DR. OSTADAN: The paragraph you referred me to, does that start with, "Additional supporting basis . . ."

Q. Yes.

DR. OSTADAN: I think what he tries to say, that if you consider the fact that the three components of time histories are independent from each other, you cannot state that they are caused by vertically propagating waves.

Q. I'm sorry. I was remiss in asking you not to stop there but to continue reading on. Could you start reading now the part that says, "Further," and go to the end of the answer.

DR. OSTADAN: Okay. Yes, I read that.

Q. The entire thing, to the end of the answer?

DR. OSTADAN: Yes.

Q. All right. Is it correct, and I don't or I don't claim that I understand it perfectly, but is it correct that they are trying to compute the wave- length of the incoming waves and tring to compute or estimate the displacement that such a wavelength would cause?

DR. OSTADAN: To some extent, yes.

Q. And my question to you is do you have

any comments or concerns or agreement or disagreement with this methodology that the Staff has used?

DR. OSTADAN: Let me read again. I am now on the next page starting with, "In this regard."

Q. Yes.

DR. OSTADAN: "In this regard the seismic wave whose length is twice the path length over width will produce maximum bending in the pad; whereas the seismic wave whose length is four times the path length over width produce maximum rocking of the pad." As I indicated a few minutes ago, I have no objection to where the main source of the energy is and what they are doing here. What I am saying, we cannot rule out that there will not be any inclined waves. As small of energy as they have. And that is the basis of ASCE 4-98 recommendation.

ASCE 4-98 gives you two choices, in my view. One is you perform your structural analysis considering inclined waves. And that is from the analysis, structural analysis. Or do not perform that, include accidental torsion just the same way you did it for the canister transfer building.

Q. But my question was this: If I understand what the Staff did, they were able to find a relationship between the wavelength of the incoming wave and the displacement that the incoming wave causes on the pad. And they computed that displacement, which I believe is on the order of, I think they call it V, and it comes to be on the order of .60 inches for maximum rocking, V is equal to .19 inches for maximum bending, that's in one direction of the pad. And in the other direction you have maximum displacements of V equal to .68 inches for displacement. And 1.16 inches for rocking.

Q. Do you have any disagreement or reason to disagree with that calculation by the Staff, with these numbers?

DR. OSTADAN: Okay. Let me read the conclusion that they state after they decide these numbers you just read.

It goes on to say that the amount of rotation of the surface of the storage pad lifts up .1 degrees and therefore the stability of the casks would not be affected by nonvertically, out-of-phase seismic waves that may occur at the site. That's basically what it boils down to.

Q. Yes. I'm sorry. I omitted to put that result. That is true also for the other direction of the pad?

DR. OSTADAN: Yes. And they go on to the other direction, north/south. And now I'm not in a position to express opinion on these numbers. I just saw it now.

Q. Assuming, again, the Staff has to defend its numbers if they are attacked. Assuming that these numbers are correctly computed. Would they tell you that the amount of displacement and rotation that is caused on these pads by nonvertically propagating waves is small enough to be negligible?

DR. OSTADAN: I would say these calculations are correct and the effect would be small in any case.

Q. Okay. Let's move --

JUDGE FARRAR: Mr. Travieso-Diaz, let me interrupt you. We have the people here that we need to take up that collateral matter, which we would like to do now. So if all counsel and their clients would approach the bench, we will go off the record.

(Bench discussion off the record.)

JUDGE FARRAR: We have just had a very brief discussion with the parties on this collateral matter and now we will return to the cross-examination. Sorry for the interruption, but the timing was right.

MR. TRAVIESO-DIAZ: I have only one more area to cover so I expect to be finished shortly. The last item that I see in your testimony that is of concern to you, I believe it's in the very last answer. Answer 46, the last page, 23. It has to do with something called cold bonding. Maybe you can explain for the Board what cold bonding means.

DR. BARTLETT: I'll take a shot at it here for a moment.

Q. Okay.

DR. BARTLETT: And I was here for the testimony of Dr. Singh so I heard his explanation of what he thought cold bonding was. And I think maybe it's just a difference in terminologies and disciplines that we see and how we are interpreting what this means. Cold bonding, to us, at least, who work with natural materials, is for example maybe we have sands in contact with each other. Obviously the sands stresses where they transfer stress from one grain to another, those contact

points, the stresses can be relatively high just from the fact that the area in which they are in contact is relatively small. Now, remember we are talking on the grain to grain size scale here. We are talking about really interparticle contact here.

