

1 There you would produce your soil-cement and then haul
2 it to where you want to place it. So it's a much more
3 controlled environment.

4 MS. CHANCELLOR: Would that be on-site or
5 off-site?

6 DR. WISSA: It would be on-site.

7 MS. CHANCELLOR: So your recommendation to
8 PFS would be to build a centralized or mechanized
9 plant?

10 DR. WISSA: I think the contractor would
11 opt to do that to be competitive.

12 MS. CHANCELLOR: So this would be left to
13 the bidding process.

14 DR. WISSA: It's left to the bidding but
15 I think any contractor would obviously look at the
16 option and probably take it. I don't think he would
17 be competitive. There are several reasons as far as
18 I'm concerned. It would pretty much definitely be an
19 on-site plant.

20 MS. CHANCELLOR: But if you were writing
21 the specifications for the construction program, would
22 you require a centralized plant?

23 DR. WISSA: No, I would leave it up to the
24 discretion of the contractor but we'd have to
25 determine what he's going to do and if he meets our

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1 qualifications. He may want to use this as a batch
2 process rather than a continuous process.

3 There are a lot of flexibilities in how
4 you produce soil-cement. In this case a batch process
5 may be practical. By that is you put it in batches
6 rather continuous because they are relatively small
7 areas of stabilizing at one time.

8 So it's very difficult for me to
9 predetermine how he is going to do it. I think I'm of
10 the opinion that any contractor should be given the
11 flexibility to come up with the best solution to
12 achieving what we want.

13 MS. CHANCELLOR: Are you aware of how many
14 storage pads that will at PFS?

15 DR. WISSA: Not exact number but I know
16 there are a lot of them.

17 MS. CHANCELLOR: Let's just say for
18 argument sake there will be 500 of them. Do you know
19 whether PFS intends to construct those 500 pads
20 continuous?

21 DR. WISSA: No, I don't know that.

22 MS. CHANCELLOR: Would it make any
23 difference to you if the facility was constructed in
24 stages?

25 DR. WISSA: If you are going to construct

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1 10 pads at a time, yes. But when you get to 50 or 100
2 pads at a time, I think that no the approach would
3 probably be the same.

4 MS. CHANCELLOR: How would you insure
5 consistency and quality over say a five or ten year
6 construction period?

7 DR. WISSA: I don't understand the
8 question as far as whether it's five years or ten
9 years. Can you explain that?

10 MS. CHANCELLOR: Let me preface it with
11 this. If PFS were to first construct a quarter of the
12 500 pads and wait until they got enough fuel to store
13 on those pads and then constructed a quarter more of
14 the 500 and then finally constructed the remainder of
15 the facility, assuming that were the case and you
16 really don't know how long that would take, it may
17 take five years, ten years, longer. Given the
18 uncertainty and the construction period for now, how
19 you would insure consistency and quality over such an
20 extended construction period?

21 DR. WISSA: I don't see the relevance.
22 Let me try and answer the question if I understand it.
23 You prepare a set of specifications. You qualify
24 contractors. Then you supervise the construction. I
25 assume you do this for each phase. The fact that you

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1 may not have the same contractor for all phases should
2 not impair the quality of a product as long as you
3 have a quality assurance process or program which is
4 enforced.

5 I think if anything what you will find is
6 the first phase you are going to be debugging your
7 problems and by the time it goes around you will have
8 learned from it. By the third time I think it will go
9 very smoothly. I think you gain experience as you go
10 through it and make some improvements and
11 modifications as you proceed. I don't see the fact
12 that it's done in three or four phases that you would
13 jeopardize the quality of product.

14 MS. CHANCELLOR: In other words, the end
15 result or the converse of getting experience would
16 also change the job in phase one. Is that right?

17 DR. WISSA: Throughout phase one I'm sure
18 there is going to be times when the contractor is
19 going to be -- Let me back off a bit. In any project
20 there is always a learning period. Learning to work
21 together is one. Getting familiar with the soils.

22 So there is always a learning period
23 between a contractor and the engineer with
24 communications and so on no matter how well you
25 prepare for it. There is always going to be that

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1 learning period. At the beginning of any project you
2 don't start construction at full efficiency your first
3 week on-site. It takes some time before everyone
4 works as a team.

5 MS. CHANCELLOR: Now isn't it true that
6 PFS is relying on the strength of the underlying
7 Bonneville clays to resist sliding of the pad?

8 DR. WISSA: I believe so, yes.

9 MS. CHANCELLOR: And in your deposition
10 you stated that you would be concerned about a loss of
11 strength and therefore the clay ability to have the
12 shear resistance for lack of movement that PFS is
13 relying on. Do you recall that testimony?

14 MR. TRAVIESO-DIAZ: Excuse me. I think
15 you have to show it to the witness. It's not as
16 simple as yes or no.

17 DR. WISSA: I'd like to see it.

18 MS. CHANCELLOR: Certainly. The reference
19 is in the transcript of your deposition dated March 15
20 on page 17. Actually it's on pages 17 and 18. Let me
21 quote from it. It's on page 18, line 9. "I think to
22 answer you first of all I'm not much concerned about
23 settlements as about loss of strength and therefore
24 its ability to have a shear resistance for this
25 lateral movement which we are relying upon."

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1 MR. TRAVIESO-DIAZ: Ms. Chancellor, will
2 you repeat the question as well?

3 MS. CHANCELLOR: Certainly. The question
4 that starts at line 5, page 18 "But in terms of about
5 why you would worry about this, is it because if you
6 were to disturb the subgrade that it might be less
7 resistant in an earthquake?"

8 DR. WISSA: All right. What is your
9 question now about this?

10 MS. CHANCELLOR: My question is in the
11 excavation of the surficial layer what happens if that
12 surficial layer dips down into the Bonneville clays
13 how are you going to fill the area of the clays that
14 you may have to excavate? Am I clear?

15 DR. WISSA: No, I'm sorry.

16 MS. CHANCELLOR: That's okay. The
17 surficial layer of maybe silts or whatever they are
18 have to be removed. Is that correct?

19 DR. WISSA: That's my understanding. They
20 will be removed.

21 MS. CHANCELLOR: Will be removed.
22 Underneath that surficial layer is the next layer down
23 which is the Bonneville clays.

24 DR. WISSA: That's correct.

25 MS. CHANCELLOR: And that surficial layer

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1 is not a straight horizontal line across the side.
2 It's not a flat pancake layer.

3 DR. WISSA: That's what I understand.

4 MS. CHANCELLOR: So you will need to
5 remove all of that surficial layer whether it's one
6 foot or four feet thick. Is that correct?

7 DR. WISSA: That's what I understand.

8 MS. CHANCELLOR: And in some instances the
9 surficial layer may actually dip into the Bonneville
10 clays in some areas. Is that correct?

11 DR. WISSA: May be deeper in some areas.

12 MS. CHANCELLOR: May be deeper. Right.

13 DR. WISSA: Yes.

14 MS. CHANCELLOR: And you need a level
15 site, right?

16 DR. WISSA: I'm not sure you need a level
17 site. Why do you need a level site?

18 MS. CHANCELLOR: Let me ask you. Would it
19 be necessary to maintain a certain elevation level --
20 Let me strike that question. Isn't it true that
21 Holtec on its cast tip over analysis has put a
22 constraint of the depth of cement-treated soil under
23 the storage pad?

24 DR. WISSA: I think that's correct. You
25 may want to ask Paul Trudeau or somebody else but I

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1 believe it's correct.

2 MS. CHANCELLOR: Mr. Trudeau, isn't it a
3 minimum of one foot and a maximum of two feet for
4 cement-treated soil under the storage pads.

5 MR. TRUDEAU: That's the design. Correct.

6 MS. CHANCELLOR: With respect to the
7 Bonneville clays, what is PFS's plan if the sufficient
8 material is deeper in some parts than the Bonneville
9 clays?

10 MR. TRUDEAU: There may be an area in the
11 southeastern corner of the site based on the
12 subsurface investigations that we've done today where
13 it may be necessary to fill in below one or more of
14 the pads to limit the cement-treated soil thickness to
15 two feet. In those areas we expect to place compacted
16 clay soils using a modified proctor compaction
17 requirement which is an increased compactive effort to
18 increase the density and decrease the void ratio of
19 these soils and hence increase their strengths. We
20 believe that we will be able to demonstrate in the
21 laboratory that we have strengths that exceed our
22 design value for that compacted clay soil.

23 MS. CHANCELLOR: Isn't it true that you
24 won't know the extent to which you will need to use
25 compacted clays until Dr. Wissa or somebody has

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1 completed the index properties for the soils?

2 MR. TRUDEAU: The real proof is going to
3 be when we start excavating behind these pads and
4 where we find the upper Bonneville clay layer. If
5 it's deeper than two feet below the bottom of the pad
6 then that's an area where we will have to use this
7 compacted clay-soil.

8 MS. CHANCELLOR: Isn't it true that PFS
9 had not anticipated that there was some plastic salts
10 within the eolian silts?

11 MR. TRUDEAU: No, that's not true.

12 MS. CHANCELLOR: How will PFS use
13 compactive clays without disturbing the surrounding
14 clays?

15 MR. TRUDEAU: The surrounding clays would
16 be compacted when the compacted clay is placed on top
17 of it. These are soft Bonneville clays as applied
18 perhaps to some of the I-15 construction. These clays
19 are stiff clays. They're partially saturated. They
20 are 100 feet above the water table, 120 feet above the
21 water table up here in Skull Valley. So the potential
22 for remolding these due to this compaction effort is
23 very slight in my estimation not like would be the
24 case for a saturated soft clay.

25 MS. CHANCELLOR: So as part of PFS's

1 testing program is it correct then that you will
2 measure the strength and compressibility properties of
3 the remolded and compacted Bonneville deposits?

4 MR. TRUDEAU: That is correct.

5 MS. CHANCELLOR: Dr. Wissa, is that part
6 of any program that you are involved with or will be?

7 DR. WISSA: That doesn't have a direct
8 bearing on the source cement.

9 MS. CHANCELLOR: Whose program does this
10 come under, Mr. Trudeau?

11 MR. TRUDEAU: This is testing that needs
12 to be done. Logically it will be done as part of this
13 program that we're in discussion with Dr. Wissa about.

14 MS. CHANCELLOR: What else is there that
15 is not what Dr. Wissa would consider part of his slice
16 of this program? Are there other aspects of testing
17 other than the Bonneville deposits that need to be
18 tested?

19 MR. TRAVIESO-DIAZ: Does Dr. Wissa
20 understand the question?

21 MS. CHANCELLOR: I'm asking Mr. Trudeau.

22 MR. TRAVIESO-DIAZ: Yes, but I'm not sure
23 I understand the question myself. I wonder if the
24 witness does.

25 MS. CHANCELLOR: Do you understand the

1 question, Mr. Trudeau?

2 MR. TRUDEAU: I understood you were asking
3 what types of tests are anticipated to be done yet.

4 MS. CHANCELLOR: Other than the ones that
5 Dr. Wissa has described and that I've described in the
6 essay with respect to the mixing of cement into soil.
7 Dr. Wissa stated that the compressibility properties
8 of remolded and compacted Bonneville deposits he
9 didn't anticipate that was part of his program. I'm
10 wondering if there is anything else --

11 DR. WISSA: Excuse me. I'm able to
12 correct that. I said that isn't a part of the soil-
13 cement program. I did give the owner some ideas about
14 evaluating the effects of what you are describing for
15 the clay soils for that stabilization as far as purely
16 testing.

17 MS. CHANCELLOR: Did you give the owner
18 ideas about anything else not relating to soil-cement
19 but anything else such as you did with the Bonneville
20 clays?

21 DR. WISSA: No, basically it's testing
22 programs.

23 MS. CHANCELLOR: So other than soil-cement
24 using that term generally and testing of the
25 Bonneville clays you haven't discussed any other test

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1 with PFS. Is that correct?

2 DR. WISSA: To the best of my recollection
3 that is correct. Yes.

4 MR. TRUDEAU: May I add something to that?
5 We have discussed the possibility of doing some of
6 these rapid loading tests on these particular
7 compacted clay specimens as well just to demonstrate
8 this well known phenomenon that we've been discussing
9 in all these depositions and hearings. So that type
10 of testing is also discussed as part of these effort.

11 MS. CHANCELLOR: Does that include time
12 wise the compressibility of the Bonneville clays, the
13 rapid loading? Is the included in the six to eight
14 month program?

15 MR. TRUDEAU: Yes.

16 DR. WISSA: Yes.

17 MR. TRUDEAU: Compressibility is really
18 not the issue. It's the shear strength. It's the
19 compressive strength that we're concerned about. So
20 I'm not sure that it's fair to say yes to
21 compressibility but rather to the strength of the
22 test. The underling shear strength is what we're
23 trying to determine and especially for this particular
24 clay that may need to be compacted under one or more
25 of the paths perhaps demonstrating that we do indeed

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1 have this dynamic component that we haven't measured
2 to date.

3 MS. CHANCELLOR: Dr. Wissa, in terms of
4 collecting soil samples, does the season of the year
5 make any difference when you start your program?

6 DR. WISSA: I'm not sure. I think if the
7 soils are frozen it will be hard to break up. But
8 since they are so dry it may be possible as a physical
9 problem. Other than that I don't think it should have
10 a major impact on soil.

11 MS. CHANCELLOR: Will the soils exhibit
12 different properties if you take samples in the winter
13 as opposed to the summer?

14 DR. WISSA: The surface soil, different
15 properties, no. Not different properties. When I say
16 properties let me correct what you mean by properties.
17 Can you define what you mean by properties?

18 MS. CHANCELLOR: Different shear strength
19 values.

20 DR. WISSA: At different times of the
21 year, yes. The surface soils in particular whether
22 let's say it's at the surface and it's just rained.
23 It's going to have a much weaker strength or it's
24 going to have a higher water content and so one. If
25 that rain now freezes, you are going to get soil which

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1 is like a piece of rock, a piece of ice. So depending
2 on the time of the year and so on, yes you would have
3 a problem with it and its properties.

4 But when you take it back to the lab, most
5 of the soil samples would be collected and they would
6 be disturbed and mixed up so you aren't interested in
7 the existing properties on-site as far as the surface
8 soils. When you go down to depth at three feet or
9 more, the effect of different times of the year
10 probably would not have an effect because it isn't
11 susceptible to weather or the effect of climate.

12 In other words, as you go down deeper
13 climatic conditions do not change so if you go down
14 five feet, you would not find that your soil
15 conditions are going to change with seasonal times of
16 the year.

17 MS. CHANCELLOR: For the zero to two feet
18 surficial soils, will you have to collect samples at
19 different times of the year?

20 DR. WISSA: No, because those are the
21 soils which would be removed and reworked.

22 MS. CHANCELLOR: But you need to find out
23 the properties of those soils and test those soils
24 where you saw cement-treated soil program?

25 DR. WISSA: That's correct, yes. But

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1 let's start by the index properties. Other than the
2 moisture content which is really not an index
3 property, the properties do not change. Let's say the
4 plasticity, the atomic limits and so on by what the
5 conditions of the soil are when you obtain it in the
6 field. So physical properties are inherent to the
7 soil independent of the season.

