago when you said

1 that you have become or you are an expert in
2 geotechnical earthquake engineering.

3 Could you explain to me what that
4 means?

5 A In this case, I will choose to
6 limit the area within that overall category
7 of geotechnical earthquake engineering to
8 issues related to soil liquefaction and
9 ground modification and improvement so as to
10 increase their resistance to damaging
11 affects of seismic loading.

12 Q What work have you done on that
13 last category, ground improvements to better
14 the resistance of the ground to earthquake?

15 A I have worked both in research and
16 in consulting on the appropriate treatments
17 to attain the levels of improvement that are
18 needed to resist liquefaction. I've worked
19 on specific designs for improving the
20 foundations of existing dams that are in
21 seismic areas. It's that general area that
22 I've been working in.

1 Q We will talk about this probably
2 more later.

3 But just to get an idea, what kind
4 of techniques or designs have you been
5 involved with for improving the designs or
6 foundations to resist the earthquake loads?

7 A Things ranging from densification
8 by vibratory techniques, densification by
9 compaction grouting or injection grouting,
10 the construction of structural fills to
11 replace potentially liquefiable sand
12 materials.

13 Q Have you ever had occasion to use
14 soil cement as an application for helping
15 foundations or soils resist earthquake
16 loads?

17 A Well, there is a very significant
18 case that's referred to in documentation for
19 this project we're talking about here, in
20 South Africa, the Coberg nuclear power
21 station, where they replaced about an
22 eight-meter thick potentially liquefiable

1 layer of sand -- it was quite a clean
2 sand -- with the same material treated with
3 cement.

4 Q Were you involved in this case?

5 A I was.

6 Q Do you think that's a case that
7 the application is analogous to the one
8 that's been proposed here?

9 A No.

10 Q Why not?

11 A It's not analogous to this
12 particular case because the soils there were
13 loose, saturated sands that were potentially
14 liquefiable. The soils at the PFS site in
15 Skull Valley are plastic, fine grain
16 materials that I don't believe would be
17 susceptible to liquefaction.

18 Q Well, apart from the different
19 constituency of the soil, the soil material,
20 how did the application at the South Africa
21 plant differ from the application that is
22 proposed here?

1 A The one in South Africa involved a
2 large excavation. As I recall, it was
3 about 24 meters deep below the ground
4 surface, and the removal of a very thick
5 layer of loose sand, and treatment with
6 cement and replacement and recompaction.

7 Q Was it with treated with cement,
8 or did they make a cement soil mixture?

9 A They mixed cement with the sand.

10 Q Isn't that what they're proposing
11 to do here at PFS, as well?

12 A They're proposing mixing cement
13 with the soil, but the soil type is totally
14 different.

15 Q Perhaps it's an ignorant question,
16 but what difference would it make in terms
17 of the nature of the application whether you
18 have one type of soil or another? Wouldn't
19 you be doing the same thing?

20 A The South African issue was
21 potential liquefaction of the sand which
22 would lead to loss of foundation support.

1 The application in the PFS case, it's
2 shallow. It's treatment of a fine grain
3 soil at a location where liquefaction is not
4 an issue. The purpose of the treatment is
5 to provide a stronger material; and, if I
6 understand correctly, is also to be able to
7 use the upper two feet of material that
8 otherwise would have to be wasted.

9 Q Well, which of the two do you
10 consider more significant or difficult
11 technical problem: To solve the
12 liquefaction concern in the South Africa
13 plant, or to straining the soils at PFS?

14 A I wonder if that isn't, in some
15 ways, an apples and oranges kind of
16 comparison. Because each project had
17 different challenges. I can't say that one
18 is more difficult or critical than the
19 other.

20 Q All right. Go back to your
21 qualifications, if you would for a second.

22 Since this was prepared on April

1 of last year, would you take a look at this
2 statement of qualifications and tell me
3 whether you have done any additional work
4 since the time this statement was prepared
5 that would be relevant to the issues in
6 Contention QQ?

7 A I don't think that there are any
8 projects that are directly relevant to this
9 one that I've been working on recently.

10 Q Now, you said a moment ago that
11 apart from your declaration and some notes
12 that you wrote to yourself, you haven't
13 prepared any written materials relating to
14 this contention in this litigation; is that
15 correct?

16 A To the best of my knowledge, yes.

17 Q Have you performed any tests, any
18 soil examinations, or any physical
19 inspections with respect to the soils at
20 PFS?

21 A I have not.

22 Q Have you been to the PFS site at

1 all?

2 A No. I have not.

3 Q Do you anticipate doing any
4 written analysis or performing any tests of
5 the type that are normally performed on soil
6 or otherwise, between now and maybe in the
7 next month, when the hearing will take place
8 in this proceeding?

9 A I have no plans to do so.

10 Q Let's go back to Exhibit 1, which
11 is the text of Contention QQ. You
12 personally had no input in the preparation
13 of this document that's Exhibit 1; is that
14 correct?

15 A This is the combined L and QQ?

16 Q Correct.

17 A No, I had nothing to do with that.

18 Q All right.

19 MS. CURRAN: Hold on just a
20 minute.

21 (Counsel conferred with witness)

22 BY MR. TRAVIESO-DIAZ:

1 Q Please go back on the record and
2 explain what you were talking to counsel
3 with.

4 A Well, she was asking if I had
5 involvement in the preparation of QQ. My
6 involvement was the preparation of a
7 declaration. I believe that there were
8 drafts of QQ that I looked at the relevant
9 pieces of back in -- a year ago time frame.
10 So I did have involvement in that. But when
11 it became the combined L and QQ, I don't
12 recall having done anything with that.

13 Q That was precisely my question,
14 whether you had anything to do with the new
15 version, which was submitted in January of
16 this year.

17 I thought you said "no"?

18 A I did, but --

19 Q I'm sorry. Let me see if we can
20 get this way. I can clarify my question.

21 You testified that you provided
22 input that ultimately formed the basis for

1 what became Contention QQ that was filed in
2 May of 2001?

3 A That's correct.

4 Q Now, had you had any input in the
5 process, whatever it may have been, that led
6 to the preparation and the filing of
7 Exhibit 1, the document that was filed in
8 January of this year?

9 A No.

10 Q That was what I though you said.

11 Now, in that case, will you turn
12 to Exhibit 1? I ask you to review section
13 C, D, and E for a moment.

14 A Little C, D, and E, is that what
15 you're asking?

16 Q I'm sorry. Big C, D, and E,
17 starting on page 2 and going all the way
18 through the end.

19 What I'm going to ask you, so that
20 you may do this very quickly, is to confirm
21 for me that, as you understand it, you're
22 going to be testifying only with respect to

1 the matters raised on subsection C, big C,
2 that goes from page 2 to page 3?

3 A That is my understanding, yes.

4 Q So we can limit what we need to
5 talk about.

6 A Yes.

7 Q Now, turn to section C, big C.
8 Look at subparagraph three that begins on
9 page 2 and goes on to page 3.

10 Would it be correct to say that on
11 paragraph C-3, with the exception of the
12 first and the last subparagraph, which are A
13 and E, that the rest of them relate to or
14 address the use of soil cement?

15 A Yeah. That's correct.

16 Q So to put it differently, you
17 don't expect that you will be testifying
18 with respect to C-3-A or C-3-E; is that
19 correct?

20 A I have some opinion on C-3-E.
21 That's, again, related to the soil and
22 cement.

1 Q So you expect to be testifying
2 with respect to C-3-E, as well?

3 A As it relates to the Youngs
4 modulus of the soil cement, yes. As to its
5 impact on the impact forces, no, that's --
6 that part of the analysis is not something
7 I've been involved in. But I have some
8 understanding of the modulus of
9 cement-treated soil.

10 Q Let's then turn to paragraph C-3-B
11 on page 2 of Exhibit 1.

12 Do you have that before you?

13 A I do.

14 Q Were you involved in providing
15 facts or information that form the basis for
16 the formulation of paragraph C-3-B?

17 A I was not involved in the
18 formulation of that.

19 Q Do you expect that you will be
20 offering testimony with respect to the
21 matters addressed in this paragraph?

22 A I believe that the dynamic

1 analyses that are needed there are more in
2 the area of expertise of Dr. Ostadon.

3 Q As I understand paragraph C-3-B,
4 it raises the potential lack of case history
5 present and the potential lack of site
6 specific testing about or relating to the
7 use of cement-treated soil at PFS or soil
8 cement?

9 A Yes. That's what it says.

10 Q Those two areas, will you be
11 addressing them?

12 A Well, if the earthquake loadings
13 are determined in terms of stress and
14 strength requirements for the soil cement, I
15 might be testifying according to the --
16 relative to that. But as for determining
17 what those loadings would be, that's not my
18 area.