In the case of something like sands, the stresses, the contact stresses over a long period of time can cause local deformation actually of the grains. And because of these stresses then in this grain-to-grain contact, there will be some localized deformation of those contact points and, in fact, a subtle but measurable interlocking effect. This has been documented in sands. I recall John Smertland from the University of Florida was looking at the mechanical aging of sands and bonding of sands. I don't know if he used the term "bonding" but mechanical aging, and noticed an increase in shear resistance of the sands due to these contact stresses and local deformations with time, and it was a measurable effect.

In the case here at PFS, we are not really dealing with sands but we must remember that with concrete, one of the major components of

concrete still is sand and there are grains of sand that will be exposed at the surface of the concrete. Now, the metal will be in contact with that sand that's bound in the concrete. And with time, because again it's grain-to-grain-contact with a metal surface, there can be some local deformation of the grains of the sand and in conjunction with the bottom of the metal. And this can produce an effect where the shear resistance or resistance to sliding, maybe I should say, in this case will be higher due to this effect. It is somewhat of an interlocking effect. So there's additional resistance to movement caused by this, and what we refer to now as cold bonding. But it has nothing to do with the bonding that somebody would be studying in metallurgy and those types of things. Pressure bonding of two metals.

Q. This is interesting, Dr. Bartlett. I'm not sure it's accurate. But my understanding of both the testimony here in Answer 46, all that has been said before in depositions and so on, related to the situation in which the potential for somehow, due to the continued contact between a metal in this case, the cask surface, and the concrete would cause the equivalent of, if I can

use the term, a weld. And so I am not understanding the mechanism, because what you are talking about is at a microlevel. I don't see how having a grain of sand or the portion of a grain of sand as part of the concrete material on the surface could create a bond with steel which doesn't have similar kind of material. Can you explain that?

DR. BARTLETT: Again, we need to back off and make sure the two disciplines are talking to one another. The welding analogy I'm not sure we have ever used. We have used cold bonding in the sense of what we meant. I went to the grain-to-grain size, to that scale, just to explain the phenomenon and what is occurring. Even though these local contact surfaces at the grain-to-grain scale are small, remember the net effect or the phenomena over a large area still can give you an additional sliding resistance that is not purely frictional. It is an extra resistance due to some bonding. And that's the way we use cold bonding. Again, it's not meant to be a welding. It's meant to be just an additional resistance to shear due to these contact points and high stresses that develop there and the local deformations that occur with

time.

Q. Let me tell you what my problem is. I'm reading from the testimony of Dr. Ostadan, Answer 46, the last sentence. "Even though you started with a considerably smooth surface with limited friction, because of the stress on the contact points over time, however, there may be a bonding, a welding taking place, and you may no longer have this smooth, ready-to-slide condition such as the one Holtec relies upon in its analysis." What I'm hearing Dr. Ostadan here, and I'm thinking perhaps he should help us here, is not in the nature of what you are talking about. It's in the nature of the more traditional type of, well, as he says, stress-induced contact, akin to a weld in some cases.

DR. BARTLETT: I will defer to Dr. Ostadan. But we will see if his definition of cold bonding was consistent with the way I explained it.

DR. OSTADAN: Well, I think Dr. Bartlett explained the phenomena itself, why cold bonding happens and this interlocking takes place. But to the extent I relate to the subject, the word really is the key word you just read. That if you have

this locking condition developed due to concentration of stresses over time, we do not have a cask that is ready to slide, as the computer program assumes is the case. It would need the initial shock to break that lock, and then from there on it slides. And so that initial shock creates additional vibrations and disturbance in the movement.

Q. I'm sorry. I missed what initial shock you are talking about.

DR. OSTADAN: To break that bond, to break that cold bonding that exists between the cask and the pad, there is a kick needed to unlock it.

Q. Well, okay. But you are talking about the consequences. I'm still trying to understand the phenomena itself. How do you get the cold bonding in the first place?

DR. OSTADAN: The cold bonding, I think Dr. Bartlett tried to explain that from a geotechnical point of view. I can also answer some explanation from a structural point of view.

As I discussed the other day, the other form of isolation system is called friction pendulum system that is used for structures in

which you have two metal surfaces, one in the form of the sphere and one in the form of a concave shape. And the sphere is moving inside the concave shape to try to dissipate the energy. The main concern, this has always been, "What happens over time?" This phenomena in that language is called strike/slip. You need to strike this thing and let it loose after ten, fifteen years so that it can do what we assume it will do. And I think the same concern applies here with the cask and the pad.