8 To answer your question, collecting those
9 samples when you collect them is irrelevant to the
10 results you are going to get from your index testing.
11 It has no bearing other than the natural moisture
12 content of the soil at the time you collected. That
13 has no real bearing on what you are trying to do.

14 MR. TRUDEAU: Might I add?

15 MS. CHANCELLOR: Certainly, Mr. Trudeau.

16 MR. TRUDEAU: The moisture content of the
17 near surface soils may indeed change through the
18 course of the year due to different climactic
19 conditions that prevail in Skull Valley. However any
20 differences in the moisture content of the soils as
21 received from the site whenever as part of the soil-
22 cement testing program will be measured. The mix will
23 have a certain optimum moisture content that needs to
24 be achieved.

25 When we get to the field and start

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1 constructing the soil-cement, the moisture content of
2 the soils at that time needs to be measured and
3 factored into the optimum moisture content used to
4 compact these soils. Therein lies the efficacy of
5 having a batch plant to help control the resulting
6 product to make sure that we have the right amount of
7 moisture because it is important to the soil-cement
8 recipe so to speak.

9 MS. CHANCELLOR: Do you know Mr. Trudeau
10 whether PFS is committed to have a centralized batch
11 plant on-site at the PFS site?

12 MR. TRUDEAU: It is not my understanding
13 that there is a commitment to have a batch plant at
14 this time. But all of the discussions that I have
15 been party to, it's been clearly recognized that this
16 is likely to be the outcome for the reasons that Dr.
17 Wissa said earlier.

18 MS. CHANCELLOR: Dr. Wissa, how will
19 samples collected from the site be stored and
20 processed prior to lab testing?

21 DR. WISSA: How will they be stored and
22 processed?

23 MS. CHANCELLOR: Yes.

24 DR. WISSA: I would assume that they would
25 be processed if they come to us to our laboratory. As

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1 far as how to handle it for the soil-cement treatment,
2 you would probably put them in containers and ship
3 them. I'm not sure how they would be shipped if it
4 would be by truck or whatever method.

5 So we would probably also take samples in
6 jars to prevent moisture contents change so as to get
7 a natural and situ moisture content. The bulk of the
8 sample would be sent probably without sealing it or
9 you may put them in plastic bags but you would
10 definitely take a small sample or several small
11 samples to determine moisture content with depth and
12 with location.

13 So you would have also these samples which
14 is standard procedure by the way when you do a program
15 especially when you seal up small samples. I'm
16 speaking about a glass container which is sealed with
17 a cap and may be three inches long and two inches in
18 diameter or something like that.

19 MR. TRUDEAU: Might I add that that's
20 exactly what we did on the test pits samples that we
21 took in the 16 test pits that we dug on-site. The
22 bulks of the samples went into five gallon buckets
23 that did have a cover but we weren't relying on that
24 cover to seal moisture into those samples.

25 We did also take a water content specimen

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1 and seal it in a standard eight ounce olive type jar
2 that has a gasket on the cap to seal in the moisture.
3 We taped those caps to make sure that the moisture
4 stayed in the jar. And we tested those quickly upon
5 return to the lab.

6 MS. CHANCELLOR: So it's fair to say that
7 sample collection and handling and the procedures you
8 used are important with respect to the testing
9 program?

10 MR. TRUDEAU: I don't think that it's fair
11 to say that they are important in that regard because
12 the soil-cement mix doesn't depend on the condition of
13 the sample that it received that gets to the lab.
14 It's really a disturbed sample at that point. It gets
15 brought to the lab and gets mixed up as a bulk sample.

16 We measure gradations which are clearly
17 not affected by disturbance of these samples. The
18 only thing that's perhaps of interest to warrant some
19 additional handling is this moisture content thing.
20 That's not really part of the soil-cement design. But
21 as I said earlier whatever the moisture is in the soil
22 at the time that we mix the soil-cement needs to be
23 adjusted whether it's up or down to meet the optimum
24 moisture content that's being measured in the lab as
25 the correct soil-cement recipe.

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1 MS. CHANCELLOR: Dr. Wissa, are samples
2 ever dried before index and compaction tests?

3 DR. WISSA: What we usually do is we do
4 both. We do them at natural moisture content and we
5 do them after drying. We don't oven dry. We air dry.
6 From that you run an the Atteberg limits at both. If
7 there is a difference due to dry then you would not
8 dry your samples.

9 So you always are concerned about the
10 possibility that drying may have an effect. In this
11 case where you have a very arid climate, the
12 probability of drying and I'm not speaking of oven
13 drying here because we wouldn't oven dry the samples,
14 air drying the samples having an influence on their
15 properties is unlikely. From the impression I get
16 this is not the case but we do always check that out.

17 MS. CHANCELLOR: On question 48 of your
18 testimony, you state that PFS will place cement-
19 treated soil in six inch lifts. Is that correct?

20 DR. WISSA: On page 48?

21 MS. CHANCELLOR: Question 48.

22 MR. TRUDEAU: It says approximately six
23 inches that's not --

24 DR. WISSA: Yes.

25 MS. CHANCELLOR: That's fine. Just

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1 looking at this diagram on State's Exhibit 212, the
2 first thing in terms of this layering of cement-
3 treated soil, you will have the Bonneville clays at
4 the base. Correct?

5 DR. WISSA: Correct.

6 MS. CHANCELLOR: Then you need to, Dr.
7 Wissa, I believe you said use an epoxy bond in your
8 testimony responding to Mr. O'Neill. You said
9 something about epoxy bonds.

10 DR. WISSA: No, I was trying to explain
11 the difference between cohesion and friction.

12 MS. CHANCELLOR: I see.

13 DR. WISSA: When I spoke about the epoxy
14 bond.

15 MS. CHANCELLOR: How would you achieve a
16 bond between the Bonneville clays and the first six
17 inches compacted cement-treated soil?

18 DR. WISSA: That would established during
19 the laboratory testing program. In actual fact, you
20 may not need to treat. But if you do you have several
21 options. One would be to put either a dry cement or
22 either a cement slurry depending and this will be
23 determined during the laboratory program to get the
24 bonding you require.

25 The way you do that is you take a sample

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1 of the clay. You would build a model if you want
2 having the top being the soil cement to modified soil
3 and in between the two you would do one test where you
4 would have no treatment on it. You may try dry
5 cement. On the third one you may use a cement slurry.
6 You shear these samples and make sure that if they all
7 failed through the parent material rather than at the
8 bond at the interface then they are acceptable. If
9 not, you would choose where the failure occurs within
10 the parent material rather than at the interface.

11 MS. CHANCELLOR: And anything that you use
12 for bonding couldn't change the Young's modulus of the
13 material to exceed 75,000 psi. Is that correct?

14 DR. WISSA: It is such a thin layer that
15 you are speaking about less than a millimeter a very
16 thin layer. It would have no measurable effect.

17 MS. CHANCELLOR: The second and third six
18 inch lifts would be less of cement-treated soil. Is
19 that correct? So you would then be up to eight
20 inches? If you are starting at the bottom and you
21 have the Bonneville clay and then you have three
22 widths of cement-treated soil, would you need to
23 establish a bond working from the bottom up between
24 the second and third lifts?

25 DR. WISSA: Yes. The program in vision

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1 would look at the bonding between the clay foundation
2 and the soil cement or the modified soil cement.

3 MS. CHANCELLOR: The cement-treated soil?

4 DR. WISSA: The cement-treated soil. The
5 layer between the cement-treated soil layers, the
6 interface there and then finally between the cement-
7 treated soil layer and the concrete layer.

8 MS. CHANCELLOR: But would you have to
9 establish bonds at the interface between the various
10 six inch lifts of cement-treated soil? We've have a
11 sandwich. You have a bond between the Bonneville clay
12 and the first six inch layer. Then you have a bond is
13 that correct between the first and second six inch
14 layer of cement-treated soil?

15 DR. WISSA: That's correct and you go up
16 to --

17 MS. CHANCELLOR: Until you get to bottom
18 of the pad.

19 DR. WISSA: And at the bottom of the pad
20 you still need a bond between the bottom of the pad
21 and the cement-treated soil below it.

22 MS. CHANCELLOR: So you have three
23 different types of bonds that you need to test for and
24 determine whether they will perform to resist sliding
25 at the PFS site and still stay with in the 75,000 psi

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1 Young's modulus.

2 DR. WISSA: Let me correct that. The bond
3 is going to have no effect on the Young's modulus
4 because it's such a thin layer that it's going to have
5 essentially no measurable effect on the Young's
6 modulus. What you are concerned about is the ability
7 to transmit shear stresses to prevent sliding between
8 those layers. So that's what you are mainly
9 interested in. I think the effect of having that thin
10 layer between is not going to affect the modulus's
11 plasticity or Young's modulus. I should mention that
12 during construction you will be able to still check
13 that you are still achieving a bond.

14 MS. CHANCELLOR: Now with respect to the
15 soil cement at the side of the pad, would you need to
16 establish a bond between the cement-treated soil that
17 extends out from under the pad and the bottom layer of
18 soil cement around the pad?

19 DR. WISSA: To my knowledge, no because
20 they are not relying on any lateral confinement due to
21 the stabilized soil-cement and the concrete pad.

22 MS. CHANCELLOR: Would you need to
23 establish a bond at the interface between the edge of
24 the three foot thick concrete pad and the soil cement
25 around the pad?

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1 DR. WISSA: Not to my knowledge, no.

2 MS. CHANCELLOR: How do you anticipate
3 that the cement-treated soil can be created that has
4 a maximum Young's modulus of 75,000 psi?

5 DR. WISSA: Can you repeat that question
6 please?

7 MS. CHANCELLOR: Could you read back the
8 question please?

9 (Question repeated.)

10 MS. CHANCELLOR: And I would like to add
11 and a compressive strength of 40 psi.

12 DR. WISSA: The way it's done is by trial
13 and error. What you do is you make up mixed design of
14 the cement and the soils and you measure the strength.
15 Then you measure the modulus until you get a
16 combination that gives you what you require. Here you
17 have flexibility and density control and moisture
18 control in cement. You have three variables that you
19 would have to play with to come with a value that
20 meets that criteria.

21 It is a reasonable requirement because
22 here you are speaking about a relatively low strength
23 and a relatively low modulus. Had you told me that
24 you wanted a high modulus and a low strength or a low
25 modulus and a high strength then I would have had a

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1 problem in trying to meet the criteria, more than one.
2 In this case it's consistent with the performance of
3 soil-cement and cement-modified soil.

4 MS. CHANCELLOR: Is the modulus a dynamic
5 or a static modulus?

6 DR. WISSA: I'm looking at it as a static
7 modulus.

8 MS. CHANCELLOR: Is the modulus a high
9 strain or a low strain modulus?

10 DR. WISSA: I think it's a Young modulus.
11 When you say low strain it's an initial type of
12 tangent modulus we're talking about.

13 MS. CHANCELLOR: Yes. That's correct.

14 MR. TRUDEAU: May I add something?

15 MS. CHANCELLOR: Certainly.

16 MR. TRUDEAU: That applicable modulus is
17 a large strain modulus as indicated in I don't
18 remember the particular Holtec report number but in
19 the vicinity of the cask tip over where the cask hits
20 the pad the strains in the soil-cement or the soil
21 right below the soil-cement are in the order of two
22 percent which is clearly a large strain modulus.

23 MS. CHANCELLOR: Is this from Appendix B
24 of the Holtec Tip Over analysis? Do you know?

25 MR. TRUDEAU: That sounds like the right

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1 report, yes.

2 DR. WISSA: I must correct myself then
3 because the initial tangent modulus is at a much lower
4 strain than that so it isn't the initial tangent
5 modulus. But you would get a stress strain and from
6 that you could select whatever modulus is appropriate
7 for the analysis.

8 MR. TRAVIESO-DIAZ: Mr. Chairman, I'm not
9 objecting to this line of questioning but I would like
10 to remind the Board that we discussed this issue as
11 part of Section D at quite some length in the last set
12 of hearings. I'm concerned that we are going back to
13 repeat this again. We may become inefficient.

14 MS. CHANCELLOR: Your Honor, this is an
15 area that caps across both C and D. I notice a stop
16 in that testimony addresses specifically in the soil-
17 cement testimony. Part of the State's testimony also
18 addresses Young's modulus and soil-cement so I think
19 it accounts across both.

20 MR. TRAVIESO-DIAZ: But if I might clarify
21 the issue here I believe on Section C is whether the
22 requirements can be met in the soil-cement mix not how
23 the requirements are set, how you test for them or how
24 you obtain them. In other words, what the modulus is
25 and how it is obtained is outside the scope of Section

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1 C and we already talked about that. That's my point.
2 You can ask I think as much as you want as to whether
3 this can be achieved in your proper soil-cement mix
4 but that's a different issue.

5 MS. CHANCELLOR: Your Honor, I think we
6 should proceed with questioning and that if Mr.
7 Travieso-Diaz has an objection, we will go to bat
8 then.

9 CHAIRMAN FARRAR: All right. He was
10 careful to say that he was not objecting at this
11 point. Nonetheless he will at some point have it. So
12 if you will try to be conscious of the line existing
13 somewhere as you go through your questioning.

14 MS. CHANCELLOR: Yes, Your Honor.

15 MR. O'NEILL: I just wanted to make one
16 statement. I know the Staff does address it to some
17 extent and that's in response to portion of the
18 contention in Part C. It's that final paragraph e.
19 It states the Applicant is unconservatively
20 underestimating the dynamic Young's modulus, the
21 untreated soil, etc.

22 MR. TRAVIESO-DIAZ: If I may clarify. If
23 you recall the parties had agreed that although even
24 though this particular issue was part of Subsection C
25 it would discussed and it was discussed as part of

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1 Subsection D last set of hearing.

2 CHAIRMAN FARRAR: Let me say this. This
3 is an enormously complicated issue. We are taking
4 witnesses in different order. This is the fifth week
5 of seismic hearings so it may not be possible to draw
6 sharp line or clear lines but yet we do need to avoid
7 in these next two weeks getting into matters that are
8 clearly duplicative of other sessions. Given the
9 somewhat disjointed nature of the hearings in terms of
10 time and space we could use everyone's help in
11 adhering to that principle.

12 Ms. Chancellor, at any point in the next
13 few minutes if you could come to a good point let us
14 know and we'll take lunch.

15 MS. CHANCELLOR: Right now, Your Honor.

16 CHAIRMAN FARRAR: Sold. It's almost 12:30
17 p.m. Let's be back at 1:30 p.m. Those people who are
18 not members of the NRC staff you will have to stick
19 together with your escorts and not straggle all over
20 the place. Off the record.

21 (Whereupon, at 12:28 p.m., the above-
22 entitled matter recessed to reconvene at
23 1:30 p.m. the same day.)

24 CHAIRMAN FARRAR: We are back on the
25 record for the afternoon session. Any preliminary

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1 matters before the State continues?