19 Q I need you to clarify a little bit
20 more for the record what you mean, after the
21 "if." Explain to me.

22 A Well, what I mean is that I could

1 potentially testify as to whether I believe
2 the soil cement will have properties
3 adequate to resist the earthquake loading.

4 Q State the definition, if you will,
5 as of today, of the earthquake loadings that
6 will imparted upon the soils of PFS?

7 A My in-depth knowledge of what the
8 specific loads will be is very limited. I
9 understand that the seismic design is based
10 on a maximum horizontal and vertical
11 acceleration of .7 g. But that has to be
12 translated into what the actual loads will
13 be that are transferred into the foundation.
14 I don't know those values.

15 Q Are you aware of whether PFS has
16 done calculations to try to determine
17 exactly that?

18 A I believe they have. But I
19 haven't reviewed any of them in detail.

20 Q So that I can understand the
21 extent of your knowledge, you have not
22 reviewed the calculations so you don't have,

1 today, a current knowledge of what the
2 calculated loads on the soil will be; is
3 that correct?

4 A That is correct.

5 Q Without knowing what those loads
6 will be, you wouldn't know whether the
7 proposed soil cement design will be
8 sufficient to meet those loads? Is that
9 your view?

10 A That's my view, yes. I know --
11 let me add that -- that design strength
12 values have been indicated in the PFS
13 application that they are intending to
14 obtain. But what I do not know is whether
15 the particular soil cement that they're
16 planning to use will provide them.

17 Q Let me ask the question this way
18 then.

19 Is it your lack of current
20 understanding or knowledge, if I can use the
21 term, based on the fact that you don't know
22 whether those numbers are appropriate for

1 use, or is it based on your not being able
2 to tell whether soil cement can achieve
3 those values?

4 A I am unable to comment on whether
5 the numbers are appropriate because I've not
6 been involved in that dynamic analysis.
7 It's not an area I have expertise in. I
8 would suspect that a proper formulation of
9 soil cement could attain the values that are
10 proposed for the design. But I've seen no
11 data for the soils and soil cement mixtures
12 for that site that demonstrate it.

13 Q We'll talk about this a little bit
14 more later, but just so I understand the
15 limitations of your current knowledge --
16 you're saying that -- I suspect that you
17 give me a number, say to pick one, 250 PSI,
18 that it is possible to achieve soil cement
19 of that strength; but you don't know,
20 sitting here today, whether, in fact, the
21 methodology that PFS intends to use will
22 indeed resolve in soil with that

1 characteristic? Is that what you're saying?

2 A That's I think a reasonable way to
3 put it. It's certainly possible to obtain a
4 strength of 250 PSI. But to date, I have
5 seen the results of -- I have not seen the
6 results of any tests that show me that for
7 this soil.

8 Q Again, I'm jumping way ahead, but
9 we my go back to this. I provided to the
10 state at their request earlier this week
11 some preliminary test results of the program
12 that PFS is conducting.

13 Have you seen those?

14 A Yes.

15 Q So you have seen those test
16 results?

17 A I have.

18 Q Going back --

19 A That is, if it's the same set of
20 results -- you know, there may -- I don't
21 know how many sets of results there are, but
22 I have seen one set of results.

1 Q We'll talk about that a little bit
2 more in a moment.

3 We were addressing or discussing
4 paragraphs C-3-B?

5 A Yes.

6 Q You were explaining to me that the
7 portion of the paragraph that related to
8 site specific testing, I believe?

9 A Uh-huh.

10 Q I was about to ask you to clarify
11 for me whether you will be addressing the
12 concern about the lack of case history
13 present.

14 Will you be addressing that, as
15 well, or is that for others?

16 A Well, I'm personally unaware of
17 any case history precedent for this
18 particular kind of application. It may be
19 there but I, personally, don't have
20 knowledge of a nuclear waste canister
21 storage area involving the use of
22 cement-treated soil.

1 Q Well, so where you're defining
2 this particular application, you're
3 referring to the use of soil cement to, if
4 you will, improve the performance of the
5 foundations underneath storage casts for
6 nuclear waste?

7 A Yes. I know of no other case
8 exactly like this.

9 Q Well, as an experienced engineer,
10 what conclusion or what importance do you
11 attribute to the fact that soil cement has
12 never been tried to be used before in
13 connection with waste storage casts for
14 nuclear facilities? What's the significance
15 of that?

16 A I'm not sure there is any
17 significance. We're always finding new
18 applications for our materials. I don't see
19 anything inherently wrong with the basic
20 concept that's being proposed here.

21 Q Let me ask you to look at a
22 document that you referred to as among of

1 the things that you reviewed. Correct me if
2 I'm wrong. But I believe we're talking as
3 the same document. This was previously
4 introduced as Exhibit 23 in earlier
5 deposition in this case.

6 For the record, this document is
7 entitled, ACI 230.1R-90. The title is,
8 State-of-the-art report on soil cement,
9 reported by ACI committee 230. It bears the
10 caption on the top, Reapproved 1997. There
11 was earlier testimony that this document, in
12 fact, was released in 1998.

13 Is this a document that you
14 reviewed?

15 A I have the original version of
16 this, which I believe was 1991, something
17 like that. I have not had access to the
18 reapproved version, which you have just
19 handed me here.

20 Q Tell me, are you familiar with
21 this document; not this particular exhibit,
22 but the state-of-the-art report on soil

1 cement?

2 A This one, yes.

3 Q Well, tell me about what is this
4 document? What is the intent of the
5 document? What is it done for?

6 A I think the intent of the document
7 is to describe what soil cement is, how it
8 can be used, how you construct it, how you
9 design the mixtures, what are the general
10 ranges of engineering properties. It
11 provides a good overview coverage of the
12 subject for both people who are trying to
13 learn initially about it, and for people who
14 want to have some reference information with
15 values for different properties.

16 Q Were you involved with the
17 preparation of this document originally?

18 A I was not involved with the
19 preparation of the document, although there
20 are some figures in it that came from
21 publications that I was involved with in
22 years past.

1 Q Is this considered a standard
2 reference to work in the field of soil
3 cement?

4 A I don't know for sure. But I
5 guess it certainly could be considered a
6 standard reference.

7 Q Do you use it yourself?

8 A I have not used it in this form
9 myself because, for years, my own notes and
10 other reference materials have formed the
11 basis for the classes that I taught on
12 stabilization with cement, and those types
13 of things. So, basically, the information
14 that's organized very nicely here is what
15 I've had in my own files.

16 Q So, essentially, this reflects
17 information that you, yourself, have
18 developed?

19 A Well, there's some information in
20 here that I've developed. But it reflects
21 what a lot of people have developed. I
22 think it reflects a very good coverage of

1 the subject.

2 Q Do you think it would be
3 appropriate for somebody seeking to design a
4 soil cement program to use this as a
5 reference to go by?

6 A Oh, I think so, yeah.

7 Q Let me show you what has again
8 been previously marked as Exhibit 21 in this
9 proceeding.

10 For the record, Exhibit 21 is a
11 portion of the safety analysis report for
12 the PFS facility. It comprises
13 section 2.6.411 and goes to the end of
14 section 2.8.

15 Is this one of the documents that
16 you were saying that you reviewed last week
17 in preparation for this deposition?

18 A Yes.

19 Q If you will turn your attention to
20 page 26117.

21 A Okay.

22 Q Look at the last paragraph on the

1 page, that starts with the words "the
2 design."

3 A Yes.

4 Q Concentrating just on the first
5 sentence, it says, The design placement,
6 testing, and performance of soil cement is a
7 well established technology.

8 Would you agree with that?

9 A I would.

10 Q Now, the paragraph goes on to say
11 that PFS will develop site specific
12 procedures to implement the recommendations
13 presented in ACI 1998.

14 If you go back to the references
15 on the back or even to the second line of
16 this paragraph, it appears to refer to the
17 same document that we're talking a moment
18 about before, the state-of-the art report on
19 soil cement; is that correct?

20 A I believe so.

21 Q Would it be appropriate for PFS to
22 follow the guidance in the state-of-the-art

1 report on soil cement in developing the site
2 specific procedures for mixed portion and
3 testing, construction and quality control?

4 A I'd have to go back and look at
5 the guidelines in some detail to be sure
6 whether you would follow them exactly in all
7 respects. But I think that there's good
8 guidance there, yes. The same kind of
9 guidance are available through the Portland
10 Cement Association publications and
11 elsewhere.

12 Q Is it, in fact, your understanding
13 that the state-of-the-art report on soil
14 cement references all the publications, such
15 as the Portland cement standard that you
16 talked about?