Q. Perhaps we could expedite this discussion by asking you these two questions. Have you ever sought to estimate the maximum amount of deformation that you could expect to see at the pad/cask interface due to cold bonding?

DR. OSTADAN: No, I have not.

Q. Have you?

DR. BARTLETT: No, I have not.

Q. Have either of you been aware that the NRC staff in its testimony has undertaken this task?

DR. OSTADAN: I'm not aware of that, either.

DR. BARTLETT: I'm not aware of that, either.

Q. And this is -- again, this doesn't have to go on the record because this is a copy of the transcript of the May 3 testimony by Dr. Ofoegbu and Mr. Pomerening. It would refer you to page 6505 of the transcript in which I ask Mr. Pomerening, I'm looking at Line 7. "Now you compute a maximum total deformation on 972 microinches. Is that 972 times ten to the minus six?" And the answer is, "Yes, sir." Again, I'm not expecting that either of you will attest for this number. But will you regard, as experienced engineers, a deformation of 972 microinches to be significant?

MS. CHANCELLOR: Your Honor, maybe the witnesses should see the question or the answer that Mr. Pomerening gave to which this question applies, which I understand is Answer 2 of Mr. Pomerening's testimony.

DR. BARTLETT: Yes. I think what would be relevant to us is understanding how this was calculated and what theory is this. Is this elastic deformation we are looking at, the 972 microinches? How is it calculated?

Q. My question to you is I don't expect you to agree or disagree with the number based on the

fact that you, as you said, you don't know how they computed it. But my question is assuming that the number is correct on its face, 972 microinches, what significance would you attach to it?

JUDGE FARRAR: But Ms. Chancellor is correct. I think that --

MS. CHANCELLOR: There's no need to --

JUDGE FARRAR: Or you are not correct?

MS. CHANCELLOR: I'm correct, your Honor. I didn't mean to interrupt you.

JUDGE FARRAR: That even if this is a hypothetical, he has to know what the hypothetical relates to, what that number relates to. Is that your point?

MS. CHANCELLOR: Exactly. You could do this without this testimony; is 972 microns a small number?

JUDGE FARRAR: Can we get the simple -- the simple solution is let's get a copy of that testimony.

MR. TRAVIESO-DIAZ: I believe we have it already because we just used it to talk about inclined waves, the same testimony.

JUDGE FARRAR: But was that the same question?

MS. CHANCELLOR: No. I believe it is Answer 23.

JUDGE FARRAR: It's a different question and answer.

MR. TURK: Question and Answer 23 that appears at Pages 24 to 25 of the prefiled testimony.

DR. OSTADAN: Page 24?

MR. TURK: May we go off the record?

JUDGE FARRAR: Yes.

(Discussion off the record.)

DR. BARTLETT: No. I guess looking at the way the number was derived, I guess I would comment on a few points. First, we are talking about local deformations of contact points. As I understand what I'm seeing here, this is a calculation distributing the full weight of the cask over a large diameter. So it is talking about the area of the bottom of the cask. And so the contact points of this grain-to-grain contact that we are talking about, or point-to-point contact, are much less than the total area of the contact.

Then, also, it seems to be this has been done on a modulus of elasticity so this number that we see is really an elastric strain. This effect

we are talking about is really more of a creep phenomenon. In other words, it is deformation with time at these contact points. And it's not an elastic phenomenon. It's a creep phenomenon.

Q. Dr. Bartlett, before going on, perhaps we could clear up something. I believe that Answer 23, as I read it, is based on the concept of creep. In fact, it cites ACI Standard 209 relating to creep, shrinkage, and temperature effect on concrete structures. Are you saying that's not a proper thing to look at to compute deformation?

DR. BARTLETT: Could you show me the line again, please?

Q. It is at the beginning -- in fact, it starts with the word "creep". It's like ten lines from the end of the answer to question 23.

MS. CHANCELLOR: Seven.

MR. TRAVIESO-DIAZ: I can't count, I told you.

DR. BARTLETT: Yes, I see. I do now stand corrected that it appears -- I was looking on the first page and just saw the modulus of elasticity. But reading on, it does appear that also creep was put in the calculation. But again, the issue is not only what type of moduli you use,

whether you are using a modulus appropriate for elasticity and also one that includes now the creep, but the area over where you distribute the stresses. This is a stress distributed over a very small area where we actually have contact. In other words, over a bottom of a cask it's unreasonable to think that over that full area everything is in contact, because of surface irregularities, grain-to-grain, point-to-point contacts. So you can't take the full cask load and distribute it over the diameter of the cask to calculate these varying stresses.

