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

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

DR. WISSA: It would be on-site.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DR. WISSA: If you are going to construct

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

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

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

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

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

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

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

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

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

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

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

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

DR. WISSA: I believe so, yes.

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

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

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

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

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

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

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

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

DR. WISSA: No, I'm sorry.

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

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

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

DR. WISSA: That's correct.

MS. CHANCELLOR: And that surficial layer

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

DR. WISSA: That's what I understand.

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

DR. WISSA: That's what I understand.

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

DR. WISSA: May be deeper in some areas.

MS. CHANCELLOR: May be deeper. Right.

DR. WISSA: Yes.

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

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

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

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

believe it's correct.

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

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

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

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

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

completed the index properties for the soils?

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

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

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

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

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

MS. CHANCELLOR: So as part of PFS's

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

MR. TRUDEAU: That is correct.

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

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

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

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

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

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

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

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

MS. CHANCELLOR: Do you understand the

question, Mr. Trudeau?

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

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

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

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

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

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

with PFS. Is that correct?

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

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

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

MR. TRUDEAU: Yes.

DR. WISSA: Yes.

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

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

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

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

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

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

MS. CHANCELLOR: Different shear strength values.

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

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

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

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

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

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

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

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

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

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

MR. TRUDEAU: Might I add?

MS. CHANCELLOR: Certainly, Mr. Trudeau.

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

When we get to the field and start

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

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

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

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

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

MS. CHANCELLOR: Yes.

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

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

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

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

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

We did also take a water content specimen

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

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

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

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

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

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

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

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

DR. WISSA: On page 48?

MS. CHANCELLOR: Question 48.

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

DR. WISSA: Yes.

MS. CHANCELLOR: That's fine. Just

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

DR. WISSA: Correct.

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

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

MS. CHANCELLOR: I see.

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

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

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

The way you do that is you take a sample

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

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

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

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

DR. WISSA: Yes. The program in vision

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

MS. CHANCELLOR: The cement-treated soil?

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

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

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

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

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

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

Young's modulus.

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

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

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

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

DR. WISSA: Not to my knowledge, no.

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

DR. WISSA: Can you repeat that question please?

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

(Question repeated.)

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

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

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

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

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

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

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

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

MS. CHANCELLOR: Yes. That's correct.

MR. TRUDEAU: May I add something?

MS. CHANCELLOR: Certainly.

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

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

MR. TRUDEAU: That sounds like the right

report, yes.

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

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

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

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

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

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

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

MS. CHANCELLOR: Yes, Your Honor.

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

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

Subsection D last set of hearing.

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

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

MS. CHANCELLOR: Right now, Your Honor.

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

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

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

matters before the State continues?

MS. CHANCELLOR: No, Your Honor.

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

PARTICIPANT (JACK): Away from microphone.

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

PARTICIPANT (JACK): Yes.

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

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

MR. TRUDEAU: Yes.

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

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

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

Would it crash it?

MR. TRUDEAU: I couldn't say.

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

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

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

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

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

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

MS. CHANCELLOR: Right.

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

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

MR. TRAVIESO-DIAZ: Sorry.

MS. CHANCELLOR: Concrete pad.

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

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

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

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

DR. WISSA: Two percent strain at 24 inches?

MS. CHANCELLOR: Below the pad. Right.

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

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

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

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

DR. WISSA: Can you give me a minute to

read?

MS. CHANCELLOR: Absolutely.

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

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

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

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

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

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

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

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

CHAIRMAN FARRAR: Does staff have a position?

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

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

CHAIRMAN FARRAR: Good. Thank you.

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

MS. CHANCELLOR: That's correct.

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

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

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

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

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

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

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

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

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

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

MR. TRUDEAU: Of the soil cement?

MS. CHANCELLOR: Soil cement. Correct.

MR. TRUDEAU: Correct.

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

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

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

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

MS. CHANCELLOR: Is it your position that

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MR. TRUDEAU: Thank you.