17 A I think it does. References the
18 AFTM standards that are often used.

19 Q Those would be the standards that
20 you would expect somebody designing or
21 constructing soil cement probably would be
22 follow; is that correct?

1 A Yes, I believe so. Yes, I would.

2 Q As long as we are on that
3 page, 26117, would you take a look at the
4 discussion we just began looking? Take a
5 second to read that, or more than a second.
6 I would like you to take a look at that
7 paragraph on page 26117, and then three
8 paragraphs with bullets that go on
9 page 26118 and 119. Take a second to review
10 those. Let me know when you're finished.

11 A Okay.

12 Q Before we go into the specifics of
13 this bullets, maybe it would be good for the
14 record if we talked about your understanding
15 of what PFS intends to do with soil cement.

16 Are you sufficiently familiar with
17 what you understand to be their intents, so
18 you can describe it for us?

19 A Do you want me to describe it?

20 Q Yes. If you could describe your
21 understanding of what they're trying to do.

22 A They're using it in two ways, my

1 understanding. They're planning to put a
2 roughly two-foot thick layer of soil cement
3 beneath the cast storage pads, over this
4 large area. The cement will be of uniform
5 thickness, essentially, between the
6 storage -- or beneath a storage pad, but
7 between the storage pads, which is a
8 distance of five feet, I think, in one
9 direction, ten in the other. Correct me if
10 I'm wrong. Whatever. 35? In the other.

11 The soil cement thickness will be
12 greater. It's going to extend up to
13 within -- I think it's eight inches of the
14 ground surface. That upper eight inches
15 between the pads is going to be crushed rock
16 or gravel for transport of vehicles, if I
17 remember correctly.

18 The other application of the soil
19 cement is around the cast transfer building.
20 It's going to be thicker. I think it's five
21 feet thick there. It's extending out.
22 It's 240 in one direction, and 360, or

1 something of that sort in the other.

2 Q Feet?

3 A Feet. Those are feet, yes.

4 That's my understanding of the use of soil
5 cement, the intended use of soil cement.

6 Q A couple of clarifying questions.

7 With respect to the pad and
8 placement area or the cast and placement
9 area, is it your understanding that the
10 storage casts will sit on a reinforced
11 concrete pad?

12 A Yes. This was my area of
13 misunderstanding when I did the declaration.

14 Q Three feet thick?

15 A Yes, a three-foot thick reinforced
16 concrete mat.

17 Q That mat, in turn, will be sitting
18 on the two feet of soil cement that you
19 described a moment ago?

20 A That's my present understanding,
21 yes.

22 Q The intent is to use different

1 strengths of mixes, if you will, of soil
2 cement underneath the pad, as opposed to
3 elsewhere; is that correct?

4 A Yes.

5 Q So what is your understanding of
6 the compressive strength, if you will, of
7 soil cement that they want to use underneath
8 the pads, as opposed to in other areas?

9 A My understanding if -- is that the
10 strength of the treated soil beneath the
11 pads is low. Is 40 PSI right, the right
12 number? That the soil cement surrounding
13 the building is stronger, 250 PSI.

14 Q The soil cement around the pads is
15 also stronger?

16 A I don't remember on that but I --
17 I don't remember whether it's still the 40
18 or whether it's 250.

19 Q With that background, let's turn
20 to the first bullet on page 26118.

21 In that paragraph, with the first
22 bullet that is entitled, soil/cement mix and

1 procedure development, the first paragraph
2 of that entire section says, The sliding
3 forces due to design bases ground motion
4 will be resisted by bond between the base
5 and sides of the foundation and the soil
6 cement, and by passive resistance of the
7 soil cement acting against the vertical side
8 of the foundation. The soil cement mix will
9 be designed and constructed to exceed the
10 minimum shear resistance requirements.

11 Do you have any reason to believe
12 that this approach as a technical
13 proposition will not be successful if done
14 properly?

15 A I don't have any reason to believe
16 that it wouldn't be successful, no.

17 Q It goes on to say that there be
18 direct shear testing conducted to replicate
19 the soil conditions and to confirm the
20 adequate shear resisting and other strength
21 requirements will be provided by the final
22 soil cement mix.

1 Do you see that?

2 A Uh-huh.

3 Q Assuming that, in fact, such
4 testing is conducted appropriately, do you
5 have any reason doubt that, in fact, it will
6 be possible to do demonstrated by testing
7 that the shear strength requirements will be
8 met?

9 A I would anticipate that it should
10 be possible to meet those requirements. But
11 in my opinion, it's necessary that it be
12 demonstrated by testing. To this point, I
13 have seen no results to indicate that it's
14 been achieved.

15 Q Of course. I guess the proof is
16 in the pudding?

17 A Yeah.

18 Q So your present doubt is not
19 whether it can be done, but whether PFS has
20 demonstrated that what they intend to do
21 specifically will meet the objective that
22 they're describing here; is that right?

1 A I agree.

2 Q That will have to be done through
3 a testing program?

4 A Yes.

5 Q Now, let's go to the second
6 bullet. The second bullet starts on the
7 bottom of page 2118 and go to the top of
8 page 2119. It appears to talk about the
9 actual techniques that will be used to
10 construct the soil cement.

11 Is that how you read that
12 paragraph?

13 A Yes.

14 Q Now, is the approach to
15 construction rate described here, as far as
16 your experience tells you, is this the way
17 you would do it, or is this an appropriate
18 way to do it, as far as constructing the
19 soil cement itself?

20 A Excuse me. I'm reading it.

21 Q Go ahead.

22 MR. TRAVIESO-DIAZ: I'll ask you

1 to read that question back to him.

2 THE WITNESS: That seems a
3 reasonable construction procedure for me.

4 BY MR. TRAVIESO-DIAZ:

5 Q Thank you. Then let's go back to
6 the last bullet that is entitled, soil
7 cement and in situ clay interface. That one
8 appears to describe the construction
9 technique to make sure that there is a good
10 bonding between the soil cement and the
11 underlying clay.

12 Is that how you read the
13 paragraph?

14 A There are two aspects of it. The
15 first is whether the bond that's necessary
16 will be achieved. That can be determined by
17 testing.

18 Q Correct.

19 A Should be determined by testing.
20 Construction techniques are proposed --
21 well, they're not specified here. But they
22 proposed to develop them such that that

1 interface bond is indeed obtained.

2 Q Does this look to you a reasonable
3 approach?

4 A It's a reasonable approach. I
5 think that the first step would be to
6 demonstrate that the bond could be obtained.
7 In my opinion, there is no reason that
8 couldn't be done now.

9 Q That, again, would have to be done
10 or could be done by testing?

11 A That's correct.

12 Q Would it make any difference
13 whether that demonstration is done now, or
14 at some future time?

15 A Well, in the unlikely event that
16 you couldn't obtain the bond that you have
17 designed your project to have, yes, it would
18 make a difference.

19 Q Sure. It would be a terrible
20 waste of time?

21 A Yeah.

22 Q But putting that aside, does it

1 make any difference when you test it, as
2 long as you can demonstrate that you can
3 achieve the bond?

4 MS. CURRAN: Clarification.
5 Difference to what?

6 MR. TRAVIESO-DIAZ: If I
7 understand his testimony, he testified that
8 if instead of doing it now you do it at the
9 end of the process, you risk failing to
10 demonstrate that you'll be able to achieve
11 the bond and therefore you have to do
12 something else.

13 THE WITNESS: That's correct.

14 BY MR. TRAVIESO-DIAZ:

15 Q By the same token, if you do that
16 today and you demonstrated that the bond
17 cannot be achieved, then you have to do
18 something else.

19 Is there any the significance to
20 reaching the determination either way,
21 whether it is done today or whether it is
22 done say just before construction starts?

1 A Seems to me to be prudent that you
2 would want to demonstrate these things
3 before the final design is completed and the
4 appropriate licensing to go ahead with the
5 project is issued.

6 Q Do you know what they intend to
7 test for the achieving of the bond, the
8 ability to achieve such a bond, at any point
9 in the near future?

10 A Do I know if --

11 Q What their intent is, as far as
12 you know, with respect this, to this
13 performing this kind of a test?

14 A No. I don't.

15 Q Assuming that, in fact, they
16 deferred making this demonstration until the
17 point when they were ready to start
18 construction and at that point they realize
19 that, my God, we cannot achieve this bond,
20 what would happen then? Would they have to
21 come up with a different alternative
22 approach?

1 A Well, I would assume so. But I
2 know also -- and I'm no authority in this
3 area -- but I know that when you're dealing
4 with nuclear facilities, things have to be
5 pretty well demonstrated and proven before
6 you can go too far in your process.