Q. Well, Dr. Bartlett, let's just go back to my question. I understand you have some concerns of the methodology. I just want to get your assessment as to what will be -- assuming that this number that they came up with is right, and again you may have methodological difficulties with the way they came up with it, but assuming the number is right and the total amount of deformation attributable to cold horse is 972 microinches, what physical significance would you attribute to that deformation?

MR. BARTLETT: I'm not sure I can. The way one would set up an experiment to measure this,

if indeed it was happening, was to place something similar to a cask on a pad, let it sit for 20, 30 years so we have elastic and creep strain going on, and then see if one could measure additional resistance to movement that you wouldn't have found if you did this initially at day one with a new cask and a new pad. So I'm not sure I can relate the amount of surface deformation and how it relates to an additional sliding resistance that may be provided by this bonding that may be going on.

Q. One more question. I think this horse is getting pretty beaten. One last question. Wouldn't, in fact, in terms of practical consequences, having this bond that you said needs to be broken before the cask can slide, be equivalent to having a higher coefficient of friction in terms of the way it works? I know the mechanisms are different. But the practical effect, wouldn't it make it harder for the cask to slide?

DR. OSTADAN: At the initial stage. It would be quite different from what you postulated based on coefficient of friction. Coefficient of friction means that even with the coefficient of

friction of 1.0, that means the cask is able to slide. It's just the frictional forces will be different. But what this is talking about, at the initial stage before the cask slides there is some resistance to break that bond. And that resistance in dynamics means some additional vibrations and shock, if you will, to break the bond.

Q. Well, would it be equivalent to having, and I promise this is my last question, would it be equivalent, in fact, to having a rougher surface in between the two, having perhaps steel that is not totally polished or concrete that has granular irregularities? In its effect. Again, the mechanism is different but in its effect.

DR. OSTADAN: I can't relate it to that. Sorry.

Q. But the testimony is it would make the cask harder, it would be harder for the cask to move, whatever you call it. Is that right?

DR. OSTADAN: Initially. That's the key word.

Q. And you know, you are aware, I'm sure, that Holtec has drawn a wide range of cases, assuming different degrees of resistance to sliding by the cask?

DR. OSTADAN: They have, yes.

Q. So this particular instance might well be covered by the cases; right?

DR. OSTADAN: I can't --

Q. They went from .2 to .8.

DR. OSTADAN: Again, I cannot relate -- this is a phenomenon that would cause some resistance at the initial stage of sliding and then it would slide whichever coefficient is appropriate.

Q. That's all I have.

JUDGE FARRAR: Forgive my layman's question here. But as I have heard you describe this phenomenon, I'm trying to compare it qualitatively to the forces imposed by the design basis earthquake. Is it really significant when compared to those forces? In other words, how does this make a difference?

DR. BARTLETT: I think the forces from the design basis earthquake are significant to overcome this cold bonding. It would break it.

JUDGE FARRAR: And in breaking it, in other words how much difference in the motion of the cask would result by the fact that at the first instant some of the energy of that earthquake had

to go into breaking this bond?

DR. OSTADAN: It is very difficult, your Honor, to quantify. This is now under dynamic conditions. Once we break it, what it really means in dynamics is that we are introducing some high frequency motions. Initial release. And that puts some additional vibration or movement in the case. Unfortunately, I couldn't quantify what it means by additional displacement.

JUDGE FARRAR: Okay. You said you were through?

MR. TRAVIESO-DIAZ: I'm still finished.

JUDGE FARRAR: Mr. Turk, before you start, Dr. Lam has a couple questions.

JUDGE LAM: Dr. Ostadan, Dr. Bartlett, good afternoon. In two days of testimony we have heard both of you gentlemen had raised numerous challenges to the Applicant's application. Let me give you the same courtesy as I have done earlier, very early in this proceeding, which I promised Mr. Jim Soper. Let me ask you a couple global questions which is, Gentlemen, what is wrong with the Applicant's applications? And if I may ask you to give me your three most compelling deficiencies about the application, would you be able to do

that?

DR. OSTADAN: Yes, your Honor. I'd be happy to. Maybe I can give you three on the demand side of the equation and perhaps Dr. Bartlett could give you three on the capacity side. Would that do it?

JUDGE LAM: Okay.