2 MS. CHANCELLOR: No, Your Honor.

3 CHAIRMAN FARRAR: We had talked about
4 debating tomorrow's proceedings. Let's wait on that.
5 Jack, do we have a video conference capability for
6 tomorrow?

7 PARTICIPANT (JACK): Away from microphone.

8 CHAIRMAN FARRAR: We do. Do we have a
9 reservation?

10 PARTICIPANT (JACK): Yes.

11 CHAIRMAN FARRAR: Okay. Then, Ms.
12 Chancellor, go ahead with your cross examination.

13 MS. CHANCELLOR: Thank you, Your Honor.
14 Mr. Trudeau, I believe earlier this morning you
15 mentioned a two percent strain in the soil from the
16 cask tip over.

17 MR. TRUDEAU: Yes.

18 MS. CHANCELLOR: What layer is that two
19 percent strain in?

20 MR. TRUDEAU: I don't recall where it
21 whether it was in the cement treated soil or just in
22 the Bonneville clay right below the cement treated
23 soil.

24 MS. CHANCELLOR: What effect would this
25 two percent strain have on the cement treated soil?

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1 Would it crash it?

2 MR. TRUDEAU: I couldn't say.

3 MS. CHANCELLOR: Dr. Wissa, do you have
4 any opinion on two percent strain and cement treated
5 soil?

6 DR. WISSA: As far as the modulus? I'm
7 missing the question.

8 MS. CHANCELLOR: What would happen to the
9 cement treated soil if in a tip over there was a two
10 percent strain in the sediments measured in the top of
11 the Bonneville clay. What effect would that have on
12 say the bending stresses in the cement treated soil?

13 DR. WISSA: I'm still having a little bit
14 of difficulty because what you have is a pad which is
15 heavily enforced. So you would not have the
16 underlying, the pad itself. The reinforced concrete
17 pad itself would be taking the impact of the loads.
18 The underlying cement treated soil would not be what's
19 carrying the bending forces. It would be the concrete
20 pad itself. So I'm not sure I understand your
21 question.

22 MS. CHANCELLOR: Could the cement pad
23 crack for example with that level of strain?

24 MR. TRAVIESO-DIAZ: Excuse me. You said
25 "cement pad."

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1 MS. CHANCELLOR: Right.

2 MR. TRAVIESO-DIAZ: I don't think we have
3 any cement pads here. We have a concrete pad.

4 MS. CHANCELLOR: Oh. Isn't concrete the
5 same as cement? Okay.

6 MR. TRAVIESO-DIAZ: Sorry.

7 MS. CHANCELLOR: Concrete pad.

8 DR. WISSA: I didn't design the concrete
9 pad, but it's certainly reinforced. I think you'd
10 have to ask the structure of engineers who designed
11 the pad on what would happen to the pad.

12 MS. CHANCELLOR: If the two percent strain
13 in the soils included the pad where this two percent
14 strain was calculated, would that change your answer
15 with respect to the stresses, or the bending stresses,
16 or the effect on the cement treated soil?

17 DR. WISSA: Again, I'm having a lot of
18 difficulty. A two percent strain to determine
19 deformations, you want to me to know over what
20 thickness or what layer you're talking about. The two
21 percent strain, I'm not sure I know where it's
22 occurring. If you can tell me where it's occurring,
23 I can --

24 MS. CHANCELLOR: Assume that it's 24
25 inches deep.

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1 DR. WISSA: Two percent strain at 24
2 inches?

3 MS. CHANCELLOR: Below the pad. Right.

4 DR. WISSA: If it's a uniform deformation?
5 I'm not sure how you achieve this. You have a
6 concrete layer. You have a soil cement, cement-
7 treated soil below it. It's acting as a unit now.
8 The control of the deformations is essentially the
9 most rigid part of it primarily which is now a very
10 thick -- dimensions heavily reinforced concrete mat.
11 Therefore, all the deformations are going to be
12 controlled by the mat rather than by the underlying
13 soil cement, cement of bonafide soil. So I'm having
14 a hard time understanding your model.

15 MS. CHANCELLOR: Dr. Wissa, let me hand
16 you a document entitled "PFSF site specific high storm
17 drop tip over analysis, Holtec report HI2012653
18 attachment B page B-1."

19 MR. TRAVIESO-DIAZ: Ms. Chancellor, is
20 this an exhibit already?

21 MS. CHANCELLOR: I don't think it is. If
22 you would review page B-1 of the Holtec drop tip over
23 analysis report, Dr. Wissa, and see where it refers to
24 two percent strain or 1.93.

25 DR. WISSA: Can you give me a minute to

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1 read?

2 MS. CHANCELLOR: Absolutely.

3 MR. TRAVIESO-DIAZ: While he's reading,
4 I'm going to raise an objection to this line of
5 questioning. It's totally beyond the scope of the
6 testimony of this witness. It deals with the
7 hypothetical tip over analysis in which a cask drops
8 and the potential impact that it may have on the cask,
9 the concrete pad, it's all cement. None of that has
10 to do with the design of the soil cement itself.

11 He doesn't refer to any of this in his
12 testimony. He wasn't referred to up to this point by
13 anyone. So I do think this is clearly outside of his
14 scope. I have been very patient with these kinds of
15 questions. If we're going to start looking at these
16 documents here, we are wasting time and not getting
17 anything of this witness --

18 MS. CHANCELLOR: That is incorrect. Mr.
19 Trudeau mentioned the two percent strain and the
20 Bonneville clays. This does relate to cement treated
21 soil because if there's a two percent strain in the
22 Bonneville clays, then we need to know what effect
23 those strain rates are going to have on the cement
24 treated soil immediately above the Bonneville clays.
25 So I'm looking at this from a point of view of whether

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1 this is going to be part of PFS's design and how that
2 design for the cement treated soil is going to
3 withstand that effect.

4 CHAIRMAN FARRAR: What I think Counsel for
5 the Applicant's point is we can talk to these
6 witnesses about what it might do to the cement treated
7 soil. Then when you go beyond that into what will
8 happen to the casks because of that, isn't that
9 something that we've already covered?

10 MS. CHANCELLOR: I'm not going there, Your
11 Honor. I'm not going to what happens to the cask. I
12 just simply gave Dr. Wissa an attachment to the Holtec
13 report because he couldn't understand this two
14 percent. I'm focusing on the cement treated soil and
15 what's going to happen in the event of a potential tip
16 over in an earthquake.

17 MR. TRAVIESO-DIAZ: I'm going to make this
18 brief because arguments take longer than asking the
19 question. My point is very simple. She can ask Dr.
20 Wissa if he can or Mr. Trudeau what effect a two
21 percent strain on the cement treated soil will have on
22 the performance of the soil. That could considerably
23 be within the scope. But going into a cask tip over
24 analysis in any form, I think it is unnecessary and
25 it's beyond the scope.

1 MS. CHANCELLOR: It was necessary, Mr.
2 Travieso-Diaz because Dr. Wissa couldn't understand
3 how you could get two percent strain in the soils when
4 you got a cement pad on top. I don't want to put
5 words in his mouth, but that's the reason I showed him
6 the calculation.

7 CHAIRMAN FARRAR: Does staff have a
8 position?

9 MR. O'NEILL: I wouldn't state a formal
10 objections at this point. I mean, I agree to the
11 extent that we're focusing on possible effects and
12 integrity of the soil cement. That's fine.

13 MR. TRAVIESO-DIAZ: I will withdraw my
14 objection for the moment in the interest of time.

15 CHAIRMAN FARRAR: Good. Thank you.

16 DR. WISSA: I think I understand the
17 question now. Looking at this clarified it in as much
18 as the strains we're talking about of the deformations
19 in the underlying clay. The clay is going to settle
20 up to two percent apparently. This is an assumption.
21 You're asking the question here what happens to the
22 soil cement above the clay as a result of a clay
23 settling by or moving by a two percent strain. Is
24 that right?

25 MS. CHANCELLOR: That's correct.

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1 DR. WISSA: All right. In this case, the
2 soil cement will follow the clay. If the clay drops,
3 the soil cement will drop by that two percent,
4 whatever that corresponds to in movement. It will
5 drop as a single unit because you have above it a very
6 rigid concrete unit which will follow too. If you
7 look at compatibility of movements, the controlling
8 one will be the concrete. As long as the concrete can
9 take the movement of bending stresses, the soil cement
10 will not be affected by that movement.

11 You have a compatibility of movements of
12 strains, so the soil cement to try and clarify follows
13 the concrete. The concrete is a controlling membrane,
14 the strong stiff material on top of a soil cement.
15 It's like a sandwich. If the toast if you want to
16 think that had ham in it. If the toast is rigid, the
17 ham will just follow the toast. In this case you have
18 the soil cement as a softer layer, the weaker layer
19 and you have a very rigid pad above it. It will just
20 follow the pad. It should have no effect on the
21 performance of the soil cement.

22 MS. CHANCELLOR: What about the mustard
23 between the ham and the toast; the bond at the
24 interface of the soil cement, cement-treated soil and
25 the pad?

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1 DR. WISSA: Okay. I was going to say the
2 mustard is the treatment between the two layers. That
3 one would just follow too. It has no effect on the
4 performance of the soil cement.

5 MR. TRUDEAU: Might I add that this is a
6 hypothetical case that needs to be addressed per
7 regulations. This is not a design case. We don't
8 expect that we're going to be dropping any casks out
9 on these pads.

10 MS. CHANCELLOR: Good. Is attachment B to
11 the Holtec report that I showed you the analysis that
12 set the modulus for Young's modulus?

13 MR. TRUDEAU: I am not sure that this is
14 the analysis that set the modulus.. This one
15 demonstrated that the strains involved are
16 appropriately characterized as being large strains so
17 that the moduli that we are talking about are not
18 dynamic moduli, large strain moduli.

19 These are the same moduli that the study
20 by Lawrence Livermore Labs table 13 refers to from --
21 that those are static moduli of elasticity that this
22 Lawrence Livermore billet drop study that this cast
23 tip over analysis is based on is derived from. This
24 attachment B was put together to demonstrate why the
25 large strain moduli are applicable rather than the

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1 dynamic moduli that we've heard in various filed
2 documents.

3 MS. CHANCELLOR: I'd like to move on. Mr.
4 Trudeau, it's correct that in the PFS base case for
5 the sliding analysis that PFS takes no credit for the
6 passive resistance of cement-treated soil. Correct?

7 MR. TRUDEAU: Of the soil cement?

8 MS. CHANCELLOR: Soil cement. Correct.

9 MR. TRUDEAU: Correct.

10 MS. CHANCELLOR: But in some of the other
11 cases in that analysis that you do at times take
12 credit for that passive resistance.

13 MR. TRUDEAU: In the analysis of multiple
14 paths in a long row, north-south, I believe that the
15 analysis did include the passive resistance at the far
16 end of that. We're relying on the compressive
17 strength of the soil cement between the pads.

18 MS. CHANCELLOR: Isn't it true that PFS
19 cannot lead a factor of safety of 1.1 if it just used
20 structural fill, if it didn't have cement-treated soil
21 under the pads?

22 MR. TRUDEAU: That is correct. We need
23 the cohesion of the cement-treated soil that's not
24 provided by a typical granular structural fill.

25 MS. CHANCELLOR: Is it your position that

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1 PFS must meet a factor of safety of 1.1 to ensure
2 safety?

3 MR. TRAVIESO-DIAZ: Objection. That calls
4 for a legal conclusion.

5 MS. CHANCELLOR: I'll withdraw the last
6 couple of sentences.

7 MS. CHANCELLOR: Is it your position that
8 PFS must meet a factor of safety of 1.1 to resist
9 sliding?

10 MR. TRUDEAU: 1.1 is the typical target
11 used for sliding stability analyses due to earthquake
12 loadings. That's the number that is found to be
13 acceptable according to regulatory guidance provided
14 by NUREG 0800 for nuclear power plant structures.

15 These pads are not typical nuclear power
16 plant structures. We have seen and heard testimony
17 that if the pads were to slide the amount of movement
18 that the casks experience atop those pads is actually
19 diminished by that sliding pad. In this case, it
20 clearly is better not to meet a factor of safety
21 against sliding of 1.1. This is all driven by the
22 fact that there are no safety related connections to
23 these pads.

24 MS. CHANCELLOR: Is it good engineering
25 practice to design a structure that will slide?

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1 MR. TRAVIESO-DIAZ: Ms. Chancellor, is
2 your question intended to be all circumstances? It
3 seems to me that I could if I wish interpose an
4 objection as being too broad.

5 CHAIRMAN FARRAR: If you did, you'd lose.

6 MR. TRAVIESO-DIAZ: That's why I didn't
7 raise it.

8 MR. TRUDEAU: As I just said, it would
9 benefit the performance of the casks atop these pads
10 if we permitted them to slide. So the answer would be
11 no to your question here. We've heard Dr. Ostadon
12 (PH) speak about base isolated structures. Those are
13 clearly designed to have sliding occur underneath
14 their foundation. So the answer to your question is
15 no.

16 MS. CHANCELLOR: Isn't it true that for
17 base isolation structures only 25 percent credit is
18 taken for sliding?

19 MR. TRUDEAU: I have never designed a base
20 isolation system structure, so I don't know all of the
21 details.

22 MS. CHANCELLOR: I think we're beating
23 this horse in Salt Lake City.

24 MR. TRUDEAU: Thank you.

25 MS. CHANCELLOR: PFS is using the buttress

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1 effect of soil cement around the CTB to meet the 1.1
2 factor of safety. Is that correct?

3 MR. TRUDEAU: That is correct based on
4 other conservative assumptions for the strength of the
5 clay underlaying that building. One of those
6 assumptions is it's based on the static, the strength
7 measured in static tests in spite of the fact that we
8 understand and expect that these clays will exhibit
9 increased strength due to the dynamic loading
10 associated with the earthquake.

11 MS. CHANCELLOR: Now going back to the
12 pads, it's true that the buttress effect as you said
13 was not included in the sliding calculations. Right?

14 MR. TRUDEAU: Of our base case, that's
15 correct.

16 MS. CHANCELLOR: Do you mean to imply that
17 there will be no passive resistance provided by the
18 soil cement during an earthquake?

19 MR. TRUDEAU: No. I just mean to indicate
20 that the resistance that can be provided by that
21 material is conservatively ignored so that if you were
22 to include it the factor of safety would be higher.

23 MS. CHANCELLOR: So practically you could
24 get passive resistance from soil cement around the
25 pads during an earthquake. Right?

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1 MR. TRUDEAU: Yes.

2 MS. CHANCELLOR: If passive resistance is
3 provided by soil cement adjacent to the pads, where
4 does the force that is mobilized go?

5 MR. TRAVIESO-DIAZ: Mr. Chairman, I have
6 to object here. Dr. Ostadon (PH) and I talked about
7 this for hours in Salt Lake City. This is dynamic
8 analysis, part to part interaction. I don't know you
9 but I'm really sick and tired of hearing about it.
10 This hearing is not all that.