MS. CHANCELLOR: PFS is using the buttress

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

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

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

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

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

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

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

MR. TRUDEAU: Yes.

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

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

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

MR. TRAVIESO-DIAZ: I apologize.

MS. CHANCELLOR: Some things just never go away.

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

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

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

CHAIRMAN FARRAR: That is quite all right.

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

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

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

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

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

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

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

Koeberg, South Africa.

MR. TRUDEAU: Yes.

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

MR. TRUDEAU: Yes. That is correct.

MS. CHANCELLOR: They were potentially liquefiable.

MR. TRUDEAU: That's my understanding.

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

MR. TRUDEAU: That is correct.

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

MR. TRUDEAU: That is correct.

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

MR. TRUDEAU: That's my understanding.

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

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

MS. CHANCELLOR: PFS's application is for

a shallow condition. Correct?

MR. TRUDEAU: That's correct.

MS. CHANCELLOR: Not liquefiable.

MR. TRUDEAU: That is correct.

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

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

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

CHAIRMAN FARRAR: Thank you, Ms. Chancellor.

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

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

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

trouble meeting these as a practical matter.

MR. TRUDEAU: That is correct.

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

MR. TRUDEAU: The 250 is a minimum here.

JUDGE KLINE: Okay.

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

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

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

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

MR. TRUDEAU: Yes.

JUDGE KLINE: Or meet them within a fair approximation.

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

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

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

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

MR. TRUDEAU: I would expect that we would

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

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

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

JUDGE KLINE: Okay.

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

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

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

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

JUDGE KLINE: Okay. Thank you.

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

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

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

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

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

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

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

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

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

MR. TRUDEAU: That is correct.

JUDGE LAM: Because a typical range to

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

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

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

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

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

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

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

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

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

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

MR. TRUDEAU: Was that number 45?

JUDGE LAM: Right. Dr. Wissa?

DR. WISSA: Yes.

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

DR. WISSA: I assume you're speaking about

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

JUDGE LAM: Thank you.

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

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

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

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

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

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

MR. TRAVIESO-DIAZ: No.

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

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

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

satisfy the State.

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

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

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

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

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

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

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

MS. CHANCELLOR: Your Honor, I would just

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

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

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

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

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

CHAIRMAN FARRAR: All right.

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

CHAIRMAN FARRAR: Yes.

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

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

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

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

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

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

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

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

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

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

JUDGE LAM: Dr. Kam (PH).

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

MR. TURK: The test results would involve judgment.

CHAIRMAN FARRAR: Right.

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

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

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

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

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

CHAIRMAN FARRAR: I don't know if you were

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

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

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

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

CHAIRMAN FARRAR: Yes.

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

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

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

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

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

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

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

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

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

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

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

Third, in the regulations there's an

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

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

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

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

CHAIRMAN FARRAR: Right.

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

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

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

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

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

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

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

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

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

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

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

discussing it here.

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

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

CHAIRMAN FARRAR: No.

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

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

MR. TRAVIESO-DIAZ: All right.

REDIRECT EXAMINATION BY MR. TRAVIESO-DIAZ

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

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

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

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

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

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

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

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

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

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

DR. WISSA: I beg your pardon?

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

DR. WISSA: Ten percent of the number?

MR. TRAVIESO-DIAZ: Yes.

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

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

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

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

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

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

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

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

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

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

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

DR. WISSA: Yes.

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

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

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

DR. WISSA: That's correct.

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

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

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

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

What you try to do is specify the testing

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

RECROSS EXAMINATION BY MR. O'NEILL

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

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

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

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

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

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

MR. O'NEILL: Thank you.

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

MR. TRUDEAU: Definitely, it was.

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

CHAIRMAN FARRAR: Does the State have any additional cross?

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

RECROSS EXAMINATION BY MS. CHANCELLOR

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

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

it.

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

DR. WISSA: It is a DG --

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

DR. WISSA: That's it, yes.

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

DR. WISSA: Can you repeat that?

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

DR. WISSA: Yes.