DR. OSTADAN: Since you are looking for global, global, I will stay with that notion. The features called on for this facility are, in my view, a number of key features are unprecedented and unproven. That's number one. And I could elaborate on that. One is having foundation of structures here with barely minimal embedment and expecting these to carry the large seismic loads that we have here. This is not a new thing we have discovered. It is a problem that we have in our practice all along. This is a major problem for many infrastructure facilities in the U.S. They don't meet the codes. And unfortunately it is not easy to go out and try to glue the foundation by layer of soil cement. This doesn't work. It is much more involved. So I think having surface foundation and being able to meet the requirement for sliding is, in my mind, quite a challenge.

Second is the concept of cask sliding on the pad. It is unproven. There is no test. And unfortunately, full credit has been taken for a great deal of reduction of seismic loads based on a nonlinear computer analysis. I'm concerned with that, since this analysis we know very well could be quite sensitive. And therefore, as I indicated the other day, even for other types of isolation that our industry employs, our conventional codes do not allow the designers to take full advantage of this dissipation. They limit that, to a certain extent. And it's mainly because we really don't know how they act during major earthquakes.

Third concern I have is to recognize that it's a very poor soil site. It is a very soft soil. The calculation that Applicant has performed indicates several inches of settlement. That, by itself, indicates that the site soil may not be capable of carrying these horrendous loads coming to it and, therefore, the foundation concept proposed here becomes more vulnerable to carry the seismic loads.

JUDGE LAM: Thank you, Dr. Ostadan.

DR. BARTLETT: My experience is that the upper Bonneville clay is too -- we have to be

careful in designing with them. They do not have a lot of capacity. These soils here at the PFS site, because they are considerably above the water table, they tend to be drier, desiccated, stiffer. However, we must keep in mind that this facility is going to be there for approximately 40 years. We must consider, also, that the Applicant's relying solely on these clays and their strength to resist sliding. The design is to take and transfer the seismic loads to these clays. If, per chance, these clays may change their characteristics with time, maybe due to moisture content, other things, their resistance may not be as high as we have anticipated. They could be influenced by construction activities and other things that are going on. Now, so my concern is the capacity really of the clays to take these seismic loads and resist them with adequacy.

And somewhat parallel with that, I guess, would be the really sparse testing that has been done to quantify the resistance of these clays. The mode of failure in this case is shear failure in this direction. And we see, particularly for the pad and placement area, that we have just a few tests to really quantify what

the shear resistance is. This leaves us open to uncertainty. There could be potential that we may be somewhat overestimating their shear strengths. And this really lack of large numbers of tests to support the design really concerns me.

And I guess lastly, the use of soil cement in itself in this case we think is unique. Soil cement has been used under roadways, for highways, for providing a stabilized base. It's been used in construction of dams to stabilize the slopes of a dam. However, in this case it is unique in that we are now looking at a case where foundations are trying to move back and forth, and the soil cement is expected to resist those motions. One of the main concerns we really have in addition to all the cracking and the things that can go on that could damage the soil cement during the seismic event really is its poor tensile capacity. The soil cement in this case will be expected to not only resist compression, which it does have fairly reasonably high compression strengths compared to soils, but it will also be placed in tension. So to draw an analogy, when we do reinforced concrete design, and concrete has relatively low strengths in tension, there has to

be reinforcing steel which provides the tensile strength within the concrete.

In this case, the soil cement around the pads is expected to behave like a mat, but yet it is unreinforced. And the seismic demands being placed on it are large. We know that it will go into tension due to potential for out-of-phase motion between the foundations and the adjacent soil cement, and I'm just not sure that it will actually be able to survive this event without serious damage and reduction of its capacity. So I guess that sums it up. And I know we will talk more about the soils and the soil cement in Part C.

JUDGE LAM: Thank you, Dr. Bartlett. I have a final question to both of you gentlemen. To help me to better calibrate your concerns, which are numerous here, let me ask you to reflect on the pad settlement issue. If I may group your concerns into major, major concerns which you have described or something minor or something somewhere in between, where would you put your concerns regarding the pad settlement? I mean, where would you put it? Would you call it the major concern or minor concern or somewhere in between?

Before you answer, let me share with you

where I am going. I see a pad of 67 feet long. I see testimony from you and the Applicant's counsel that we are dealing with settlement of two inches. We are talking about dimensions perhaps well within the tolerance of pad manufacturing and installation. But in listening to your testimony, I have not been able to come away with the impression in terms of degree of significance where you, Dr. Ostadan, or Dr. Bartlett, were placing it. I mean, where does it belong?

DR. OSTADAN: Let me try to answer that, and Dr. Bartlett might have other points to add. I think, first of all, as I indicated, to inches, as small as it may sound, compared to the dimension of the pad, is a significant number in geotechnical engineering practice. Even for a building, a regular building, having a two-inch settlement is a significant number and something needs to be done about this. It's not a good foundation to have a two- inch settlement.