11 MS. CHANCELLOR: Well, I wouldn't say
12 we're sick and tired of it Mr. Travieso-Diaz, but I
13 shall move on.

14 MR. TRAVIESO-DIAZ: I apologize.

15 MS. CHANCELLOR: Some things just never go
16 away.

17 CHAIRMAN FARRAR: I will say that was
18 going to give me a rare opportunity to rule on the
19 legitimacy of the previously unheard of objection that
20 you're "sick and tired."

21 MR. TRAVIESO-DIAZ: In this case, I think
22 it would be a valid objection.

23 MS. CHANCELLOR: Sorry, Your Honor, I
24 won't be a moment. I have a jigsaw puzzle here.

25 CHAIRMAN FARRAR: That is quite all right.

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1 MS. CHANCELLOR: Mr. Trudeau, you
2 mentioned cracks occurring in the cement-treated soil
3 due to shrinking and other phenomenon. I remember you
4 saying they don't all line up in a neat little row.
5 What are the consequences to the tensile capacity of
6 the soil cement and cement-treated soil if there are
7 vertical cracks due to shrinkage or other phenomenon?

8 MR. TRUDEAU: We don't rely on the tensile
9 strength of the soil cement so it's immaterial.

10 MS. CHANCELLOR: So you don't believe that
11 vertical cracks if they exist would have any effect on
12 shear resistance.

13 MR. TRUDEAU: I do not believe that the
14 presence of vertical cracks will effect the shear
15 resistance available under the pads, no.

16 MS. CHANCELLOR: Would your answer by the
17 same for the soil cement around the CTB?

18 MR. TRUDEAU: Yes it would because the
19 shear strength that we're talking about is the bond
20 between the soil cement and the underlying clay. That
21 won't be affected by any measurable amount by the
22 presence of a vertical crack.

23 MS. CHANCELLOR: In your testimony, you
24 refer to precedent for using cement-treatment and you
25 mention the South African Nuclear Power Plant at

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1 Koeberg, South Africa.

2 MR. TRUDEAU: Yes.

3 MS. CHANCELLOR: Isn't it true that at the
4 Koeberg site there were low saturated sands?

5 MR. TRUDEAU: Yes. That is correct.

6 MS. CHANCELLOR: They were potentially
7 liquefiable.

8 MR. TRUDEAU: That's my understanding.

9 MS. CHANCELLOR: And at PFS, the plastic
10 fine-grain material.

11 MR. TRUDEAU: That is correct.

12 MS. CHANCELLOR: And the PFS -- are not
13 susceptible to liquefaction.

14 MR. TRUDEAU: That is correct.

15 MS. CHANCELLOR: Isn't it true in South
16 Africa they removed a thick layer of sand
17 approximately 24 meters deep?

18 MR. TRUDEAU: That's my understanding.

19 MS. CHANCELLOR: Then they treated with
20 cement and replaced and compacted it.

21 MR. TRUDEAU: Yes. They did in order to
22 increase or enhance its shear strength so that it
23 would be strong enough to resist the cyclic shear
24 stresses from the earthquake.

25 MS. CHANCELLOR: PFS's application is for

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1 a shallow condition. Correct?

2 MR. TRUDEAU: That's correct.

3 MS. CHANCELLOR: Not liquefiable.

4 MR. TRUDEAU: That is correct.

5 MS. CHANCELLOR: The purpose is to provide
6 resistance to sliding during an earthquake.

7 MR. TRUDEAU: That is correct. We are
8 using the cement to impart a cohesion, an underlying
9 strength to the eolian silts.

10 MS. CHANCELLOR: If I could take just a
11 second, Your Honor, I think I'm done. I'm finished,
12 Your Honor.

13 CHAIRMAN FARRAR: Thank you, Ms.
14 Chancellor.

15 MS. CHANCELLOR: Could I just go retrieve
16 the document from the witness?

17 CHAIRMAN FARRAR: Yes. Go ahead. My
18 colleagues have some questions.

19 JUDGE KLINE: I just want to refer you
20 generally to your question and answer 48 on page 31.
21 You refer there to certain specifications that the
22 soil cement must meet specifically either 250 PSI or
23 40 PSI. I know elsewhere you referred to Young's
24 modulus of 75,000. My understanding from your
25 testimony is that you don't believe there's any

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1 trouble meeting these as a practical matter.

2 MR. TRUDEAU: That is correct.

3 JUDGE KLINE: My question then is how much
4 practical latitude do you have in meeting these
5 targets, that is, when you're actually out in the
6 field and you have people in the field, contractors
7 and all making engineering judgements and feeling the
8 soil and that sort of thing. How much latitude do you
9 feel you have when you know you're going to be dealing
10 with variable material and variable judgements and
11 that sort of thing? For example, on a 250 PSI
12 specification, what would be the practical limits up
13 and down from that that you'd allow yourself?

14 MR. TRUDEAU: The 250 is a minimum here.

15 JUDGE KLINE: Okay.

16 MR. TRUDEAU: This is an extremely
17 comfortable lower bound value. It's my expectation
18 that the soil cement that we're going to be building
19 out there that will pass the durability test, the
20 freeze-thaw, and the wet-drying test that the
21 unconfined compressive strengths of that material are
22 more likely to be 400 PSI than 250 PSI. Our analyses
23 are based on this lower value just to demonstrate that
24 this is a readily achievable value that we won't have
25 any problem achieving in the field.

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1 JUDGE KLINE: And I'm not talking about
2 achieving it in the laboratory. I'm talking about
3 achieving it under the practical field conditions when
4 there are a lot of different judgements and a lot of
5 different soil textures and variable conditions that
6 you'd encounter in the field.

7 MR. TRUDEAU: There again, the key is the
8 control that you have and putting the recipe together.
9 That's why as I said all of the discussions today we
10 fully expect that we're going to have a batch plan on-
11 site to permit that control to be exercised; to get
12 the right proportion of moisture, the right proportion
13 of cement with the soils. Perhaps to address your
14 concern a little more directly, it's my understanding
15 that typically when you go to a field mix you even add
16 a couple of percent cement just to make sure you get
17 there.

18 JUDGE KLINE: Okay. I am getting at
19 really whatever comments you have on the practical
20 constraints that occur in the field. I understand you
21 can meet standards in the lab, but when you're in the
22 field and you're dealing with variable judgements and
23 variable textures, at that point, are you still
24 confident you can meet these standards.

25 MR. TRUDEAU: Yes.

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1 JUDGE KLINE: Or meet them within a fair
2 approximation.

3 MR. TRUDEAU: We're committed to testing
4 the as constructed material. We have to demonstrate
5 that we have these bond strengths constructed in the
6 field. We have to deal with those issues. If we're
7 not meeting those strength requirements, then clearly
8 we have to do something different to get better
9 control over the materials, whatever. The tests will
10 demonstrate that we're there or we're not there.

11 JUDGE KLINE: What contingencies do you
12 have in mind for materials that happen to fail a test?
13 I mean, if you made a big pore and then find that it
14 doesn't meet the test, do you have to tear it all out
15 again and start over? What do you do? Is there a
16 plan for that at all?

17 MR. TRUDEAU: That eventuality would have
18 to be dealt with if it occurred. The process as I
19 envision it would be to do everything that we can up
20 front, to do some field testing when we get permission
21 to go actually build something out there.

22 JUDGE KLINE: I understand you'd rather do
23 it right the first time. The issue is what happens
24 when that doesn't work.

25 MR. TRUDEAU: I would expect that we would

1 then go and core some more samples and run some more
2 tests on those samples to try to get a handle on the
3 extent of the problem area. Then that material would
4 have to be ripped out in my estimation.

5 JUDGE KLINE: Okay. All right. Does the
6 same thing hold for meeting the standards of the
7 Young's modulus? Do you feel you can hit that in the
8 field under the constraints of practical field
9 conditions?

10 MR. TRUDEAU: I believe we can get there.
11 I haven't got any test data to show it yet.

12 JUDGE KLINE: Okay.

13 MR. TRUDEAU: But that certainly will be
14 determined in the lab testing.

15 JUDGE KLINE: I am inquiring into how
16 field conditions differ from the more or less ideal
17 conditions of the lab and what you can do as a
18 practical matter dealing with the major construction
19 not just with lab tests.

20 MR. TRUDEAU: The lab testing will vary
21 the percentages of cement, the percentage of moisture,
22 and we will develop more or less a parametric study of
23 how much we can use to get and still meet the 75,000
24 limit along with the 40,000 PSI compressive strength
25 to determine what kind of latitude we actually have

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1 out in the field. We do have the opportunity to
2 segregate different materials. As I said earlier,
3 it's easier to get a better quality soil cement
4 product with non-plastic silts than it is with clayey
5 silts. We can reserve those materials for use in this
6 one to two foot thick layer directly underneath the
7 pads where it's relied on for those key design
8 properties.

9 JUDGE KLINE: Okay. Thank you.

10 CHAIRMAN FARRAR: In response to Judge
11 Kline's questioning about the hypothetical pore that
12 doesn't meet this test, you said you'd deal with that
13 contingency. Then you said in your judgement you'd
14 have to rip it out or you might have to rip it out.

15 MR. TRUDEAU: If it didn't meet the
16 strength requirements, for instance, definitely.

17 CHAIRMAN FARRAR: Or is there a
18 possibility that someone in the organization would say
19 we have layers of conservatism here and let's redo the
20 calculations and let's leave it in place.

21 MR. TRUDEAU: I suppose that could be part
22 of the analysis of where we were depending on how wide
23 spread the problem was.

24 CHAIRMAN FARRAR: In your understanding of
25 the system and if you don't know the answer say so,

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1 are these tests something you report regularly to the
2 NRC staff?

3 MR. TRUDEAU: I don't know the details of
4 that. I just know that we will be having field
5 quality control that will be I'm sure audited by NRC
6 staff on some kind of a regular basis. Typically I
7 would expect that passing tests would just be
8 routinely fit into a schedule, that they'd be looked
9 at on a routine basis, but there could be some
10 mechanism perhaps for a failed test to draw some
11 attention to itself and people would get involved much
12 sooner than they would otherwise have on a routine
13 basis.

14 The 250 PSI is really an easy number to
15 meet. There is no question in my mind based on the
16 ACI report, all of the Portland Cement Association
17 reports on soil cement that I've read for this
18 project. This 250 PSI is really an easy thing to
19 achieve. I'm not at all concerned about that number.

20 JUDGE LAM: Therefore, one would assume
21 when you are mixing the soil cement you would just add
22 a little bit more cement to make sure you meet the
23 250. Isn't it?

24 MR. TRUDEAU: That is correct.

25 JUDGE LAM: Because a typical range to

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1 achieve 250 would be what, a few percentage in the
2 form of Portland cement.

3 MR. TRUDEAU: It could be maybe even nine
4 percent for these finer grain soils, maybe even 12
5 percent. We don't know that yet because we haven't
6 gotten past the durability test yet. That's what is
7 going to drive it, not the strength. To get to 250
8 PSI, I think we only needed about six percent cement
9 to get to there based on 40 times the compressive
10 strength.

11 JUDGE LAM: So the Young's modulus is the
12 one that drives your --

13 DR. WISSA: The Young's modulus as far as
14 the soil cement, it has no bearing. It's a
15 compressive strength. In fact to answer your question
16 generally you do the lab work. Then as you said, you
17 add extra cement to compensate for variability in the
18 field and for control in the field. That's common
19 practice. Two percent is by the way not a bad
20 addition of two percent cement as far as strength.

21 But as Paul said, the probability will be
22 that the durability testing will control it. In other
23 words, you're going to be adding more cement not to
24 achieve a strength but to achieve a durability. So
25 you'll probably have four or five hundred and even

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1 possibly higher strength. So strength will not be the
2 limiting factor but rather the durability as far as
3 effect of cycles of wet-dry and freezing-thawing.

4 You would add that extra cement anyway
5 even with durability. Let's say you need ten percent
6 cement for durability in the lab. You may add another
7 two percent to make sure you have a durable product in
8 the field too.

9 MR. TURK: May I inquire for clarification
10 about the last answer that had to do with the soil
11 between the pads? You're talking about compressive
12 strength.

13 MR. TRUDEAU: Yes, and around the canister
14 transfer building.

15 JUDGE LAM: Dr. Wissa, if I may ask you to
16 look at your prefiled testimony answer to question 45.

17 MR. TRUDEAU: Was that number 45?

18 JUDGE LAM: Right. Dr. Wissa?

19 DR. WISSA: Yes.

20 JUDGE LAM: You indicated it is your
21 opinion that this soil testing program if properly
22 implemented would be adequate for this facility. My
23 question to you is what do you consider a proper
24 implementation?

25 DR. WISSA: I assume you're speaking about

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1 implementation in the field. There is in the ESSOQ an
2 outline of what kind of QA/QC program will be applied
3 during construction. That's the type of program I'm
4 talking about as far as implementation. There is a
5 section I believe which speaks about QA/QC joint
6 construction; Quality Control and Quality Assurance.
7 That's the type of program I'm talking about to make
8 sure it's properly implemented in the field.

9 MR. TRAVIESO-DIAZ: For clarification,
10 when he's talking about ESSOQ, he's referring to
11 Applicant's Exhibit GGG which you have in front of
12 you.

13 JUDGE LAM: Okay. Dr. Wissa, the reason
14 I asked you this question is --

15 DR. WISSA: And as I mentioned earlier,
16 the SAR has information on it too.

17 JUDGE LAM: Yes. But the reason I asked
18 you this question is while Ms. Chancellor was
19 questioning you earlier she conveyed a sense of
20 complexity about implementation. Her questioning
21 relayed to me a sense of this is going to be a long
22 program of building soil cement. This is going to be
23 a program that has to deal with a wide range of
24 variable properties of soil. It's in that context
25 that I'd like to hear from you about what is the

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1 proper implementation of the soil testing program.
2 Can you elaborate on that?

3 DR. WISSA: Maybe I can clarify it by
4 during the laboratory portion as Paul mentioned, we're
5 going to be looking at the range of potential soils
6 that will be used and the sensitivity of those soils
7 to stabilization as far as moisture content, cement
8 content, and other factors density. Based on that,
9 you will be able to develop a range that you can live
10 with in the field. You can't say I want a fixed
11 thing. You can say as long as it doesn't fall below
12 or above a certain number you will achieve your
13 objectives.

14 Then you confirm this by the testing
15 program in the field. So you have flexibility. You
16 cannot be rigid by saying I want seven percent cement
17 in this soil. When you test for cement content let's
18 say you may find it at 7.1 or 6.9 percent. How
19 sensitive is the soil to that variability is what you
20 have to establish. It is unreasonable to put a spec
21 saying that it should be 7.0. You have to give a
22 range. It can be 7 plus or minus 0.1. Or 7 plus but
23 minus nothing, so the contract in that place would
24 instead of putting 7 he put seven and a half so he's
25 never below the minimum requirement.

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1 What you do there is you bracket what's
2 permissible in advance. Then the contractor has the
3 range you allow him to work with. Does that help you?