7 Q The part I was trying to get to
8 actually was this.

9 Do you know of any regulatory
10 requirement, in terms of the licensing of
11 this facility, that would make it required
12 for PFS to perform this test that we're
13 talking about before they get a license to
14 build the facility?

15 MS. CURRAN: Objection. You're
16 asking for a legal conclusion.

17 MR. TRAVIESO-DIAZ: I'm asking if
18 he knows there is both regulations,
19 regulatory guidance that the technical
20 people use all the time. I just want to
21 know whether he knows of any.

22 THE WITNESS: I do not know the

1 legal and licensing requirements in this
2 area.

3 BY MR. TRAVIESO-DIAZ:

4 Q All right.

5 MS. CURRAN: Matias, just let me
6 know when is a good time to take a break.

7 MR. TRAVIESO-DIAZ: No, no, no,
8 no. You to tell me. The witness is the one
9 who's not going to suffer here. If this is
10 a good time now --

11 MS. CURRAN: No. If you're --

12 MR. TRAVIESO-DIAZ: This is a good
13 point, if you want to take a break.

14 THE WITNESS: I wouldn't mind.

15 (Recess)

16 BY MR. TRAVIESO-DIAZ:

17 Q Dr. Mitchell, we were talking
18 about Exhibit 1, the list of contentions.

19 A Exhibit 1? This one?

20 MS. CURRAN: No. It's this here.
21 It's open. That's it.

22 THE WITNESS: Thank you.

1 BY MR. TRAVIESO-DIAZ:

2 Q Before the break, we were talking
3 about subparagraph C-3-B on page 2
4 Exhibit 1?

5 A Yes.

6 Q We were beginning to talk about
7 site specific testing. Do you see those
8 words there?

9 A Yes, I do.

10 Q Could you tell us what your
11 understanding is of site specific testing as
12 is used here?

13 A My understanding of this is that
14 we have not yet seen evidence that the
15 soil from the site mixed with the cement
16 that's proposed for use at the site will
17 produce the material that is being relied
18 upon in the design. That's from the
19 formulation of the material standpoint.

20 Subsequently, I suspect there will
21 be need to demonstrated in the field,
22 perhaps through a test pad, that the

1 proposed material can be produced using the
2 field construction procedures.

3 Q So you interpret the site specific
4 testing as meaning two different sets of
5 tests: First test that, if you will, will
6 qualify the material for the use that you
7 want to give it and ensure that it meets the
8 design characteristics; and the second phase
9 in which then you demonstrate that the
10 construction techniques that you intend to
11 use are suitable? Is that how you do it?

12 A Yes.

13 Q So you have seen neither of those
14 so far?

15 A That's correct. I have not seen
16 it.

17 Q Is it your understanding that PFS
18 has formulated a program to do the first of
19 the two sets of tests that you talked about;
20 that is to say, to qualify the material for
21 use under the site conditions?

22 A My understanding is that they

1 have, yes.

2 Q Do you know whether PFS is, at
3 this point in time, conducting such a test
4 program?

5 A It's my understanding that they
6 have indeed had some tests done by AGECE in
7 Salt Lake City.

8 Q Have you reviewed any
9 documentation that reflects the test program
10 that PFS is conducting?

11 A Yes. As we noted earlier, I was
12 sent some test results quite recently.

13 Q But I was actually asking about
14 have you seen any documentation that defines
15 the type of tests that are to be conducted
16 and the manner in which they're going to be
17 performed?

18 A There is such a document that I
19 scanned briefly, that provides a scope of
20 work. ESSOW, I think is what it was called.

21 Q I'm going to hand you a document
22 that has already been identified in this

1 proceeding as Exhibit 14.

2 For the record, this document is
3 dated January 31, 2001, entitled,
4 Engineering services scope of work for
5 laboratory testing of soil/cement mixes.
6 The document number is ESSOW
7 number 05996.02-G01030.

8 Is this the document that you said
9 that you reviewed?

10 A It appears to be, yes.

11 Q I want to state for the record
12 that Stone & Webster and PFS believe this
13 document contains confidential information.
14 Therefore, depending on the extent of which
15 we discuss it, we may have to have the
16 reporter bind the pages of this discussion
17 and this document separately, so it's
18 confidential and shall be protected, and
19 that only the parties have access to it.
20 But let's just talk about it for a moment
21 before we decide whether we need to do that
22 not.

1 You said you reviewed this
2 document.

3 Is it your understanding that this
4 document defines the portion of the test
5 program that PFS intends to carry out that
6 satisfies or that will carry out the first
7 of the two sets of tests that you were
8 talking about a moment ago?

9 A This proposes or describes a
10 series of tests that will give the basic
11 information needed to support some but not
12 all of the design proposals.

13 Q Let me just ask you a couple
14 questions about the document. Again, given
15 that it is confidential, I'll see if we can
16 talk about generally without into too much
17 detail. But we'll go, of course, to
18 whatever detail we need to.

19 You will take to section 20, which
20 is applicable documents. It starts on
21 page 1 and goes through page 3, after the
22 cover page.

1 Do you see that?

2 A Okay.

3 Q Now, section 20 starts by saying
4 that, All work shall be performed in
5 accordance with the latest version of the
6 following regulatory requirements, codes,
7 and standards.

8 Do you see that?

9 A Yes.

10 Q Would you review the listing of
11 codes and that appears in section 2.0 and
12 tell me whether you believe that those are
13 the appropriate standards to use in the
14 performance of the tests that are described
15 in this ESSOW, which is sometimes pronounced
16 "ESSOW" I think?

17 A I am unable to state relative to
18 the USNRC, because I'm not familiar in
19 detail with all of their requirements. So I
20 can only address the American Society for
21 Testing Materials list, which is on page 2,
22 I guess. They look correct. I've not gone

1 back to my detailed listing of ASTM
2 standards and checked them off one by one.
3 But these seem to be the correct ones for
4 the test program as described.

5 Q Let's turn now then to section
6 three. Why don't you look at section 3.2
7 that starts on page 5?

8 Do you have that section?

9 A Yes.

10 Q Would you take a look at the
11 listing or the description of the tests that
12 starts on page 5 and goes to the end of
13 page 7, and tell me whether you believe that
14 these are tests that are appropriate to be
15 conducted in the process of qualifying soil
16 cement for an application?

17 A Yes.

18 Q Would you take a moment to look at
19 the description of the manner in which this
20 test are specified to be conducted on those
21 two pages?

22 Tell me whether you believe that

1 the description of the manner in which the
2 tests are to be conducted conforms to your
3 expectation on how this test ought to be
4 done.

5 A They seem to be consistent with
6 what is the current state of practice.

7 Q You mentioned a moment ago there
8 may be some additional tests that you would
9 like to see or you expect to see conducted.
10 Could you tell me what those tests
11 are, beyond the ones listed in this
12 document?

13 A It's the test to provide the
14 information to establish that the sliding
15 resistance between the different layers is
16 sufficient.

17 Q So you expect that there would
18 have to be a test or should be a test that,
19 in fact, demonstrates that the sliding
20 resistance that is called for in the design
21 can, in fact, be achieved?

22 A Yes.

1 Q You don't see that here?

2 A No. This would be the resistance
3 between the concrete pad and the underlying
4 soil cement and between the soil cement and
5 the underlying Bonneville clay.

6 Q Do you remember that you mentioned
7 that you looked at the transcript of
8 Mr. Trudeau's deposition last week?

9 A It was yesterday. It was just
10 about as fast as I could turn the pages
11 because I just received it.

12 Q You may not have an answer to
13 this.

14 But do you recall whether
15 Mr. Trudeau testified that, in fact, is an
16 intent to define and carry out such a test
17 as the one that you mentioned, at some time
18 in the future?

19 A I recall seeing that in one or the
20 other of the documents that I received. It
21 described -- or it mentioned a test program
22 that going to be done at Dr. Wissa's

1 laboratory at Ardaman & Associates.

2 Q So as far as you are concerned,
3 that is a test that will have to be done?

4 A Yes.

5 Q Any other tests that you believe
6 should be done that are not included in what
7 was marked as Exhibit 14?

8 A There is one property that
9 evidentially is very important to their
10 analysis. That's the modulus of the
11 cement-treated soil that's going to be
12 placed beneath the pads, which has an upper
13 bound of 75,000 PSI, according to their
14 analysis. I don't see that indicated here,
15 or how it's to be deduced from the data that
16 they will be obtaining.

17 Q Again, that's something that you
18 expect should be done or you believe that it
19 should be done, and it's not among the tests
20 listed here?

21 A Yes. What I would say is a
22 determination of that modulus is extremely

1 important, as I interpret the requirements
2 for their tip-over impact analysis.