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

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

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

MR. TRUDEAU: I don't recall.

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

MR. TRUDEAU: That I recall, yes.

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

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

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

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

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

MR. TRUDEAU: I don't think so.

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

issue?

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

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

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

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

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

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

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

CHAIRMAN FARRAR: Objection's overruled.

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

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

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

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

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

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

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

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

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

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

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

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

(Laughter.)

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

(Laughter.)

MS. CHANCELLOR: Dr. Wissa, you mentioned,

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

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

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

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

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

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

MS. CHANCELLOR: Thank you.

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

MR. TRUDEAU: That's correct.

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

MR. TRUDEAU: I don't recall.

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

MR. TRUDEAU: It certainly could if that

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

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

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

MS. CHANCELLOR: Maybe a ruling by the Board?

(Laughter.)

MR. TRUDEAU: Well, okay.

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

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

I think it was Paul Trudeau who suggested that.

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

DR. WISSA: It makes sense to some extent.

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

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

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

MS. CHANCELLOR: In both or --

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

MS. CHANCELLOR: Okay.

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

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

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

MS. CHANCELLOR: Could you give any

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DR. WISSA: I'm not sure --

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

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

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

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

CHAIRMAN FARRAR: Yes, thank you.

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

CHAIRMAN FARRAR: Okay, fine. Thank you.

Does that do it or --

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

(Laughter.)

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

move into evidence.

CHAIRMAN FARRAR: Any objection to those?

MR. TRAVIESO-DIAZ: No objection.

MR. O'NEILL: No objection.

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

MR. TRAVIESO-DIAZ: Better late than never.

CHAIRMAN FARRAR: Okay, those will be admitted.

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

Go ahead, Mr. Travieso-Diaz.

MR. TRAVIESO-DIAZ: I have two questions.

REDIRECT EXAMINATION BY MR. TRAVIESO-DIAZ

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

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

Association.

MR. TRAVIESO-DIAZ: Thank you.

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

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

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

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

MR. TRUDEAU: Essentially.

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

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

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

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

points.

CHAIRMAN FARRAR: All right.

RECROSS EXAMINATION BY MR. O'NEILL

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

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

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

MR. TRUDEAU: That's correct.

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

MR. TRUDEAU: Yes.

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

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

MR. O'NEILL: Thank you.

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

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

MR. O'NEILL: Okay, thank you.

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

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

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

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

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

CHAIRMAN FARRAR: Go ahead.

RECROSS EXAMINATION BY MS. CHANCELLOR

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

MR. TRUDEAU: I don't know specifically

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

MS. CHANCELLOR: Approved or audited it?

MR. TRUDEAU: Excuse me?

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

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

MS. CHANCELLOR: Okay, thank you.

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

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

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

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

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

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

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

JUDGE LAM: Right.

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

JUDGE LAM: Okay, thank you.

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

CHAIRMAN FARRAR: Go ahead.

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

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

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

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

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

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

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

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

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

MR. TRUDEAU: Thank you.

CHAIRMAN FARRAR: Thank you.

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

(Laughter.)

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

MR. TRAVIESO-DIAZ: No.

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

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

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

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

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

Whereupon,

DR. GOODLUCK I. OFOEGBU

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

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

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

CHAIRMAN FARRAR: All right.

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

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

DIRECT EXAMINATION

BY MR. O'NEILL:

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

A Yes, my name is Goodluck I. Ofoegbu.

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

A Yes, I did.

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

A Yes.

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

A That's correct.

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

A Yes, it is.

Q Okay. It's also attached to this

testimony now before you, your Part C testimony?

A Yes.

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

I know we have already made these corrections.

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

Q And that's the only correct, correct?

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

Q Thank you.

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

A Yes.

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

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

A Yes.

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

CHAIRMAN FARRAR: Any objection?

MR. TRAVIESO-DIAZ: No objections.

MS. CHANCELLOR: No objection, Your Honor.

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

(Insert prefiled testimony of Dr. Ofoegbu.)