4 JUDGE LAM: Yes. Are we dealing with a
5 great deal of precision here, Dr. Wissa?

6 DR. WISSA: No. That's the whole point.
7 The precision here is that you have to have
8 flexibility. You're working with a variable, a
9 complex thing. The actual tests can be fairly
10 precise, the measurement in a lab. You can get pretty
11 good precision in measuring the strength. Not as good
12 maybe with cement content, but what you're really
13 interested in is the impressive and shear strength.
14 That can be measured with a lot of precision.

15 JUDGE LAM: So the system that you
16 described to me is reasonably tolerant on errors?

17 DR. WISSA: Yes. It has to be by
18 definition. The tolerance is part of what we're going
19 to find out during the laboratory investigation. I
20 think in general soil cement is very flexible because
21 you have several variables that you can play with or
22 vary.

23 Moisture content is one. Density is
24 another one. Cement content is a third. Obviously
25 the last one is soil type. You may want to eliminate

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1 certain soils if they're going to be difficult to
2 control.

3 JUDGE LAM: Thank you.

4 CHAIRMAN FARRAR: Let me ask Counsel. In
5 terms of the extent of NRC staff review of the tests
6 of the implacement of the cement-treated soil and soil
7 cement and the pad itself in terms of staff review
8 enforcement, is this a matter for presentation of
9 evidence, argumentation of Counsel, stipulation of the
10 parties or notice by the Board of what this system is?

11 MR. O'NEILL: I have some thoughts on the
12 matter. I would strongly prefer to defer to Mr. Turk
13 on this particular issue.

14 MR. TURK: Your Honor, my understanding is
15 that the staff will have inspectors at the site at
16 various times during the construction of the
17 facilities post-licensing. They will not be at the
18 site constantly, but they will be conducting
19 inspections at the site. All documentation is
20 available for review at that time which will include
21 documentation of tests that were conducting when they
22 were not present.

23 I personally spoke with the region IV
24 civil engineering inspection chief. He's the chief of
25 the section that does civil engineering inspection.

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1 He confirmed to me that that's what they would be
2 doing during construction.

3 CHAIRMAN FARRAR: Is there anyone who
4 wants to take issue with Mr. Turk's representation?

5 MR. TRAVIESO-DIAZ: No.

6 MS. CHANCELLOR: Yes, Your Honor. Whether
7 or not NRC does inspections post-licensing does not
8 give the State any ability to challenge the tests and
9 whether PFS has met those tests. As you can see the
10 staff has already signed off on this concept. The
11 State is challenging it. So to say that we can rely
12 on the staff is not a substitute to addressing the
13 issues here.

14 CHAIRMAN FARRAR: Well, what I meant by a
15 question of course is there's three levels. The
16 system could say we rely simply on the Applicant and
17 no one will check it. Step two is we won't rely on
18 that. The staff will be checking. Then third would
19 be have you involved.

20 MS. CHANCELLOR: I think it gets down to
21 the question of is this merely a procedure that PFS is
22 implementing or does this go to the fundamental
23 question of a finding that the commission must make to
24 issue a license. We come down on the latter side and
25 nothing short of addressing it in this proceeding will

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1 satisfy the State.

2 MR. TRAVIESO-DIAZ: Mr. Chairman, I will
3 say this. First, I don't believe there's anywhere in
4 the regulations and I say this with all due respect a
5 provision that gives the State the right to win this
6 approve or pass on the -- That is uniquely the
7 function of the staff. That is their function under
8 the regulations.

9 I also will say that it's typical practice
10 in the construction facilities that the staff will be
11 present whenever they think a test is important to
12 review the acts of conduct. All the test results are
13 supposed particularly as to quality assurance. Under
14 the quality assurance programs, all the test results
15 are available for the staff to inspect. So there is
16 no bar for impediment of the staff discharging this
17 function on the regulations. Nor is there a
18 requirement that the conduct of the laboratory tests
19 or -- the facility be witnessed by anybody else.

20 CHAIRMAN FARRAR: All right. The first
21 part I wanted to clarify Ms. Chancellor. You're not
22 disagreeing with Mr. Turk's representation that this
23 is a function the staff will carry out.

24 MS. CHANCELLOR: I don't know, Your Honor.
25 Region IV I think is in Grand Junction, Texas. We

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1 don't know how often the staff is going to go there.
2 We don't know the competence of the staff inspector
3 who will go out and whether that person has any
4 knowledge of soils. How they will do it and whether
5 they are competent to do it, I'm not going to agree to
6 that.

7 CHAIRMAN FARRAR: Okay. We certainly
8 don't want to try that issue in this proceeding.
9 That's a matter for argumentation as is I think the
10 matter of the disagreement between you and Mr.
11 Travieso-Diaz as to whether the staff's ordinary
12 functioning is sufficient or whether State has some
13 right to be involved. I just want to make sure there
14 wasn't anything more we need to get out of these
15 particular witnesses on this point.

16 MR. TRAVIESO-DIAZ: If I can make a five
17 second commentary. I think Ms. Chancellor raised
18 something that is very important to have clear. It is
19 not an appropriate claim to be made by a -- licensed
20 proceeding that the staff won't do its job. That is
21 not an appropriate concession to raise. You have to
22 presume that the staff will do whatever is required.
23 Assuming to the contrary is not a valid contention.
24 I know Mr. Turk will agree with me there.

25 MS. CHANCELLOR: Your Honor, I would just

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1 like to say that the qualification of the soil cement,
2 cement-treated soil in this new application to meet
3 seismic design criteria is covered by the regulations.
4 Site specific investigations and laboratory analysis
5 must show that soil conditions are adequate for
6 proposed foundation loading.

7 By deferring this issue to a testing
8 program that will last eight months long that has a
9 narrow window for whether PFS can meet the 75,000 PSI
10 Young's modulus because they can't add more cement to
11 the cement-treated soil mix under the pads, that is a
12 very narrow window that requires judgement.
13 Therefore, the cement-treated soils, the soils
14 conditions would not be adequate for the proposed
15 foundation loading. The State's position is that this
16 is squarely within the regulations and it is squarely
17 part of this proceeding.

18 CHAIRMAN FARRAR: Let me ask Mr. Turk a
19 question. 25 years ago when I was doing this for
20 reactors, we had construction permit proceedings and
21 then operating permit proceedings. The purpose of the
22 latter was to make sure that the company had done what
23 it had promised in the construction permit. What if
24 any is the analogy here? There's going to be no
25 construction permit phase assuming that -- gets what

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1 they're asking for now. There's no operating permit
2 phase. Correct?

3 MR. TURK: There's a single phase of
4 licensing. There's not the dual stage that existed in
5 the Nuclear Power Plant Licensing. You would note
6 that probably the new applications conceive of a
7 single stage of licensing. There are applications to
8 come in the future.

9 CHAIRMAN FARRAR: All right.

10 MR. TURK: May I respond to Ms.
11 Chancellor?

12 CHAIRMAN FARRAR: Yes.

13 MR. TURK: First of all let me say that I
14 agree with Mr. Travieso-Diaz that what's proposed here
15 for staff inspections is the same type of inspections
16 that would exist during nuclear power plant
17 construction. The staff does employ a qualified civil
18 engineering staff to inspect the construction of
19 concrete structures as well as other structures at
20 nuclear facilities. So I'm not troubled by the
21 question of whether the staff has the qualifications.
22 I think the Commission ensures through its funding of
23 staff programs that whatever qualifications are
24 required can be obtained and are used in post-
25 licensing inspection of nuclear facilities.

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1 Second, I think the applicable test is not
2 is there something that's been identified by the
3 Applicant that's necessary for its facility, such as
4 the applicable Young's modulus or the applicable
5 strength of the underlying cement-treated soil. The
6 Applicant has established the criteria that it must
7 achieve through its construction, testing and
8 placement of materials. Those are easily verifiable.
9 Those are matters that can be determined both as a
10 result of lab testing and based upon field inspections
11 and testing of materials placed at the facility.

12 There is no judgement involved contrary to
13 what Ms. Chancellor has indicated but rather these are
14 verifiable matters that are the same type of matters
15 that are subject to what is referred to as ITAC,
16 inspections testing and acceptance criteria, matters
17 which can be left for verification post-licensing as
18 long as the well defined standards have been
19 established, the methods of testing have been
20 explained, or the test program has been explained --

21 CHAIRMAN FARRAR: Let me interrupt you.
22 I can follow the argument. If the standard is 250
23 PSI, then the test comes out 300. They have it
24 documented. Then your inspector comes. There's no
25 problem. That's almost ministerial. But if the

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1 standard is 250 and it comes out 240 and somebody
2 makes a judgement well with all the conservatism
3 that's okay, that's not ministerial.

4 How if at all do we get at that or is that
5 not for us to get at? Once the actual licensing
6 proceeding is over, that's not a matter for the Board.
7 That's not a matter for an intervenor. That's just
8 the staff and the Applicant.

9 MR. TURK: The test results would not
10 involve judgement. Whatever the test results are,
11 they are.

12 CHAIRMAN FARRAR: Right. The test says
13 240 but the Applicant's people got together and said
14 we're going to go ahead anyhow. You come on the scene
15 three months later and review that. You find the 240.
16 Now you caucus and say it seems okay to us or it
17 doesn't seem okay to us. That's anything but
18 ministerial.

19 JUDGE LAM: And for that matter if Dr. Kam
20 (PH) is here, if he imposed the order to estimate
21 interpretation of the 250 then 125 PSI would be
22 adequate.

23 MR. TURK: I don't understand the comment,
24 Judge Lam. Dr. Kam (PH)?

25 JUDGE LAM: Dr. Kam (PH).

1 CHAIRMAN FARRAR: Once the actual
2 licensing proceeding is over, that's not a matter for
3 the Board; that's not a matter for the Intervenor.
4 That's just the staff and the Applicant.

5 MR. TURK: The test results would involve
6 judgment.

7 CHAIRMAN FARRAR: Right.

8 MR. TURK: Whatever the test results are,
9 they are.

10 CHAIRMAN FARRAR: The test says 240, but
11 the Applicant's people got together and said, "Aw,
12 we're going to go ahead anyhow." You all come on the
13 scene three months later and review that, and you find
14 the 240 and now you all caucus and say, "It seems okay
15 to us." or "It doesn't seem okay to us." That's
16 anything but ministerial.

17 JUDGE LAM: For that matter, if Dr. Khan
18 is here, if he imposed the automatic to estimate the
19 interpretation of 250, then 125 psi would be adequate.

20 MR. TURK: I don't understand the comment.
21 Judge Lam, Dr. Kim?

22 JUDGE LAM: Dr. Khan. Remember when we
23 asked for guidance on the interpretation of 10 to the
24 minus 6?

25 CHAIRMAN FARRAR: I don't know if you were

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1 there, Mr. Turk, but Dr. Lam's referring to the order
2 of magnitude suggestion the staff made on the aircraft
3 accident issue.

4 MR. TURK: I probably was there, and I
5 think I know what you're referring to. That's an
6 interpretation that would be subject to your ruling
7 here in this proceeding and subject to Commission
8 review.

9 CHAIRMAN FARRAR: Right. That's because
10 it is in front of us now, but suppose, what Judge Lam
11 is suggesting is that, if after the fact, on the soil
12 somebody says, "Well, it was supposed to be 250; 240
13 is okay. It's within 5 percent. That's good
14 enough."?

15 MR. TRAVIESO-DIAZ: Mr. Chairman, if I
16 could comment on that?

17 CHAIRMAN FARRAR: Yes.

18 MR. TRAVIESO-DIAZ: I will respectfully
19 argue with your hypothetical. The Applicant is
20 committed to proving to 50. If the results show less
21 and they want to have the results stand, they need to
22 get approval. They can't just go ahead and say, "240
23 is close enough. We're going to go blithely do it."

24 It is a commitment in the SAR that they
25 are going to meet. I would be very surprised if the

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1 Applicant prefers to find out with a particular lift
2 the soil cement was 245 and they're going to try to
3 get an exemption as opposed to, as Dr. Wissa said,
4 pull or rip it out. Just as a matter of practicality,
5 it is much easier to fix something that is not
6 combined than to try to prove by calculation otherwise
7 that you are still okay.

8 CHAIRMAN FARRAR: How big an area would be
9 poured at a single time? In other words, is this the
10 underneath the whole 500?

11 DR. WISSA: Oh, no, this would depend on
12 the plant capability, but I would think that it is
13 difficult to tell, but maybe a few slabs a day would
14 be probably what I envision. That probably would be
15 a maximum. I don't seem them working -- you don't
16 want to expose the whole site and try to do it en
17 masse. So it is going to be a long process of
18 construction.

19 CHAIRMAN FARRAR: But the flip side of
20 that is it is in individual sections that would be
21 tested as you go along.

22 DR. WISSA: That is correct. You would
23 be --

24 CHAIRMAN FARRAR: So the cost and/or
25 hassle of ripping it out is not enormous?

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1 DR. WISSA: No. I think you would know
2 very quickly if you have a problem. I mean, there's
3 been situations on highways where you have had to rip
4 out pieces of highways, and highways go much faster
5 than this type of construction because highways are a
6 continuous strip. Here it is one little block and the
7 next and the third. So it is going to be much slower,
8 and the opportunity to correct defects is much easier
9 and financially not out of control. So you would know
10 fairly quickly if you have a problem.

11 MR. TURK: May I add to my answer? I
12 think what we have to look at are two things that the
13 State is ignoring. No. 1, the Applicant has a duty to
14 inform the NRC of facts directly. They cannot make
15 material false statements to us. They cannot alter
16 documents. They cannot provide false test results
17 without running afoul with criminal penalties. So you
18 have that as a first measure, assurance of the
19 integrity of the results reported by the Applicant.

20 Second, you have staff inspection, which
21 provides us independent means of auditing and
22 verifying that test results have shown the conditions
23 have been achieved that the Applicant committed to
24 achieve.

25 Third, in the regulations there's an

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1 entire section on quality assurance/quality control.
2 This is Subpart (g) of NCFR Part 72, which includes
3 provisions for things like control of the test
4 program. That is 10 CFR 72.162.

5 The licensee, if it obtains a license,
6 must conduct its tests in an appropriate manner.

7 CHAIRMAN FARRAR: Right now we're not
8 questioning the test. We're questioning --

9 MR. TURK: Yes, I'm going to come to
10 judgment.

11 CHAIRMAN FARRAR: Right.

12 MR. TURK: Then, finally, you asked the
13 question, well, what happens if they miss and then
14 there's some attempt to justify? Is it good enough?
15 Under 72.48, there is a provision that states that
16 anytime any Applicant has a result of a test that
17 constitutes an unreviewed safety question, they must
18 evaluate what steps to take next. This is similar to
19 50.59 in the Nuclear Power Reactor regulation scheme.

20 If the result of the test is not what they
21 had committed to in their SAR, they must determine
22 whether an unreviewed safety question is presented by
23 that result, and then there must be some corrective
24 action. Either they conduct an analysis to determine
25 that the result is acceptable or it's found not to be

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1 acceptable. Then there's a required series of steps
2 that must be taken. But there's no attempt to brush
3 under the carpet or hide things from the public or
4 from the State of Utah.