3 Q Again, in reviewing the transcript
4 of Mr. Trudeau deposition, do you remember
5 whether he referred to any intent of
6 performing such a test?

7 A I don't remember.

8 Q Any other tests that you think
9 should be conducted, beyond those that are
10 listed on Exhibit 14?

11 A I don't think of any. There is
12 one -- no, I think that's okay.

13 Q Now, I have heard the term used
14 index property tests.

15 Does that term mean anything to
16 you?

17 A Yes.

18 Q What does that mean?

19 A These are the kind of tests that
20 you do to get a basic characterization for
21 the soil. Includes primarily the moisture
22 contents, the Atterberg limits, and the

1 particle gradation as determined by
2 sym-analysis and hydrometer analysis.

3 Q Would you take a look back at
4 Exhibit 14, starting on page 5?

5 Would you confirm for me what I
6 believe you just said, that the tests listed
7 on page 5, starting with 3.22 and going to
8 the next page of 3.27, are the tests that
9 you were referring to as the index property
10 tests?

11 A The index property tests would
12 be 3.22 through 3.26. I don't think that
13 moisture density tests would regularly be
14 referred to as an index test.

15 Q That would be a separate test?

16 A That's a separate test. These are
17 all separate tests.

18 Q Yes. But I mean in the category
19 of index properties would be the first five
20 that are listed here from 3.22 to 3.26?

21 A Yes.

22 Q All right. Do you know whether

1 PFS or PFS contractors have performed the
2 tests listed in 3.22, 3, 4, 5, and 6?

3 A They have done some of these, yes.

4 Q You said that you reviewed some
5 test results?

6 A Yes.

7 Q Would those be among the ones that
8 you reviewed?

9 A Yes.

10 MR. TRAVIESO-DIAZ: Let me mark as
11 an Exhibit 37, I believe.

12 (Deposition Exhibit No. 37 was
13 marked for identification.)

14 BY MR. TRAVIESO-DIAZ:

15 Q We are short we may have to
16 surrender one of the two. Keep the one that
17 is the marked and then you can pass the
18 other one.

19 Exhibit 37, I will identify for
20 the record as being a letter dated
21 March 27, 2001, from Applied Geotechnical
22 Engineering Consultants, Inc., that goes by

1 the initials AGECE, to Stone & Webster. It
2 consists of a cover letter and a number of
3 tables and figures; is that right?

4 A That's correct.

5 Q Is it your understanding that this
6 document reports the results of some index
7 property tests?

8 A It does.

9 MR. TRAVIESO-DIAZ: Let me now
10 mark as Exhibit 38, another document.

11 (Deposition Exhibit No. 38 was
12 marked for identification.)

13 BY MR. TRAVIESO-DIAZ:

14 Q Exhibit 38 is another letter dated
15 December 13, 2001, from AGECE to Stone &
16 Webster and one attached page appears to
17 contain a table.

18 Would you understand this to be
19 also another set of index property tests
20 results?

21 A It is a set of Atterberg limit
22 test results, which is one of the index

1 property tests that are listed in the other.

2 Q Have you reviewed the test results
3 shown on Exhibit 37 and 38?

4 A I have looked at them, yes.

5 Q Did you have any concerns or
6 comments with respect to these test results?

7 A These test results refer to the
8 shallow material which in prior documents
9 had been called an eolian silt. It seems to
10 me that the material that's identified by
11 these test results is not well is described
12 as an eolian silt. It's a much finer grain
13 and more plastic material than that term
14 silt would imply to me.

15 Q Well, first of all, is this a
16 question of characterization, or it, in your
17 mind, more of a concern as to the actual
18 nature of the property, of the material?

19 It's a question of what we call
20 it, or more as to what properties it has?

21 A Well, the question that I was
22 raising was what you call it. The important

1 thing is what you have. This defines, I
2 think rather clearly, what you have, which
3 is a finer grain material that has a
4 reasonably high natural moisture content,
5 and exhibits a fair amount of plasticity.

6 Q As a person experienced in
7 reviewing test results, would these result
8 of phase one be sufficient to proceed to
9 subsequent phases in the testing?

10 Can you use these test results to
11 prepare yourself to do the other phases of
12 the tests?

13 A Oh, yes. Yes, it provides
14 guidance for that.

15 Q Tell me what the phases that you
16 expect that you will see take place in this
17 testing program will be; in other words, in
18 which order will you be doing the various
19 tests?

20 A I would now be moving into the
21 moisture density relationships for the
22 material, and begin to do some tests adding

1 what I think are reasonable values of cement
2 to get the properties that are required.

3 Q Then what tests would you do?

4 A Well, they're listed in this
5 program. This is the moisture density test,
6 the wet/dry, freeze/thaw, the strength
7 tests, and the permeability tests. The
8 splitting tensile strength test is a rapid,
9 indirect way to measure the tensile strength
10 that seems to provide pretty good results.

11 So that suite of tests I think
12 should provide the information that is
13 needed. Except for the bonding between
14 layers, of course.

15 Q Which will be a separate test that
16 is not listed here; is that right?

17 A Yes.

18 Q Now, with respect to moisture
19 density tests, have you reviewed any results
20 of tests conducted to date on moisture
21 density?

22 A I have seen some results.

1 MR. TRAVIESO-DIAZ: Let me mark
2 this as Exhibit 39.

3 (Deposition Exhibit No. 39 was
4 marked for identification.)

5 BY MR. TRAVIESO-DIAZ:

6 Q Let me describe this document for
7 the record. Exhibit 39 is a set of figures
8 without a cover page, bearing the heading,
9 Applied Geotechnical Engineering
10 Consultants, Inc. It has figures with
11 captions such as moisture content, percent
12 of dry weight, gradation of moisture density
13 relationship. It looks to be a set of
14 figures of tests performed on different
15 samples.

16 Is that your understanding?

17 A That's what I see, except that
18 there is no data on the gradation sections
19 of each of these pages.

20 Q All right. If you reviewed
21 Mr. Trudeau's deposition, you will probably
22 remember or you may remember that he

1 indicated that he had received by fax a set
2 of preliminary results on moisture content
3 tests.

4 Do you remember that?

5 A I think so, yes.

6 Q Well, in any event, I will
7 represent for the record that Mr. Trudeau
8 testified to that effect. The record will
9 be whatever it is.

10 Assuming that, in fact, these are
11 moisture content tests, is there any
12 information, comment, or reaction by you to
13 these results? Does it mean anything to
14 you?

15 A I am very surprise at the low
16 densities that resulted in these tests.

17 Q Give me an example so that we --

18 A Well, they seem to be typically
19 less than 90 pounds per cubic foot. I think
20 I even saw one that was less than that, one
21 that's 77.5 maximum density, with optimum
22 water contents that are really quite high.

1 But that's the one thing that jumped out at
2 me most significant.

3 Q If you were given these test
4 results to evaluate, would you draw any
5 conclusion from that?

6 A I would wonder what is it that is
7 making these densities so low and the
8 moisture contents so high. There's one with
9 a maximum dry density of 70 pounds per cubic
10 foot. May be it's 71. It's the next to the
11 last sheet. The last sheet is only 71, as
12 well. Those values, to me, are surprisingly
13 low. The cause, I don't know.

14 Q Could you draw any inference or
15 relationship, perhaps not based on this
16 alone, but could you draw any inference or
17 relationship between these test results,
18 assuming they are correct, and the
19 properties of the soil?

20 A I don't know, based on these
21 results by themselves, whether this is a
22 soil composition issue or a test procedure

1 issue. That needs to be determined, I
2 think.

3 Q So you would, if presented with
4 these test results, look further just to try
5 to figure out why --

6 A Try to figure out why those values
7 are so low.

8 Q You have not reviewed any other
9 test results?

10 A I think that's the extent of it.

11 Q Actually, I am going to put on the
12 record now -- although we may talk about
13 this a little later -- so to complete the
14 package, something that I'm going to call
15 Exhibit. I don't know if you have reviewed
16 this or not, but you can tell us.

17 A I'll tell you.

18 (Deposition Exhibit No. 40 was
19 marked for identification.)

20 BY MR. TRAVIESO-DIAZ:

21 Q Exhibit 40, for the record, is --

22 A Excuse me. I have seen this one

1 before. I forgot.

2 Q Let's just say on the record what
3 this is. The document that the witness
4 referred to and is marked Exhibit 40 is a
5 letter from Applied Technology and
6 Engineering Consultants, Inc., to Stone &
7 Webster, dated October 31st, 2001. It
8 appears to attach a one-page table. We will
9 be discussing this a little bit later.

10 But what is your understanding of
11 what this document conveys?

12 A It indicates the amount of water
13 soluble sulfates in parts per million that
14 was determined for samples from shallow
15 depth, zero to two feet in general, with one
16 exception: In the laboratory.