Now, I think we need to look in this number in the context of the margin that exists and what would it do to the design. The action of the pad in response to settlement, in one case could be a dishing action that we discussed. And another

element of it that we didn't get to elaborate on is the soil is a continual medium and as these pads are being loaded they drag down the ground, they tend to tilt the pads nearby. So there's a sort of a regional settlement pattern taking place, also. And given that cask response could be so sensitive, based on this analysis, I remain concerned that not having any redundancy, how much additional movement we may induce by this settlement in the response of the cask. And if it adds another few inches or another foot or so during seismic excitation, it's a concern I have.

In terms of calibrating that, whether it is extremely significant or significant or moderate, that's a really tough yes to me. I would characterize it somewhere between moderate to significant as far as the cask's response.

JUDGE LAM: I see.

DR. BARTLETT: In looking at the settlement around the pads, one of the issues we have also raised is what will the settlement do to the cracking of the soil cement around the pads? If there's cracking now as settlement occurs in the soil cement, again it will reduce this tensile capacity we have talked about. It will already be

pre-cracked. So that's another concern that we have had is the effects of settlement on the integrity of the soil cement.

JUDGE LAM: Thank you. That's all the questions I have.

JUDGE FARRAR: Dr. Bartlett, let me ask another question from my layman's perspective. When you talked about the use of soil cement now and gave some examples of how it has been used before, I took the tone of your answer that it's been used in these other applications, which are much less crucial than this one, when you mentioned highways and a few other things.

DR. BARTLETT: Correct.

Q. But when you said dams, I have this vision of a dam breaking and everyone in the valley being swept away. So I don't quite understand why you would put dams in the less crucial rather than the more crucial category.

DR. BARTLETT: I think what I was trying to point out with that example, dams are crucial facilities and if they rupture, real consequences happen. In some cases they have used soil cement or sometimes also use a product called roller-compacted concrete, which is similar to soil

cement. Remember, dams have in them many, many layers. There's different things within the dam to prevent seepage. There's clay core and different parts. And some people have used these on the facings of the dams or along the slopes mainly as a way to stabilize the slope so that you don't have excessive erosion of the slope. Obviously there's no structures built on it. It is essentially just a facing type of thing. And I see that as a distinctly different application than what's being done here.

JUDGE FARRAR: Okay. Dr. Ostadan, just so our record is clear, your years of service with Bechtel are what?

DR. OSTADAN: I started in '95, your Honor.

JUDGE FARRAR: And you are still there?

DR. OSTADAN: I still am there, yes.

JUDGE FARRAR: Okay. Mr. Turk, would you like to -- I think our next reporter is here so if you needed a break before you start, we could have that or we can just go.

MR. TURK: I'd prefer to go, because I think I'm going to have a lot and we are going to run short of time. We have a witness availability

problem.

JUDGE FARRAR: Then why not get started and we will -- we are looking at five o'clock to make your plane?

DR. OSTADAN: Yes.

JUDGE FARRAR: Then let's press forward. And when you come to a break any time in the next twenty minutes, then signal us and we will change reporters.

MR. TURK: Is everyone all right with going forward for another 15, 20 minutes?

DR. OSTADAN: Yes.

JUDGE FARRAR: Let's go.

CROSS-EXAMINATION

BY MR. TURK:

Q. Gentlemen, my name is Sherwin Turk. I'm an attorney with the NRC staff in Washington, D.C. You have probably noticed we had quite a few people with us during the past week that have attended hearings, and some of them are with me today.

I'd like to start, first of all, by asking you a bit about your professional qualifications. Dr. Bartlett, you are currently employed as an Assistant Professor of Civil and

Environmental Engineering?

DR. BARTLETT: That's correct.

Q. And that's at University of Utah?

DR. BARTLETT: That's correct.

Q. And that's a full-time position?

DR. BARTLETT: Yes.

Q. Dr. Ostadan, you mentioned just before in your response to Judge Farrar's question that you are with Bechtel?

DR. OSTADAN: I am with Bechtel and I also, at times, am retained for the University of California teaching graduate classes.

Q. Part-time teacher there?

DR. OSTADAN: Yes.

Q. At Bechtel are you employed full time?

DR. OSTADAN: Yes.

Q. What is your current position?

DR. OSTADAN: I'm a chief engineer.

Q. What's the precise title of your position?

DR. OSTADAN: Chief geotechnical engineer.