5 MS. CHANCELLOR: Your Honor, I would just
6 like to comment on Mr. Turk's reference to 72.48,
7 whether there's an unreviewed safety question. We
8 have heard Holtec say, and other people say, in this
9 proceeding that sliding is a good thing; sliding is
10 beneficial. Staff and the SER say sliding is
11 beneficial.

12 The State takes the opposite position. So
13 the fact that there is a regulation that addresses
14 unanswered safety questions, if the staff and PFS
15 don't think this rises to a safety question, then the
16 ability of the State to present its argument in this
17 forum is diminished because the State feels that, if
18 there is sliding, then that does relate to safety.

19 CHAIRMAN FARRAR: Mr. Turk, Mr. Travieso-
20 Diaz, suppose you all went through the procedure that
21 Mr. Turk just described, and it was an unreviewed
22 safety question, and it was brought to the staff's
23 attention. And the staff said, "Okay, we've checked
24 it out. You missed your mark, but it's okay." What
25 provisions, if any, do the rules provide for the State

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1 to challenge that? Is that one of those petitions
2 they would have to file?

3 MR. TRAVIESO-DIAZ: 2.206. 2.206 Petition
4 for Review. At any point the State can, and I suspect
5 they may at some time in the future. 2.206 is
6 available at all times, not only to the State, but to
7 any party who feels that there is some violation of
8 NRC regulations or safety issues raised in the design,
9 construction, or operation of a nuclear facility.
10 That can be raised in the form of the 2.206 petition.
11 That doesn't stop at the time you get the license. In
12 fact, it continues the whole time.

13 CHAIRMAN FARRAR: I think we've probably
14 exhausted this subject, but I didn't want to move on
15 if there was any need for any evidence from these
16 witnesses. I think everyone understands everyone
17 else's position, and for now we will leave it at that.

18 MS. CHANCELLOR: Could I just say, Your
19 Honor, that 2.206 has no teeth whatsoever. It's
20 basically just sending a letter to the NSC and hoping
21 somebody will do something.

22 CHAIRMAN FARRAR: The Board has trouble
23 enough dealing with the matters that are within its
24 jurisdiction to deal with. So everyone will have
25 their own opinion on that, but we will not be

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1 discussing it here.

2 I think that concludes the Board's
3 questions. Does the Applicant have any redirect?

4 MR. TRAVIESO-DIAZ: I think I have a half
5 a dozen questions. I don't know whether the Board
6 would like to take a break now or whenever it will be.

7 CHAIRMAN FARRAR: No.

8 MR. TRAVIESO-DIAZ: I can go right ahead.

9 CHAIRMAN FARRAR: Why don't you go right
10 ahead?

11 MR. TRAVIESO-DIAZ: All right.

12 REDIRECT EXAMINATION BY MR. TRAVIESO-DIAZ

13 MR. TRAVIESO-DIAZ: Dr. Wissa, let me
14 start from the end, which is the questions that the
15 various Board members have been asking as to how you
16 ensure that what is done in the field conforms to the
17 test results and the specifications. As a practical
18 matter, as you're the person who has field experience,
19 how would you go, and how do you expect that this
20 party will go, about ensuring that the work that is
21 actually constructed, the soil cement that is
22 installed, meets the requirements and the results of
23 the test parameters.

24 DR. WISSA: The proof of the pudding, if
25 you want to put it here, is in sampling the soil

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1 cement or the stabilized soil and taking cores, for
2 example, taking them back to the laboratory and
3 testing them. That will give you the strength. The
4 same thing with a bond between the layers. You would
5 core the layers after construction, bring them back
6 and test them to make sure you're getting the bonding
7 you require. So it is a fairly straightforward and
8 standard procedure.

9 What you do is two things. You take
10 samples during placing of the soil cement. You make
11 up molds and you test those. That happens as you're
12 constructing. Then you come back again after it's
13 cured in, let's say, a week or seven days or 28 days
14 after, and recore the final product.

15 As far as the bonding between layers, you
16 would not be able to do this in advance. You would
17 have to core the final product to measure that. This
18 would tell you that you're meeting your objectives.
19 So you would have quantitative numbers to document
20 what is being achieved in the field.

21 MR. TRAVIESO-DIAZ: So there is no
22 possibility that you could inadvertently have an
23 installed soil cement installation that doesn't meet
24 the requirements of the segment of the test forum, is
25 that correct?

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1 DR. WISSA: I think when you say,
2 "impossible," that's going to an extreme. The
3 probability is extremely small that you would have a
4 situation where you would not meet your objectives.
5 You would not know that you have not met your
6 objectives.

7 MR. TRAVIESO-DIAZ: Now you mentioned; I
8 think in response to Dr. Lam's questions, that you
9 expect that when the specifications for this soil
10 cement and cement-treated soil are issued, they are
11 not going to be in terms of a single number, but a
12 range of values that establish the tolerance, if you
13 will, that you are capable of living with. Is that
14 correct?

15 DR. WISSA: That is correct. As far as
16 moisture content, cement content, and so on, you can't
17 say, "I want a 5 percent moisture or 6 percent
18 moisture." You have to give tolerances. Just from a
19 practical point of view, it's never given that way.

20 MR. TRAVIESO-DIAZ: Typically, those
21 tolerances, what do they run in percentages?

22 DR. WISSA: I beg your pardon?

23 MR. TRAVIESO-DIAZ: Yes, typically, this
24 type of tolerance, for example, of cement content will
25 be 5 percent, 10 percent?

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1 DR. WISSA: Ten percent of the number?

2 MR. TRAVIESO-DIAZ: Yes.

3 DR. WISSA: Well, it depends. Let's say
4 if you only were using 2 percent cement, 2 percent and
5 your five percent of that, that's very small. The
6 larger the number, the smaller the tolerance can be.
7 So at 10 percent, you may have half or 1 percent.
8 Moisture content you usually specify plus or minus.
9 In this case where you have very good control, 1, 1.5
10 percent, 2 percent would be fairly large. So probably
11 with central plant mixing, you can control it to plus
12 or minus 1 percent moisture content, for example.

13 MR. TRAVIESO-DIAZ: You were also asked by
14 members of the Board the hypothetical as to assuming
15 that you are outside the range of the values that your
16 tolerances allow, that you may want to analyze the
17 problem away, taking into account all the
18 conservatisms that you have in the design, and so on.
19 Based on your experience, how likely is it that you or
20 PFS, for that matter, would elect to go by the way of
21 trying to paper the problem out of the problem, as
22 opposed to trying to fix it?

23 DR. WISSA: I think Paul Trudeau answered
24 that question very well. When it comes to the soil
25 cement, it's so easy to make sure that you meet the

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1 objectives. As a matter of fact, our criteria of
2 strength is probably not the controlling factor. So
3 strength is not going to be an issue.

4 As far as the cement-treated soil, you
5 have to have more flexibility, but you could have more
6 variables in there. I think in that case you are
7 going to be looking at moisture content and cement
8 content and density to be able to achieve those
9 objectives. So we're going to have to do more work to
10 determine the flexibility we have in there.

11 So I think in all cases you will be able
12 to achieve what you want before construction, and then
13 during construction make sure it's achieved by the
14 testing program of sampling and testing.

15 MR. TRAVIESO-DIAZ: But assuming that,
16 after all is said and done, you did your installation
17 and you found that the installed, you will say on a
18 particular pad that you don't meet the requirements
19 set up in the design. How likely is it to you, based
20 on your experience, that you will elect to try to
21 analyze the nonconformance away as opposed to trying
22 to take corrective action?

23 DR. WISSA: I think there is no doubt that
24 the contractor would be pretty upset if you closed
25 down the job while you are trying to analyze it. It

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1 is much easier to just rip it out and start from
2 scratch again. I think this is usually what happens.
3 You don't try and analyze something unless it's
4 extensive, but by then the job would be closed down
5 anyway, if you have had it going on for weeks on end,
6 and then you have to go back to the drawing board.
7 But this is unlikely in this case.

8 I would say I don't know of any situation
9 where you have had to close down a job, redesign a
10 job. I shouldn't say that; I'm sure they exist, but
11 in my experience I haven't seen a job where we have
12 had to close it down for redesign and then come back
13 months later to start again this job.

14 MR. TRAVIESO-DIAZ: Earlier this morning
15 you were asked to give in some detail the various
16 steps that you followed during your test program to
17 qualify soil cement mixtures for use. Do you remember
18 that?

19 DR. WISSA: Yes.

20 MR. TRAVIESO-DIAZ: Were the steps that
21 you described the same steps that appear in the ESSOW,
22 which is Exhibit GGG, prepared by PFS?

23 DR. WISSA: Yes, basically I used the word
24 ESSOW, but it is in both, but the more detailed part
25 is in ESSOW.

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1 MR. TRAVIESO-DIAZ: As long as we are
2 talking about the ESSOW, is it correct to say that the
3 ESSOW contains a quality assurance/quality control
4 program that dictates how the various tests are going
5 to be conducted to ensure quality?

6 DR. WISSA: That's correct.

7 MR. TRAVIESO-DIAZ: Do you expect that
8 when a specification is issued to a contractor in the
9 field to do the actual construction that there will be
10 a similar QA/QC document that dictates how they are
11 supposed to do the various steps of construction?

12 DR. WISSA: I'm sure there will be.

13 MR. TRAVIESO-DIAZ: And that will include
14 things such as how you go about mixing the cement in
15 the batch or how you go about placing it in the
16 various lifts, and so on?

17 DR. WISSA: I'm not sure you would go to
18 that extent, because you want to give the contractor
19 flexibility in coming up with, considering his
20 capabilities and equipment, with the best solution.
21 I think it is a mistake to overspecify because, one,
22 it prevent innovation, better ideas that the
23 contractor may have. So I don't think you would go to
24 that specific detail.

25 What you try to do is specify the testing

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1 procedures and the final product quality, but not go
2 through the details how you're going to achieve it.

3 MR. TRAVIESO-DIAZ: And you would expect
4 to make sure that the final total quality has been
5 achieved as per a specification?

6 DR. WISSA: Well, that is the QA/QC
7 program we're talking about.

8 MR. TRAVIESO-DIAZ: Exactly. Yes, that's
9 what I was asking you about, QA/QC.

10 DR. WISSA: That's why you have a QA/QC
11 program, to be able to document and make sure that you
12 are achieving your objectives, or practice achieving
13 the design objectives.

14 MR. TRAVIESO-DIAZ: Typically, that is
15 sort of the verification will be covered both by the
16 QA/QC program of the contractor and that of the
17 client, is that correct?

18 DR. WISSA: Usually the contractor has his
19 own program, and the client has his. So there are
20 usually two programs, and the client has the
21 opportunity to review the contractor's work, too, but
22 he doesn't rely solely on the contractor. He relies
23 more on his own QA/QC.

24 MR. TRAVIESO-DIAZ: Mr. Trudeau, in
25 response to one of the questions that Ms. Chancellor

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1 asked you as to what additional tests do you expect
2 that you will be doing with respect to the soil and
3 the soil cement program, you indicated that you would
4 be doing some rapid loading tests to demonstrate some
5 well-known property, but I don't think you explained
6 what that was. Could you elaborate or more fully
7 provide an answer to that?

8 MR. TRUDEAU: That well-known property is
9 that the dynamic strength of these clay soils is well-
10 known to be much greater than the static strength, the
11 strength that you would measure in static strength
12 tests for these clay soils. We have not taken credit
13 for that other than to list that as a conservatism in
14 our analysis, because we haven't run any of those such
15 tests to measure how much logically we can increase
16 the strengths, the static strengths, that we've
17 measured in these static tests.

18 I didn't say that we would be definitely
19 doing those tests, but we have discussed the
20 possibility of doing some of those, especially for the
21 compacted clay soils, because we feel that there is
22 that conservatism in there and we feel that that would
23 certainly show that we've got much greater margins
24 against sliding.

25 MR. TRAVIESO-DIAZ: Dr. Wissa, a couple of

1 times you have stated that you will be able to show,
2 during the construction process, that you have
3 achieved the proper bonding between the various layers
4 of soil cement and the pad and the soil underneath.
5 Could you explain how you expect that you will be able
6 to do that demonstration?

7 DR. WISSA: Yes. After construction of a
8 pad, you would go in and core, take a core sample
9 through the pad and the underlying layers of interest.
10 You would take these back to the laboratory and you
11 would then take each segment where you have an
12 interface and shear them apart and measure the
13 strength or the force required to shear, but, more
14 important, that the failure does not occur at the
15 interface but rather in the parallel material, whether
16 it's the clay or the soil cement or the concrete.
17 Obviously, it is going to be the cement-modified soil
18 or the clay. As long as it fails through that rather
19 than through the interface, then you have achieved
20 your objective of making sure you have a good bond.

21 MR. TRAVIESO-DIAZ: This is for either of
22 you or both. Ms. Chancellor asked Mr. Trudeau a
23 series of questions that the gist of which was to
24 establish certain differences between the
25 characteristics of the Koeberg Nuclear Power Plant in

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1 South Africa and the situation at the PFSF. Could you
2 explain what are the similarities that could make the
3 Koeberg plant a proper precedent for the use of soil
4 cement at the PFSF? Whichever wants to take a hand at
5 this, will you --

6 MR. TRUDEAU: In my estimation, the shear
7 strength of these soils was not sufficient to preclude
8 liquefaction. So they treated them with cement to
9 increase their shear strength, so that they can
10 withstand the cyclic stresses due to the earthquake.

11 Here we are taking these loose eolian
12 silts and mixing cement with them to increase their
13 shear strength, so that they can resist the sliding
14 stresses due to the earthquake. It's a shear strength
15 issue that's similar in both cases, in my estimation.

16 There are seismic loadings that are
17 earthquake-based that are similar in both cases.

18 MR. TRAVIESO-DIAZ: Mr. Chairman, that's
19 all I have.

20 CHAIRMAN FARRAR: Any recross? Any
21 recross by the staff?

22 MR. O'NEILL: Just a quick question or
23 two.

24 RECROSS EXAMINATION BY MR. O'NEILL

25 MR. O'NEILL: This first one I direct to

1 both of you. Notwithstanding the uniqueness or non-
2 uniqueness of your proposed applications of soil
3 cement or cement-treated soil, would you characterize
4 the particular procedures that you intend or have
5 committed to use? I am referring to the mix
6 proportion and construction quality control testing of
7 soil cement. Would you characterize those as well-
8 accepted procedures or standards?

9 MR. TRUDEAU: Definitely. They're all
10 very well-accepted. This particular application of
11 soil cement is not that much different than using
12 structural fill to do the same thing. It is just that
13 the soil cement has better cohesive characteristics
14 than the structural fill does

15 DR. WISSA: Several agencies, including
16 the Corps of Engineers, the Portland Cement
17 Association, have manuals today which are pretty
18 standard with all the testing we are describing, where
19 the only exception is the one of a bond between
20 layers, where that is not covered by that type of
21 standard. But everything else is pretty routine -- is
22 routine.