17 Q Again, we'll save that for
18 discussion in a moment. But for the moment,
19 if I could ask you to turn, if you could
20 find it, to your declaration that was marked
21 as Exhibit 36.

22 A Yes.

1 Q Let's take a look first at
2 paragraph 12. Let me just direct you
3 specifically to the sentence that I want you
4 to focus on.

5 Midway the paragraph, at about the
6 sixth line, there is a sentence that starts,
7 The amounts of cement that are proposed to
8 be added.

9 Do you see the sentence?

10 A I do.

11 Q Now, if I understand your
12 discussion in this paragraph 12, you are
13 expressing a concern that the amount of
14 cement in the mix, so to speak, that PFS
15 intends to use may not be sufficient to
16 qualify the mix as a true soil cement? Is
17 that your concern?

18 A That was the concern, yes.

19 Q Do you still believe that to be a
20 concern?

21 A If their intent is to produce soil
22 cement in the strict definition of the word,

1 then that would be a concern. If their
2 intent is to produce a material that has
3 certain values of strength and stiffness and
4 it can be demonstrated that it will have
5 sufficient durability for the particular
6 application that they're talking about, then
7 it's not.

8 Q Now, we talked earlier about the,
9 if you will, the design intent or
10 specification that the soil cement to be
11 used around the canister transfer building
12 have a strength of 250 PSI.

13 Would the material having that
14 strength be properly classified as soil
15 cement?

16 A It might or it might not. It
17 would depend on whether it satisfied the
18 wet/dry and freeze/thaw durability test.

19 Q So the importance as to whether
20 you call it soil cement is whether it shows
21 durability by being subjected or passing the
22 freeze/thaw, dry/wet test?

1 A That's the usual definition of a
2 soil cement.

3 Q So that is one of the tests that
4 PFS intends to conduct at this point?

5 A That's correct.

6 Q You have not seen any test results
7 with respect to that phase of the tests,
8 have you?

9 A I have not.

10 Q Assuming that, in fact, the test
11 showed that the material that is specified
12 to have a strength of 250 PSI meets these
13 durability tests, would it qualify, in your
14 mind, as to true soil cement?

15 A Yes.

16 Q If it did, would that resolve the
17 concern that you are expressing here in
18 paragraph 12?

19 A Yes.

20 Q Now, the other application that I
21 remember you described was for the
22 mixture -- let's call it a moisture for the

1 moment -- underneath the storage pads.

2 That, I believe you said, is
3 expected to have a much lower strength,
4 something on the order of 40 PSI or so?

5 A I believe that's PFS is proposing
6 for that material.

7 Q You would not call that soil
8 cement?

9 A If the material had that low of
10 strength and at the same time satisfied the
11 durability tests -- I'm not sure whether
12 there is a minimum strength requirement for
13 soil cement.

14 Q What do you need to have in
15 material that you would call soil cement in
16 accordance with the discussion that we're
17 having relating to the paragraph 12?

18 Why do we need to have that
19 material pass this durability test?

20 A PFS, in the documents that I was
21 reading, was referring to the material as
22 soil cement. My response at that point was

1 if they intend to have soil cement, then it
2 must satisfy the durability requirements.

3 My understanding now, in the later
4 submissions, is that for the material under
5 the pad, the durability requirements will
6 not be as great, as severe, and they don't
7 need such a high strength. So I believe and
8 what -- I mean now it's being referred to as
9 a cement-treated material. I have no
10 argument with that.

11 Q Explain, if you will, for the
12 record why is it important that soil cement
13 pass the durability tests?

14 A I think in this instance where we
15 are facing exposure to some rather harsh
16 climactic conditions over long period of
17 time, the durability of the soil cement that
18 surrounds the canister -- cast transfer
19 building is important.

20 Q Because over a period of time,
21 exposure to the elements would cause it to
22 degrade its property?

1 A My response to that is that's
2 important, yes.

3 Q Isn't it true that if PFS performs
4 durability tests as specified in Exhibit 14
5 that demonstrate that the mix that they
6 propose to use passes or survives these
7 durability tests, that that mixture would be
8 qualified, in your opinion, as true soil
9 cement?

10 A Yes.

11 Q If it doesn't, therefore it
12 doesn't qualify as such?

13 A It would not.

14 Q But that's independent of whether
15 the mixture that they intend to use achieves
16 the strength that is specified?

17 A Yes.

18 Q You testified earlier that you see
19 no problem with the ability to get the 250
20 PSI mix as such?

21 A My opinion is that it should be
22 possible, but I would like to see it

1 demonstrated.

2 Q Also you would like to see
3 demonstrated that in addition to having 250
4 PSI, it meets the durability test?

5 A That's correct.

6 Q Let's move to paragraph 13 in your
7 declaration.

8 It starts with, It is not
9 surprising that no site specific testing has
10 been done to date to obtain the strength and
11 durability properties of the cement-treated
12 soil.

13 Do you see that?

14 A I see that. But what I heard I
15 don't believe is what I said.

16 Q Did I misread it?

17 A I believe you said it is not
18 surprising. It's an important distinction.
19 Because I said it is surprising.

20 Q If I did that, it was a Freudian
21 slip, as they call it.

22 What I'm asking you, actually,

1 with respect to this first paragraph, would
2 you like to qualify or modify that paragraph
3 based on the results that you have seen so
4 far?

5 A Well, the first sentence still
6 holds. So far there has been no information
7 that I have seen about strength and
8 durability. I stand by the next sentence,
9 that we need test data using the actual site
10 soil and cement.

11 The third sentence about the
12 chemistry of the surficial soils, we now
13 have a little bit of information about the
14 sulfates, which was the exhibit that you
15 last distributed, Number 40. So that
16 sentence would now require some
17 qualification for it to be true today.

18 The next one, there can be salts
19 and evaporites. So it's still valid. Then
20 in this paragraph, I talk about sulfates and
21 the possible formation of ettrinite. PFS
22 seems to be obtaining information that sheds

1 some light on that issue.

2 Q Would it be fair to say that with
3 respect to the concerns expressed on
4 paragraph 13, at least in the first half of
5 the paragraph, what you're saying is, as of
6 today, is that they are conducting a test
7 program, but they have not shown me yet the
8 result that I want to see with respect to
9 durability and strength?

10 A That's correct.

11 Q So it's not that you don't believe
12 they're doing it, it's that they have not
13 shown you yet results that show durability
14 and strength?

15 A Yes. This program that is now
16 being undertaken, as I read it, is intended
17 to provide that information.

18 Q But that information is not
19 available now; that's your point?

20 A That's my point.

21 MS. CURRAN: Excuse me one second.

22 (Counsel conferred with witness)

1 THE WITNESS: All right.

2 BY MR. TRAVIESO-DIAZ:

3 Q As long as you have the exhibit in
4 front of you, let's talk about it briefly.
5 Exhibit 40, that refers to the sulfate
6 testing.

7 Have you reviewed the results of
8 the testing that has been conducted so far
9 with respect to sulfates, the existence of
10 sulfates on the soils at the site?

11 A I've looked at the information in
12 table one of this exhibit.

13 Q What intelligence, if you will,
14 did you derive from reviewing that table?

15 A It indicates that for a reasonable
16 number of samples of the shallow material,
17 which would be this material called the
18 eolian silt, that the sulfate content is
19 less than say 500 parts per million. It
20 shows for one deeper sample a depth of two
21 to four feet, however, that the sulfate
22 content is quite high, 13,800 parts per

1 million. That's one sample from a very
2 large area. So it's by no meanings
3 necessarily indicative of what its like
4 everywhere at that depth.

5 What that is if you were making
6 soil cement out of the surficial material,
7 at least in the short-term, I wouldn't
8 consider it to be a significant problem from
9 sulfates. But now I would worry a little
10 bit because of the soluble sulfate that is
11 below it, and whether that could become an
12 issue at some future time. Again, there's
13 only one data point for the deeper material.

14 Q Understanding that this is only
15 one set of results, assuming that the other
16 results of future tests were comparable to
17 the ones that this first sample takes, would
18 that lead you to believe that the use of the
19 top layer, the eolian soil, for making soil
20 cement would not in itself present a problem
21 with respect to sulfate attack or sulfate
22 presence?

1 A Based on the chemistry indicated
2 here for the surficial material, I would not
3 expect it to be a problem. But I'm a little
4 bit concerned and would want to think a bit
5 more what this high value beneath it means
6 in the long-term.

7 Q Going back again to paragraph 13,
8 to the concern that you express with respect
9 to sulfates, starting with the sentence that
10 says, Of most concern?