Q. I'm looking at what's been marked as State's Exhibit 110. I don't see that title here. I see mentioned that you are chief soils engineer.

Is that a previous position?

DR. OSTADAN: Same thing. Soils or geotechnical.

Q. Essentially the same position?

DR. OSTADAN: Right.

Q. And that is full-time, you said?

DR. OSTADAN: That's correct.

Q. Are you lead geotechnical engineer? Is that what you said?

DR. OSTADAN: That's what chief means, yes.

Q. And how many people do you supervise?

DR. OSTADAN: Really depends on the project. It changes all the time. I oversee design and design calculations I review. So my staff changes and people who I interact with changes depending on the project.

Q. Can you give me an example, for instance, currently?

DR. OSTADAN: Currently, say five people now.

Q. Five people?

DR. OSTADAN: Yes.

Q. And is that pretty much in the range of how it works from project to project, about five

people?

DR. OSTADAN: Yes.

Q. And what skills would those people have? What would those specialties be?

DR. OSTADAN: Mostly the things I deal with, I have various expertise in the group. Conventional geotechnical engineering foundation design. But focal point of our expertise in that group is soil structure interaction and geotechnical and earthquake engineering.

Q. Have you worked on many nuclear facilities applications?

DR. OSTADAN: Yes.

Q. And in what capacity do you do your work with respect to nuclear facilities?

DR. OSTADAN: Mostly soil structure interactions.

Q. And would that be part of the licensing application?

DR. OSTADAN: In support of, yes.

Q. And again, that is focusing primarily on soil structure interactions?

DR. OSTADAN: Yes.

Q. And you indicated that soil structure interaction is an important consideration that

should be taken into account in seismic design?

DR. OSTADAN: Depending on the project, yes.

Q. By the way of reference, Dr. Khan's report, the Altran report, does that include any soil structure interaction effects?

DR. OSTADAN: No, it doesn't.

Q. You mentioned that you have done work with respect to the Diablo Canyon nuclear power plant?

DR. OSTADAN: Yes.

Q. What was your role with respect to that facility?

DR. OSTADAN: I was carrying out, again, the soil structure interaction for the plant as part of the long-term seismic program.

Q. When did you begin your work on that program?

DR. OSTADAN: I'll tell you when I joined. In '85.

Q. When did they discover the Housby fault?

DR. OSTADAN: I think it was discovered when I joined.

Q. About the same time you joined, or shortly after?

DR. OSTADAN: I don't remember the dates. It was prior to that.

Q. It was discovered before you joined?

DR. OSTADAN: Yes.

Q. You made a distinction earlier in your testimony between this site, which had a fault discovered underneath it during the design process, and the Diablo Canyon site where a fault was discovered after design.

DR. OSTADAN: Yes.

Q. Did you mean to suggest that it is a worse case to discover it while you are designing the facility or a worse case to discover it when you have already completed your design?

DR. OSTADAN: Would you explain what you mean by "worst case"?

Q. Yes. You seemed to suggest that the fact that a fault has been discovered during the PFS design process was more ominous or more unfortunate than a situation where a fault is discovered after a facility has been designed. Was that your intent?

DR. OSTADAN: Well, I think I said I do not know of any nuclear facility that it was known during the design that there is a major active

fault.

Q. But the fact that a facility recognizes that fact while it is in the design process, would allow it to correct its design or analyze its design to be sure that it meets the conditions that that fault would represent for its safety; correct?

DR. OSTADAN: I think I stated my comment in the context of --

Q. I'm sorry. Could you answer the question I asked you?

DR. OSTADAN: Yes.

MS. CHANCELLOR: Objection.

MR. TURK: Your Honor, we are short on time. If I ask him a yes or no question, I hope we can move forward on that basis.

MS. CHANCELLOR: Mr. Turk, there's no need to be hostile to the witness.

MR. TURK: I don't mean to be hostile, your Honor.

MS. CHANCELLOR: The witness is trying -- just a moment. The witness is trying to answer the question you asked. The question doesn't always call for a yes/no answer.

JUDGE FARRAR: Number one, our rule which I guess we didn't re-enunciate lately is we

prefer a yes or no and then an explanation because that helps us understand the explanation. Number two, some people have one style of cross-examining and others have another. We have seen, even from the State, an effective but -- not from you, Ms. Chancellor.

MS. CHANCELLOR: Thank you, your Honor.

JUDGE FARRAR: An effective but I would say hostile cross-examination. And that's legitimate. That may not be the way you would do it or someone else would do it, but if Mr. Turk wants to do it --

MR. TURK: I don't mean to be hostile. It is three o'clock and the witness needs to leave by five o'clock. I have three hours of examination that we need to compress.