23 I mean it has been going on for years.
24 You don't have to be a specialist to follow those
25 directions. They are written in such a way that even

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1 small contractors can build parking lots and pavements
2 using these procedures. So you see it being used
3 throughout the world, and based on these type of
4 manuals which are written in fairly lay terms. So it
5 is very easy to follow. The strength type testing is
6 very, very simple. It is not high technology-type
7 testing.

8 MR. O'NEILL: Thank you.

9 During cross examination, again the
10 Koeberg plant example was brought up. Would you
11 consider that to be an example of foundation
12 stabilization that we had discussed earlier this
13 morning?

14 MR. TRUDEAU: Definitely, it was.

15 MR. O'NEILL: Thank you. That is all I
16 have.

17 CHAIRMAN FARRAR: Does the State have any
18 additional cross?

19 MS. CHANCELLOR: Yes, I do, Your Honor.

20 RE-CROSS EXAMINATION BY MS. CHANCELLOR

21 MS. CHANCELLOR: Dr. Wissa, you stated
22 that there was a QA/QC program in the ESSOW. Is this
23 the ESSOW between Private Fuel Storage and AGEC that
24 you're referring to?

25 DR. WISSA: I'm not sure. I think that's

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1 it.

2 MS. CHANCELLOR: The one that is attached
3 to your testimony as Exhibit GGG?

4 DR. WISSA: It is a DG --

5 MS. CHANCELLOR: GGG, three "G's."

6 DR. WISSA: That's it, yes.

7 MS. CHANCELLOR: And you also stated that
8 there are manuals for testing that are written in lay
9 terms and that's low-tech; it's easy to follow. Is
10 that correct?

11 DR. WISSA: Can you repeat that?

12 MS. CHANCELLOR: Manuals for testing, just
13 in response to Mr. O'Neill, you stated --

14 DR. WISSA: Yes.

15 MS. CHANCELLOR: -- that there are various
16 manuals and that they're low-tech and that they are
17 easy to follow?

18 DR. WISSA: That's correct. The PCA has
19 put out these manuals for all types of contractors,
20 from the very sophisticated to the very small one-man
21 operation.

22 MS. CHANCELLOR: Mr. Trudeau, isn't it
23 correct that during your deposition you stated that
24 AGEK has an NQA 1, follows NQA 1 QA procedures?

25 MR. TRUDEAU: I don't recall.

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1 MS. CHANCELLOR: Is it correct that you
2 said that AGECE relied on Stone & Webster's review of
3 the AGECE program for QA/QC, and AGECE basically adopted
4 Stone & Webster's QA/QC?

5 MR. TRUDEAU: That I recall, yes.

6 MS. CHANCELLOR: Isn't it true that AGECE
7 failed the durability tests that are conducted of the
8 PFS soils?

9 MR. TRUDEAU: The first round of
10 durability tests have not passed, that's correct.

11 MS. CHANCELLOR: Isn't there some question
12 about the QA/QC procedures that AGECE followed for
13 those durability tests?

14 MR. TRUDEAU: That is unknown. We just
15 know that the tests failed. We don't know yet why
16 they failed. We suspect they failed because they
17 weren't compacted to a high enough density, but we
18 haven't reached that conclusion yet.

19 MS. CHANCELLOR: If they weren't compacted
20 to a high enough density, would that suggest that
21 there is a failure of those tests and the QA/QC
22 program at AGECE?

23 MR. TRUDEAU: I don't think so.

24 MS. CHANCELLOR: Failure to compact
25 samples is not a quality assurance/quality control

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1 issue?

2 MR. TRUDEAU: The quality assurance
3 documents how the tests are done. I wasn't there when
4 they did them, so I don't know exactly what happened
5 on the molding of those specimens, but, you know, at
6 this point it is still supposition that that's,
7 indeed, what's happened. We need to pursue that
8 matter further.

9 MS. CHANCELLOR: Is this one of the
10 reasons that you are giving the -- that PFS is
11 considering Dr. Wissa as the person to do the entire
12 PFS cement program?

13 MR. TRUDEAU: We brought Dr. Wissa on
14 board to help us with this litigation. Dr. Wissa has
15 some expertise and has the ability to do these more
16 sophisticated tests, the bond tests that we're talking
17 about. It makes sense to have his lab do some of the
18 follow-on durability tests, in my estimation, so that
19 his people get familiar with working with these soils
20 and develop some expertise in working with these
21 soils. So that when they do get to the more
22 sophisticated tests, they know what they are doing
23 when they work with those soil cement mixtures.

24 MS. CHANCELLOR: Do you disagree with Dr.
25 Wissa's testimony that Dr. Wissa would need to start

1 the testing program over by collecting soil samples,
2 doing index testing, doing durability testing, et
3 cetera, et cetera? Do you disagree with Dr. Wissa's
4 assumption?

5 MR. TRAVIESO-DIAZ: Objection. That
6 mischaracterizes the testimony that Dr. Wissa gave.
7 That was supposed to be hypothetical as to whether he
8 would consider doing that. I don't think that he said
9 that he would do it

10 MS. CHANCELLOR: He said that, if he did
11 do it, he would need to collect samples and basically
12 start from scratch, but he would look at the data that
13 AGECE had developed.

14 CHAIRMAN FARRAR: Objection's overruled.

15 MR. TRUDEAU: To do any additional
16 testing, we need to collect additional samples. If
17 these samples are going to be tested at Dr. Wissa's
18 lab, we're going to have to collect enough of them to
19 do the whole program, because it just doesn't make
20 sense to a lot of different field programs to get the
21 soils necessary to run these tests.

22 MS. CHANCELLOR: Do you agree that if Dr.
23 Wissa took over the program, the program would
24 basically need to start over again?

25 MR. TRUDEAU: No, I don't think so. As

1 Dr. Wissa has said, he would be utilizing the data
2 that is available from the AGECE testing as comparison,
3 if nothing else, with the soil samples that he was
4 given or extracted from the site to test.

5 MS. CHANCELLOR: Do you envision that Dr.
6 Wissa would use the AGECE testing data to date for
7 anything other than comparison with his work?

8 MR. TRUDEAU: He will certainly be using
9 the index property data, in my estimation. Once he
10 sees that the new samples that he has done index
11 property tests on are similar to the materials that
12 AGECE has already tested, for instance, in the moisture
13 density tests, then he would feel comfortable in using
14 those moisture density test results.

15 Now I am not going to suggest that it is
16 not appropriate for him to do one or more of those
17 moisture density tests over again to develop some
18 confidence that they, indeed, agree with what he feels
19 is appropriate for those test results, but the soil
20 type is the driving animal here. The index property
21 tests are key to getting the soil type information.

22 MS. CHANCELLOR: Dr. Wissa, would you rely
23 on any, if you were to do the PFS program, would you
24 rely on any of the AGECE test data to date for anything
25 other than a comparison of your results?

1 DR. WISSA: I think I have compare myself
2 to an M.D. Doctors tend to want to do their own
3 testing to be comfortable and not rely on another
4 person's, not because they don't trust it, but because
5 of liability. As far as policy and liability, you
6 always want to be able to vouch for the work, and it's
7 hard to vouch for somebody else's work. M.D.s are
8 very sensitive to this issue. We have learned from
9 them.

10 As a matter of fact, I think they have
11 learned from us because the geotechnical field
12 developed some of these programs, the loss prevention
13 programs which are being used. This is ASFE has done
14 a fantastic job of minimizing this liability issue.

15 So, to answer your question, I would
16 definitely want to rely on my data more than somebody
17 else's data, at least confirm that their data is in
18 agreement with mine.

19 MS. CHANCELLOR: So you're still talking
20 with PFS? Is that right?

21 (Laughter.)

22 DR. WISSA: Am I still talking to them?
23 Maybe after today they will stop talking to me.

24 (Laughter.)

25 MS. CHANCELLOR: Dr. Wissa, you mentioned,

1 in answer to Mr. Travieso-Diaz, that in order to
2 demonstrate bonding, you take a core sample through
3 the pad and then send it to the lab for tests. Would
4 you do this with all 500 pads?

5 DR. WISSA: A program like this, what you
6 would do is, during early stages of a program, you do
7 fairly frequent testing. If the testing proves that
8 there are no failures, you would gradually decrease
9 the number of tests required to confirm that you're
10 achieving it.

11 So I don't think -- you would probably
12 have a minimum number of tests you would require, but
13 the frequency I would see, envision that initially
14 during the first stages of construction I would have
15 quite a few of these tests. If they are all passing,
16 then you can reduce the number of tests required to
17 confirm that you are achieving the objectives.

18 MS. CHANCELLOR: However, if it is phased
19 construction and that construction takes place over
20 several years with different contractors, would you
21 need to go back to more testing to demonstrate
22 bonding, if you are changing contractors, for example?

23 DR. WISSA: I think that each time you
24 start a new contractor you would start maybe not as --
25 you would start by frequent testing to make sure

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1 things are going right, and then you would reduce it.
2 You may be able to reduce the frequency more rapidly
3 after the first go-round than, let's say, the first
4 time around. So, obviously, you are going to use some
5 experience, but I think that in each case you are
6 going to find that the contractors may not be using
7 the same type of equipment. There are variables. So
8 I think, to answer your question, at the beginning of
9 each new phase, if you want, you would start by having
10 more frequent testing and then gradually decrease it,
11 if -- and I qualify that -- if things are proving to
12 be satisfactory and you have no failures.

13 MS. CHANCELLOR: Thank you.

14 Mr. Trudeau, you stated that PFS would
15 probably have a batch plant to make the soil
16 cement/cement-treated soil, is that correct?

17 MR. TRUDEAU: That's correct.

18 MS. CHANCELLOR: There's nothing in the
19 SAR that states this, is that correct?

20 MR. TRUDEAU: I don't recall.

21 MS. CHANCELLOR: And the rapid loading
22 test that you referred to that PFS may or may not do,
23 would that change your calculations, the GB 4
24 calculation?

25 MR. TRUDEAU: It certainly could if that

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1 was warranted, but the calculations right now
2 demonstrate that we have a factor safety of in excess
3 of 1.1 without using this increase in strength. The
4 purpose of running the test would be to demonstrate
5 that, for the compacted clay soils that we think we
6 may need to use under one or more of the pads, that we
7 definitely had a comfort margin for those soils that
8 are not currently in GB 4.

9 MS. CHANCELLOR: So this comfort knowledge
10 then would not be part of the calculation that you
11 submitted to the NSC? You wouldn't amend that
12 calculation, is that correct?

13 MR. TRUDEAU: I don't know what would
14 drive the need to revise that calc again.

15 MS. CHANCELLOR: Maybe a ruling by the
16 Board?

17 (Laughter.)

18 MR. TRUDEAU: Well, okay.

19 MS. CHANCELLOR: Dr. Wissa, I would like
20 to concentrate on the cement-treated soil under the
21 pads, not the soil cement around the pads or the CTB.
22 My understanding is that it would be your intent to
23 separate out materials and reserve non-plastic
24 materials for construction of that soil treatment?

25 DR. WISSA: I don't believe I said that.

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1 I think it was Paul Trudeau who suggested that.

2 MS. CHANCELLOR: Okay. Would you agree
3 with that concept?

4 DR. WISSA: It makes sense to some extent.

5 MS. CHANCELLOR: In response to one of the
6 questions by the judges where you talked about having
7 a certain -- you have a fairly wide tolerance in
8 whether you meet the design criteria in the field,
9 where you could change the moisture content, the
10 percentage of cement, et cetera. Isn't it true that
11 for the cement-treated soil your tolerances are much
12 smaller than it is for soil cement, because of Young's
13 modulus?

14 DR. WISSA: Well, not the tolerances. You
15 have two criteria you have to satisfy here, versus in
16 the case of stabilized soil you only have one
17 criteria. In the case of a stabilized soil cement,
18 you are really looking at your ability and strength.
19 Modulus is not an issue.

20 Fortunately, there is a correlation
21 between modulus and strength, and --

22 MS. CHANCELLOR: In both or --

23 DR. WISSA: Let me get it right. The
24 stronger the soil cement, the higher the margin. So
25 it's not inverse.

1 MS. CHANCELLOR: Okay.

2 DR. WISSA: So it is a direct correlation.
3 So in this case we are speaking about low strengths.
4 It is really the low range of stabilized soils, soil
5 cement strengths, it's really, in which case you are
6 going to be talking about low moduli. Here, remember,
7 the modulus cannot exceed -- if the modulus is much
8 less, all the better as long as you get the strength.
9 So you have a range here where in one case you have an
10 upper limit, which is a 75,000 psi, at the same you
11 also have an upper limit -- or lower limit on
12 strength.

13 MS. CHANCELLOR: How much cement do you
14 anticipate you will need to add to the soils to
15 achieve a 40 psi compressive strength and a 75,000,
16 less than 75,000 Young's modulus for the cement-
17 treated soil?

18 DR. WISSA: I can't answer it. I can't
19 answer it. If I knew the answer, we wouldn't need to
20 do the testing program. In actual fact, this is one
21 thing which will require investigation. It is a
22 function of soil. It is a function of a lot of factors
23 which, unfortunately, I am not in a position to be
24 able to predict at this time.

25 MS. CHANCELLOR: Could you give any

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1 ranges? Would it be less than 5 percent, for example?

2 MR. TRAVIESO-DIAZ: I instruct the witness
3 not to guess.

4 MS. CHANCELLOR: I'm asking him for a
5 range.

6 DR. WISSA: I don't know. It depends
7 really on the soil, whether it's a sandy or non-
8 cohesive, non-plastic material or if it has
9 plasticity. So with the plastic materials it may be
10 higher than the non-plastic. I would think probably
11 with the non-plastic silt it may be 3 percent -- I'm
12 using this, but you can't hold me to it -- while with
13 the more plastic soils it may be 5 or more. It's not
14 going to be 10 and 12 percent, if that is what you are
15 asking. You're seeing it's in the low range of cement
16 contents that you would be using.

17 MS. CHANCELLOR: So is it fair to say,
18 then, that you couldn't add a whole lot more cement,
19 portland cement, in the field to make sure you've got
20 a high enough compressive strength because in that
21 instance, if you add more cement, you would violate,
22 you may violate the limitations of the Young's
23 modulus?

24 DR. WISSA: Let me clarify this a bit. In
25 the case of a non-cohesive or the non-plastic soils,

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1 sandy soils, there two things which control, the
2 cement content, but also the moisture content. It's
3 like in concrete; it's a water/cement ratio, the ratio
4 of water to cement, as well as the amount of cement.
5 So you have flexibility there. If you increase your
6 cement content, if you want to get the lowest
7 strength, you would increase your moisture content,
8 too. That is something well-known; I'm speaking about
9 portland cement concrete.

10 That applies to sandy soils and non-
11 cohesive soils. So you have flexibility there if you
12 are having trouble with your cement content. But in
13 the case of today with the automation of continuous
14 plants or even batch plants, for that matter, you are
15 able to control your cement very accurately, I think,
16 and your moisture. So control is going to be fairly
17 easy in these today automated, very accurate plants
18 which are available.