11 A Uh-huh.

12 Q I just want to clarify how this
13 paragraph plays or interacts with the
14 testimony that you just gave.

15 It is my understanding that with
16 respect to the ability to create suitable
17 soil cement, if they used just the top layer
18 and if the rest of the test show the same
19 amount of sulfates in that soil, that this
20 paragraph would not present really a
21 problem?

22 That's what I'm trying to get to.

1 A What I'm trying to say is that the
2 material with the amount of sulfate being
3 less than 500 parts per million should be
4 okay. However, if there is prolonged
5 exposure and upward migration of sulfates
6 from that high sulfate-bearing layer -- and
7 whether it's a layer or not I don't know,
8 because we only have one data point --
9 conceivably could be a problem in the
10 future.

11 Q Now, you mentioned the word
12 migration. I suspect we'll be talking a
13 little bit about that in a minute.

14 But is that the problem in general
15 that you refer to in the next paragraph, 14,
16 of your declaration?

17 A Yes. Well, no, no. Excuse me.
18 That is not the problem in the next
19 paragraph. The next paragraph has to do
20 with just the general affect of subsequent
21 increases in moisture content in the
22 subgrade soil beneath the soil cement in the

1 pad.

2 Q I'm sorry. That was a very
3 poorly-worded question.

4 What I meant to say was: Your
5 concern about sulfates would be migration of
6 sulfates from the layer beneath to the soil
7 cement?

8 A Yes.

9 Q That, in that respect, I was
10 analyzing in my mind to the potential
11 migration of moisture.

12 A Right. Both are possible.

13 Q All right. Now, assuming again
14 that the test showed that the eolian or
15 superficial -- the top two feet of the soil
16 had low sulfate content and that there may
17 be some higher sulfate beneath, you
18 expressed the concern that maybe the sulfate
19 below will migrate over?

20 A Yes.

21 Q Wouldn't you expect that to happen
22 already if, in fact, that was a viable or

1 likely mechanism?

2 I mean, this top layer has been
3 covered with a layer for some millions of
4 years; isn't that right?

5 A Right. But the placement of a
6 cover over that layer's going to change the
7 moisture regime. This has been just an
8 open, exposed to the atmosphere soil
9 surface. Now it's going to be paved.

10 Q So you're saying that the sulfate
11 might migrate over with the moisture?

12 A Because the moisture content will
13 probably increase beneath the pad.
14 Paragraph 14 was not dealing with sulfates.
15 It was simply dealing with the whole issue
16 of changed moisture.

17 Q I recognize that I'm way above my
18 area of knowledge here. So let me try to
19 see if I understand this a little bit.

20 You're saying that the reason that
21 sulfates have not found their way, assuming
22 that they're in fact there, in higher

1 amounts in the lower amounts than on top to
2 the higher level is because the higher level
3 was, if you will, exposed, didn't have a cap
4 on it?

5 A I don't know why they haven't
6 thought the whole thing through. I can't
7 give at this point, without thinking and
8 analyzing a little bit of the exact
9 mechanism and causes. However, all we know
10 is that in the surficial layer sulfate
11 content is reasonably low. But at one point
12 below that, it's very high. There may be
13 some gypsum, for example, in that lower
14 layer. I don't know.

15 Q What would the significance be of
16 gypsum in the lower layer?

17 A Gypsum is calcium sulfate.

18 Q Well, what I was trying to
19 understand -- and, again, I have to admit
20 that I'm totally illiterate when it comes to
21 this -- is that it would me that if sulfates
22 are going to move up with the moisture and

1 you have no obstacle to the movement, that
2 they would migrate upwards, as you have no
3 surface that prevents them from going up.

4 What am I missing in that
5 scenario?

6 A The permeability of the upper part
7 of the Bonneville clay, which is the layer
8 beneath the two feet of eolian silt, may be
9 so low as to prevent any significant
10 transfer. Again, I don't know. I don't
11 know this profile, in terms of the details
12 that would be needed to evaluate that.

13 Q Let me try one more time, just see
14 if I understand it. This goes back to
15 college.

16 Is it your understanding that this
17 is a fairly arid area where this site is
18 located?

19 A Yes.

20 Q Wouldn't you expect that any
21 moisture that tends to move will migrate
22 upwards and evaporate?

1 A There will be continuing
2 evaporation and there have been continuing
3 infiltration after rains. The net result
4 though of all of this is that the moisture
5 content in that upper two feet is reasonably
6 high. It's twenty to thirty percent, as I
7 recall from the data that are here.

8 Q Based on the first set of samples?

9 A Yeah.

10 Q Is there any other observation
11 that you can make?

12 Is this actual, at this point in
13 time, a concern or a potential concern?

14 A I would say it would be more a
15 potential concern.

16 Q There is not enough information
17 for it to --

18 A Not enough information.

19 Q There is not enough information to
20 progress from potential concern to concern;
21 is that right?

22 A That's correct.

(Counsel conferred with witness)

THE WITNESS: Well, I can clarify what I mean by paragraph 14, but maybe he's going to ask about that.

BY MR. TRAVIESO-DIAZ:

Q I was going to ask you about paragraph 14. Not now, but in a moment, if I may. That way my intent. Why don't we talk about paragraph 14, since we are about to go back and back-fill, as they say.

Tell me what your concerns are on paragraph 14, as you re-read it early this morning.

A Forget about the sulfate for a minute. My concern there is that by paving over the current ground surface, you will change the moisture regime and experience in these kinds of areas as shown, that when you do that, you begin to accumulate water beneath the paved area. That could have some consequences on the engineering properties of the clay layer that's beneath

1 the treated soil cement.

2 Q So, essentially, let me see if I
3 can express my thought coherently -- that
4 the presence of a concrete seal or pad above
5 the soil cement will cause water to
6 accumulate on the soil cement layer, or on
7 the top of the clay below it?

8 Just clear it up for me first.

9 A I think it's would be concentrated
10 more in the underlying clay. It changes the
11 internal stress conditions within that
12 material.

13 Q Why don't you tell for the record
14 what are the physical mechanisms that will
15 drive the moisture to accumulate on the clay
16 below, immediately below the cement-treated
17 soil layer?

18 A Any upward migrating moisture can
19 no longer evaporate once you've sealed the
20 surface. So it stays there. Now, if you
21 have a relatively shallow water table, that
22 can lead to a significant change in the

1 moisture conditions beneath the barrier
2 layer.

3 Here, you have a very deep water
4 table. It's 125 feet, or something of that
5 sort, which is way down there. So there
6 would perhaps not be a continuing source.
7 It may be that a new equilibrium will
8 establish in a reasonably short time.
9 However, there are cases in these kinds of
10 climates where after they've paved them and
11 gone back and looked. They found that
12 moisture has accumulated beneath them.

13 Q Where would that moisture migrate
14 from in order to reach that layer?

15 That's what I'm trying to
16 establish.

17 A Probably it's going to be a
18 redistribution of what's already in the
19 soil. There's not going to be significant
20 percolation from above any more, because
21 you've sealed it off. It's going to have to
22 come from what's already there

1 redistributing itself.

2 Q . What I'm trying to understand when
3 you say redistributing there, you mean the
4 layers of clay, if you will, that are
5 adjacent to that area, the moisture that's
6 already on those areas --

7 A Beneath.

8 Q Beneath. Are you saying that
9 moisture coming all the way from the ground
10 water, or from the area just beneath the
11 clay?

12 A The area beneath the clay has some
13 moisture profile. I don't know what it is.
14 I just don't know what it is, as a function
15 of depth. But where it has been evaporating
16 has set up one water pressure condition.

17 Now we're going to change it. The
18 zone from which there is evaporation and
19 what we call suction or tension in the poor
20 water is now going to be cut off. There is
21 going to be a change in the overall
22 distribution of all of the water that's

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1 beneath the surface now to some equilibrium
2 distribution under the new pressure
3 conditions.

4 Q You expect that that equilibrium
5 will be achieved at some point in time after
6 the soil cement that they that the soil
7 cement is constructed and the pad is placed
8 on top of it?

9 A Yes.

10 Q How long a time do you think it
11 will take for that redistribution to take
12 place?

13 A Probably years.

14 Q What would the consequence be of
15 moisture accumulating in that top layer of
16 the clay that is underneath the cemented
17 soil pad, the cement?

18 A It could make it somewhat more
19 compressible.

20 Q What would a change in the
21 compressibility of the clay resulting over
22 changing the compressibilities?

1 A It could cause somewhat increased
2 settlements.

3 Q Do you know whether PFS has
4 performed consolidation tests on the soils
5 in that layer, that area?

6 A I don't know if they have. But
7 I've seen the layer referred to as a stiff
8 clay. Beyond that, I don't know what the
9 stress history is in there at this site.