19 MS. CHANCELLOR: You mentioned sandy
20 soils. Was that a hypothetical? There aren't --
21 you're not talking about sandy soils at surficial
22 layer at PFS, are you?

23 DR. WISSA: No, when I said, "sandy," it's
24 non-cohesive. I should have said the silts, the non-
25 plastic silts is what I am talking about here, versus

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1 the ones with low or medium plasticity. So when you
2 have a non-cohesive material, the water/cement ratio
3 plays a bigger role than in cohesive materials.

4 MS. CHANCELLOR: How are you going to
5 determine if you have met the Young's modulus under
6 dynamic conditions?

7 MR. TRAVIESO-DIAZ: Objection. He
8 testified that they are not going to test for dynamic
9 Young's modulus.

10 MS. CHANCELLOR: Well, that's why I tried
11 to rephrase it, but I obviously didn't do it
12 correctly.

13 How are you going to test whether you meet
14 the 75,000 psi modulus of elasticity?

15 DR. WISSA: I am going to use stress
16 strength curve obtained from non-confined compression
17 tests.

18 MS. CHANCELLOR: That's all I have, Your
19 Honor.

20 CHAIRMAN FARRAR: Dr. Wissa, at one point
21 about 10 minutes ago, Ms. Chancellor asked you a
22 question about whether certain practice made sense and
23 you said, "To some extent," which leaves open the
24 question of to what extent it doesn't.

25 DR. WISSA: I'm not sure --

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1 CHAIRMAN FARRAR: Was this the laying down
2 -- removing the soil and stockpiling it?

3 MS. CHANCELLOR: Maybe it was the
4 plastic/non-plastic --

5 MR. TURK: I think it was using a certain
6 eolian silk for use directly underneath the pads,
7 depending upon its elasticity.

8 MR. TRAVIESO-DIAZ: I don't want to
9 testify, but the question was, I think that Mr.
10 Trudeau said that preserving the material that has
11 more of a silty nature, and using what he called the
12 "preferred material" as the one to be used for the
13 cement-treated soil -- that was the question.

14 CHAIRMAN FARRAR: Yes, thank you.

15 DR. WISSA: The reason I said "to some
16 extent," obviously, that would be the preferred
17 material, but let's assume there isn't enough of it
18 onsite. Then, obviously, we're not in a box. We have
19 other options. That's why I said, "to some extent."

20 CHAIRMAN FARRAR: Okay, fine. Thank you.

21 Does that do it or --

22 MS. CHANCELLOR: Oh, I forgot to move my
23 exhibits into -- I don't have Jean here to remind me.

24 (Laughter.)

25 State's Exhibit 212 and 213 I'd like to

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1 move into evidence.

2 CHAIRMAN FARRAR: Any objection to those?

3 MR. TRAVIESO-DIAZ: No objection.

4 MR. O'NEILL: No objection.

5 MS. CHANCELLOR: Thank you, Mr. Travieso-
6 Diaz. If I didn't do it, then I would probably forget
7 again.

8 MR. TRAVIESO-DIAZ: Better late than
9 never.

10 CHAIRMAN FARRAR: Okay, those will be
11 admitted.

12 [Whereupon, the above-referred-
13 to documents marked as State
14 Exhibits 212 and 213 for
15 identification were received in
16 evidence.]

17 Go ahead, Mr. Travieso-Diaz.

18 MR. TRAVIESO-DIAZ: I have two questions.

19 REDIRECT EXAMINATION BY MR. TRAVIESO-DIAZ

20 MR. TRAVIESO-DIAZ: One is for Dr. Wissa,
21 and it is very simple. You said that an organization
22 called PCA had issued certain simple manuals. You
23 didn't get around to describing or saying what "PCA"
24 is. Could you explain?

25 DR. WISSA: Yes, it's the Portland Cement

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1 Association.

2 MR. TRAVIESO-DIAZ: Thank you.

3 Mr. Trudeau, this is for you. Ms.
4 Chancellor asked you a few questions about the
5 durability test failure experienced during the testing
6 by AGECC. My reading of her questions was that she was
7 trying to establish there has been quality
8 assurance/quality control failure in that process.

9 Now how was that failure to meet the
10 durability test discovered?

11 MR. TRUDEAU: Well, when I reviewed the
12 results, I noticed that it didn't meet the criterion
13 in the ASTM test for passing those tests.

14 MR. TRAVIESO-DIAZ: And, therefore, you
15 rejected the results?

16 MR. TRUDEAU: Essentially.

17 MR. TRAVIESO-DIAZ: Looking at the overall
18 QA/QC program, would you consider that to be a quality
19 assurance failure or success?

20 MR. TRUDEAU: Well, the failed test didn't
21 get past my review. So I would call it a success, I
22 guess.

23 MR. TRAVIESO-DIAZ: Thank you very much.
24 That's all I have.

25 MR. O'NEILL: Just a couple of real quick

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1 points.

2 CHAIRMAN FARRAR: All right.

3 RECROSS EXAMINATION BY MR. O'NEILL

4 MR. O'NEILL: On the issue of QA, Mr.
5 Trudeau, in the event that a license were granted and
6 some of this soil cement testing and placement work
7 was farmed out to contractors, any QA program of these
8 contractors or subcontractors, for that matter, would
9 implement would be subject to NRC approval, right?

10 MR. TRUDEAU: That's my understanding,
11 yes.

12 MR. O'NEILL: With respect to the 75,00
13 psi Young's modulus, that's design criterion, correct?

14 MR. TRUDEAU: That's correct.

15 MR. O'NEILL: And it's driven by the
16 hypothetical, non-mechanistic cask tipover analysis,
17 correct?

18 MR. TRUDEAU: Yes.

19 MR. O'NEILL: I presume that you wouldn't
20 have committed to testing to prove that you can have
21 a combination of 40 psi and 75,000 psi for the Young's
22 modulus if you didn't think it was at least
23 technically possible, correct?

24 MR. TRUDEAU: Yes, we think that this
25 technically achievable.

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1 MR. O'NEILL: Thank you.

2 I should go back to the QA. Mr. Turk has
3 brought something to my attention with respect to the
4 QA issue that the contractors or subcontractors would
5 be required to conform with NRC QA program
6 requirements, correct?

7 MR. TRUDEAU: Again, that's my
8 understanding. I don't know the regulations involved,
9 but --

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

11 MS. CHANCELLOR: Just one question, Your
12 Honor. Oh, sorry.

13 MR. O'NEILL: I'm set, thank you.

14 CHAIRMAN FARRAR: You were finished, Mr.
15 O'Neill?

16 MR. O'NEILL: Yes, I'm sorry.

17 MS. CHANCELLOR: I'm sorry, Your Honor.

18 CHAIRMAN FARRAR: Go ahead.

19 RECROSS EXAMINATION BY MS. CHANCELLOR

20 MS. CHANCELLOR: Mr. Trudeau, do you know
21 with respect to Stone & Webster's QA/QC program as it
22 relates to Part 72 of NRC regulations that govern
23 apices, do you know if NRC actually comes in and
24 approves any sort of QA/QC program?

25 MR. TRUDEAU: I don't know specifically

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1 with respect to Part 72, but I do know that they have
2 been through Stone & Webster's QA Department and have
3 approved our SWS cap, I think it's called, Stone &
4 Webster's something Quality Assurance Program.

5 MS. CHANCELLOR: Approved or audited it?

6 MR. TRUDEAU: Excuse me?

7 MS. CHANCELLOR: Have they approved it or
8 have they audited it?

9 MR. TRUDEAU: Well, I know they've audited
10 it. I'm pretty sure they have approved it, but I'm
11 not positive.

12 MS. CHANCELLOR: Okay, thank you.

13 JUDGE LAM: I have a quick question for
14 the staff.

15 Is it true that, whether or not the NRC
16 staff would exercise its oversight and enforcement
17 responsibility regarding the QA and QC program, that
18 is immune from Intervenor challenges? Is that true?

19 MR. TURK: Actually, Your Honor, there was
20 a contention at one time that dealt with QA/QC. I
21 believe that was resolved either -- I believe it was
22 after the contention was admitted. I think Contention
23 Utah G, if I'm not mistaken.

24 MS. CHANCELLOR: It was one of those early
25 alphabet numbers, that's correct.

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1 MR. TURK: So I wouldn't say that QA/QC is
2 immune from contention. Whether or not they have
3 developed a program that is acceptable I think was the
4 question that was raised by that contention.

5 JUDGE LAM: But that is not what I meant.
6 What I meant was whether or not the staff would
7 properly exercise its oversight responsibility in that
8 arena, is immune from challenge?

9 MR. TURK: Oh, in terms of, is the staff
10 performing its function properly?

11 JUDGE LAM: Right.

12 MR. TURK: Yes. Yes, I would agree with
13 that.

14 JUDGE LAM: Okay, thank you.

15 MR. TURK: If I may, Your Honor, I wanted
16 to supplement briefly my response to your question on
17 the legal issue. May I do that? I think you want to
18 take a break, but this will take about one minute.

19 CHAIRMAN FARRAR: Go ahead.

20 MR. TURK: You had asked me about nuclear
21 power plant licensing in the old days, and I had
22 referred to the fact that there is a new regulation
23 for future nuclear power plants. I would point out
24 that is in our Part 52, and specifically in that part
25 of the NRC regulations there's specific provision that

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1 states that the Applicant must define the tests and
2 acceptance criteria that it must achieve, and the NRC
3 may license based upon that. There is then a post-
4 licensing inspection under the regulations.

5 If you look at NCFR 52.79, 52.97, and
6 52.99, those regulations address the way in which new
7 nuclear power plant applications that choose to use
8 single-step licensing would be then inspected for
9 whether or not they have achieved the test and
10 acceptance criteria that they had defined previously,
11 which were found to be necessary to assure safety.

12 Let me point one other thing out. In
13 those regulations there's a specific provision that
14 states that any change in the test or acceptance
15 criterion would require a license amendment. Under
16 Part 72, in contrast, there is a specific two-tier
17 method for reviewing changes to tests. Again, that
18 goes back to what I was stating about whether or not
19 there's an unreviewed safety question.

20 Under 72.48, a license amendment would be
21 required if certain conditions existed, such as where
22 the tests, the change in the tests would result in
23 more than a minimum delta in safety. The specific
24 words are in the regulation. But if beyond the
25 minimum delta is not involved, then the Applicant is

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1 -- I'm sorry, a licensee would be free to go ahead and
2 make that change, once they have done the analysis
3 that's required under that Section.

4 CHAIRMAN FARRAR: All right. Thank you,
5 Mr. Turk.

6 Rather than hear from anyone else on that,
7 we will save the appropriateness of those analogies
8 for argument later.

9 Mr. Trudeau, you waited patiently in Salt
10 Lake City for your various turns. We thank you and
11 Dr. Wissa for your testimony. We appreciate your
12 being here.

13 MR. TRUDEAU: Thank you.

14 CHAIRMAN FARRAR: Thank you.

15 MR. TRAVIESO-DIAZ: Mr. Chairman, if I
16 could clarify? Unfortunately, Mr. Trudeau has some
17 more to go before he is totally excused.

18 (Laughter.)

19 CHAIRMAN FARRAR: Okay, well, we will take
20 a break now, and then we will have the staff witness.
21 Do we have a cross examination plan from the
22 Applicant?

23 MR. TRAVIESO-DIAZ: No.

24 CHAIRMAN FARRAR: No? Okay. Then it is
25 almost 25 after. Let's be here at 20 of, and are we

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1 going to finish the staff witness today? Good. Be
2 back at 20 of.

3 (Whereupon, the foregoing matter went off
4 the record at 3:23 p.m. and went back on the record.)

5 CHAIRMAN FARRAR: We're ready to go with
6 the staff witness.

7 Dr. Ofoegbu, you've previously been sworn
8 in this case. So you can consider yourself still
9 under oath.

10 Whereupon,

11 DR. GOODLUCK I. OFOEGBU

12 was recalled as a witness by counsel for the Nuclear
13 Regulatory Commission and, having been previously duly
14 sworn, was examined and testified further as follows:

15 MR. TURK: Your Honor, may I note for the
16 record we've distributed a slightly revised version of
17 Dr. Ofoegbu's testimony on Part C. There is a typo
18 that has been corrected on page 10.

19 In addition, following page 20 of the
20 testimony, we have added a reference list, and all
21 parties have had that information for some time.
22 We've given three copies to the Board members as well
23 as three copies to the court reporter.

24 CHAIRMAN FARRAR: All right.

25 MR. O'NEILL: I would note, Your Honor,

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1 that the reference list is being provided to reflect
2 the full citations, documents that were referred to
3 through partial or short citations in Dr. Ofoegbu's
4 testimony.

5 DIRECT EXAMINATION

6 BY MR. O'NEILL:

7 Q Dr. Ofoegbu, would you please state your
8 full name for the record?

9 A Yes, my name is Goodluck I. Ofoegbu.

10 Q Dr. Ofoegbu, have you prepared written
11 direct testimony for filing in this proceeding?

12 A Yes, I did.

13 Q Do you have a copy of that testimony in
14 front of you now?

15 A Yes.

16 Q Is that testimony entitled "NRC Staff
17 Testimony of Goodluck I. Ofoegbu Concerning Unified
18 Contention Utah L/QQ Part C"?

19 A That's correct.

20 Q Dr. Ofoegbu, I believe your statement of
21 professional qualifications was attached to your
22 prefiled testimony through Part D of this proceeding,
23 correct?

24 A Yes, it is.

25 Q Okay. It's also attached to this

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1 testimony now before you, your Part C testimony?

2 A Yes.

3 Q Do you have any corrections, revisions,
4 additions or deletions that you would like to make at
5 this time either to your prefiled testimony or to the
6 attached statement of professional qualifications?

7 I know we have already made these
8 corrections.

9 A Okay, okay. On page 10, where it has
10 2001A, the A has been crossed out.

11 Q And that's the only correct, correct?

12 A That's the only -- that's one correction.
13 The other one is the list of references that is now
14 attached.

15 Q Thank you.

16 With these corrections and the addition of
17 the reference list, is your written testimony and your
18 attached statement of professional qualifications true
19 and correct to the best of your knowledge?

20 A Yes.

21 Q Do you adopt this as your written
22 testimony, as now revised?

23 Do you adopt your written testimony as now
24 revised as your sworn testimony in this proceeding?

25 A Yes.

1 MR. O'NEILL: Your Honor, at this point
2 I'd like to request that Dr. Ofoegbu's written
3 testimony be admitted into evidence and found in the
4 record as if read.

5 CHAIRMAN FARRAR: Any objection?

6 MR. TRAVIESO-DIAZ: No objections.

7 MS. CHANCELLOR: No objection, Your Honor.

8 CHAIRMAN FARRAR: All right. Then the
9 reporter will bind the testimony in the record at this
10 point as if read.

11 (Insert prefiled testimony of Dr.
12 Ofoegbu.)

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