10 Q Understanding that you have not
11 reviewed these tests, but assuming that the
12 two sets of such tests were conducted, one
13 in which the soil was tested on its natural
14 condition and another one in which the tests
15 were performed on inundated samples, and
16 that the second test change indicated a
17 little change in compressibility when you
18 inundated the sample.

19 Would that tell you that
20 compressibility is not a serious problem for
21 these soils?

22 A I think that it would be a good

1 indicator, yes.

2 Q Now, what would be the consequence
3 of increased settlement of this clay layer?

4 A If it is uniform, across the area,
5 very little consequence.

6 Q Do you have any reason to believe
7 that it would not be uniform?

8 A This is a very large area, is it
9 not? Is it 50 acres? Something of that
10 sort. I would anticipate that the
11 consequences, assuming that the layer
12 thicknesses were the same and all of that
13 across the site, probably not be too great,
14 except perhaps at the edge.

15 Q Now, tell me again what is the
16 physical mechanism by which this moisture
17 will migrate.

18 A It migrates in response to changes
19 in the water pressure distribution beneath
20 the covered area.

21 Q Would the creation or the
22 temperature gradient or difference in

1 temperature between one layer of soil or
2 another cause it to migrate, as well?

3 A It could.

4 Q Would it migrate from the warmer
5 area to the cooler area?

6 A My expectation is that, at least
7 in the partly saturated zones, it would go
8 from warm to cool.

9 Q I don't know how familiar you are
10 with the PFS project.

11 But is it your understanding that
12 the waste storage casts that are going to be
13 placed at this site contain high levels of
14 radioactive spent fuel?

15 A It's my understanding.

16 Q Are you aware that high levels of
17 radioactive spent fuel, in addition to being
18 radioactively hot is also temperature hot?

19 A Yes.

20 Q Subject to check again, are you
21 aware that, in fact, there at the base of
22 the cast on top of the pad, there is a

1 temperature differential of a hundred
2 degrees, fifty to a hundred degrees above
3 ambient temperature because of the heat
4 released by the spent fuel?

5 A I did not know what the
6 temperature increase would be.

7 Q Assuming that, in fact, there is a
8 fifty to a hundred degree Fahrenheit and
9 assuming that there is a fifty to a hundred
10 degree Fahrenheit temperature differential
11 at the top of the pad, would you expect that
12 that heat that is being released on top of
13 the pad will migrate down through the
14 concrete pad?

15 A Yes.

16 Q Would it also migrate down through
17 the soil cement below?

18 A To some extent.

19 Q That heat, would it reach also the
20 top layer of the clay that is underneath?

21 A I don't know what the distribution
22 would be. I would assume that PFS has made

1 some thermal studies that would tell us.

2 Q If, in fact, there was some heat
3 that was being moved downwards by the
4 mechanism that we just described, then would
5 that heat tend to move the moisture away the
6 top layer or towards the top layer?

7 A I would expect it to move it away.
8 I'd be very interested in seeing the thermal
9 results of this. It's an interesting issue.

10 Q Of course, this is not something
11 that you have analyzed to date?

12 A I have not analyzed. But I have,
13 in the past, done both experimental and
14 theoretical research on the heat flow around
15 buried things.

16 Q This mechanism that I described to
17 you is one that you have reason to believe
18 its possible, or at least it's --

19 A Well, the heat transfer and the
20 temperature. Oh, yes.

21 Q Now, let's go back to
22 paragraph 14. Because I think in addition

1 to talking about the moisture migration, you
2 talk about some other problem that you see
3 as potentially happening.

4 A Okay.

5 Q I'm referring you to the very end
6 of paragraph 14, on page 5.

7 Can you explain for the record
8 what your concern is with respect to the
9 paragraph that starts with the words, "if
10 care"?

11 A Yes. What I'm concerned about
12 here is that if you go out with heavy
13 equipment, start excavating and moving all
14 ground with the equipment, you can cause a
15 lot of disturbance of the subgrade soil. I
16 would expect, particularly in a material
17 like this, that could cause some loss in
18 strength and support capacity of the
19 material. So the concern is that the mixing
20 and placement of the soil cement be done
21 with a minimum of disturbance to the
22 underlying material.

1 Q Now, what would you do to minimize
2 the disturbance to the underlying material
3 in the process of building the soil cement
4 layer?

5 A For the treated soil layer, one
6 way -- again, I'm not presuming to propose a
7 construction procedure, a design -- but if
8 you used a mix-in-place procedure with
9 equipment, if there is such equipment that's
10 capable of going two feet -- and that's
11 pushing the envelope I think there -- you
12 would resolve that problem.

13 I think I read in something as I
14 was skimming through, that there is a plan
15 to use equipment that has an extendable boom
16 that will enable you to get out into the
17 areas without disturbing them. I suspect
18 you could start in one place and work your
19 way across.

20 Q So this is a mix that you have
21 seen used in other jobs?

22 A The what?

1 Q Are these the types of techniques
2 that you have seen in other jobs where there
3 is a desire not to disturb the soil in the
4 process of placing soil cement?

5 A Well, I can't put my finger on
6 specific examples. But I'm just thinking of
7 the conventional procedures that are used
8 for doing this. Those are ways to approach
9 it.

10 Q But I take it, what I'm trying to
11 get to, these are things that are within the
12 state-of-the-art?

13 A Yes, I guess.

14 Q In skimming through Mr. Trudeau's
15 deposition, do you recall whether he had
16 discussed what PFS is considering in doing
17 to address this issue?

18 A In something I saw it. It could
19 have well be there.

20 Q But, essentially, if I can presume
21 to boil down your concern -- and tell me if
22 I'm wrong -- your concern is that if care is

1 not taken not to disturb the top layer of
2 the soil in the process of putting soil
3 cement, you could do injury, if you will, to
4 the soil; is that right?

5 A To the subgrade material beneath
6 the soil cement or the treated soil, yes.

7 Q What would the nature of the
8 injury or damage be?

9 A It would be disturbing the
10 material that I believe, from what I've
11 read, is fairly stiff. It may be sensitive
12 disturbance in the sense that it would loose
13 strength, become mushier, so to speak, and
14 not provide as good subgrade support.

15 Q That's a concern that should be
16 addressed in developing the construction
17 procedures, if you will?

18 A I think so.

19 (Counsel conferred with witness)

20 BY MR. TRAVIESO-DIAZ:

21 Q Let me go back a moment to
22 sulfates. Because I know we have some

1 things that are pending with sulfates.

2 Assuming there is a presence of
3 sulfates either in the top layer -- which
4 the test have been shown so far -- or in the
5 layer below, are there treatment methods
6 that can be use to address the presence of
7 sulfates?

8 A There are some things that you can
9 do if sulfates are likely to be an issue.
10 One of these is to use sulfate-resistant
11 cement. Another is to increase the
12 treatment level. You know, those are
13 probably the two main approaches.

14 There are some chemical approaches
15 that have been proposed or suggested for
16 dealing with sulfates in the case of
17 lime-treated soils. But that's a little bit
18 different issue. I think it's sort of
19 experimental at this point. So I think that
20 the more logical way here would be either to
21 use more cement, or to use sulfate-resisting
22 cement.

1 Q Now, let's talk about the first.

2 When you mean sulfate-resistant
3 cement, meaning a mixture that includes some
4 additive that will make the soil cement
5 result be more likely to resist the affects
6 of sulfate?

7 A Well, to get the inverse
8 reactions, you need to have a source of
9 alumina. There's two sources. Three
10 sources, I suppose. One is in the cement
11 itself, just because of the formulation of
12 cement. Another is in compounds that might
13 be present in the soil itself. The third is
14 from the breakdown of clay that may be
15 present in the soil during the hydration
16 processes. Because when you break down the
17 clay, then you will liberate alumina.

18 The main cementing material in
19 this case though is the cement itself. So
20 anything that comes from breaking down the
21 soil probably will be not too significant.
22 It's the aluminum that's in the cement that

1 could be the biggest problem in this case.
2 The way you minimize that is to use
3 sulfate-resisting cement.

4 Q That's what I was going to ask
5 you. You anticipated my question.

6 There are different types of
7 cement mixes that can specify that will have
8 say less aluminum contact and, therefore,
9 they will be less subject to sulfate attack?

10 A That is correct.

11 Q So that would be a question of
12 coming up with a proper chemical proposition
13 with the cement that you use?

14 A Yes.

15 Q Is that right?

16 A Uh-huh.

17 Q That's something that somebody
18 aware of the problem can come up with a, if
19 you will, a cement recipe that will minimize
20 its affects?

21 A Yeah. Right. Type four cement, I
22 believe, is sulfate --