JUDGE FARRAR: It can be curt, it can be aggressive, and it can be fast. Let's get moving.

Q. (By Mr. Turk) Do you recall my question?

DR. OSTADAN: No. Please repeat it.

MR. TURK: Madame Reporter, could you repeat it, please.

(Record was read as follows:

"Q. But the fact that a facility

recognizes that fact while it is in the design process, would allow it to correct its design or analyze its design to be sure that it meets the conditions that that fault would represent for its safety; correct.")

DR. OSTADAN: That's fine, yes.

Q. Also with respect to Diablo Canyon, the Housby Fault was discovered after a design had been completed.

DR. OSTADAN: Correct.

Q. And they had commenced construction before the fault was discovered; correct?

DR. OSTADAN: I can't be clear on that. I know it was discovered after the initial design.

Q. And that was a strike/slip fault?

DR. OSTADAN: Yes.

Q. It is correct that a strike/slip fault has potentially greater energy than a normal fault of the same magnitude?

DR. OSTADAN: I can't comment on this.

Q. Dr. Bartlett, can you comment on that?

DR. BARTLETT: Still a little bit of point of controversy, I think there's been studies done for Yucca Mountain showing that normal faulting can lead to somewhat lower ground motions

than strike/slip for the same I guess fault size and area.

Q. That's consistent with my general understanding, as well.

DR. BARTLETT: I can't remember the number, but it can be somewhat less.

Q. Yes. Also, is directivity, Dr. Bartlett, I'll direct this to you. Is directivity a function that has to be considered when evaluating the potential strength of an earthquake?

DR. BARTLETT: Generally if you are within 10 kilometers directivity effects can be important.

Q. Dr. Ostadan, do you understand the term "directivity"?

DR. OSTADAN: Yes.

Q. The Housby fault, can you tell me the direction it points with respect to the Diablo Canyon Facility?

DR. OSTADAN: I can't recall.

Q. In fact, it has a directivity towards the facility; doesn't it?

DR. OSTADAN: Perhaps you are right. I cannot recall.

Q. And it is approximately four kilometers away from the Diablo Canyon site?

DR. OSTADAN: I can't recall the numbers.

Q. So your testimony here does not mean to suggest that the fault underneath the PFS facility has a greater potential consequence than the Housby Fault near the Diablo Canyon facility; correct?

DR. OSTADAN: No, I did not indicate that.

Q. Okay. Just before we started my cross-examination, you were asked a question about settlement and you indicated that two inches of settlement may be small, but you believe it to be significant with respect to geotechnical practice. Do you recall that?

DR. OSTADAN: That's correct.

Q. Are you familiar with a document published by the U. S. Army Corps of Engineers, entitled Engineer Manual 1110-1-1904?

DR. OSTADAN: No, I'm not.

Q. Do you recognize that the U.S. Corps of Army Engineers establishes standards with respect to geotechnical engineering?

DR. OSTADAN: They have the standards,

yes.

Q. This document is entitled Engineering and Design Settlement Analysis. Have you heard of that document?

DR. OSTADAN: I don't recall it.

MR. TURK: Your Honor, I only have one copy of the document. May I approach the witness? And I invite counsel for other parties to view the document as well at the same time.

JUDGE FARRAR: Sure.

Q. (By Mr. Turk) I'm showing Dr. Ostadan a two-page document -- I will show the three pages. The cover is as I described. It is a document entitled Engineering and Design Settlement Analysis. Do you see that statement, with the engineering manual number I gave previously.

I'd like to turn -- by the way, this is a table of contents for reference. It establishes the nature of the document. Different chapters and sections. It has to do with limitations of settlement, evaluation of settlement for static loads and other matters. I'm turning now to Page 2-1 of chapter two which is entitled Limitations of Settlement. Do you see that page?

DR. OSTADAN: Yes.

Q. And this document is dated September 30, 1990. Correct?

DR. OSTADAN: Yes.

Q. And I'd like you to read the paragraph that begins with the number 2-2, Total Settlement. Could you read that to yourself down through and including the table?

DR. OSTADAN: To myself?

Q. Yes, please.

Have you had a chance to read that paragraph?

DR. OSTADAN: Yes.

Q. And I want to read it and tell me if I'm reading it correctly. And Denise, if you want me to start -- if you want me to read the paragraph, I will.

MS. CHANCELLOR: No, that's fine, Mr. Turk.

Q. I think I will read it aloud.

Total settlement. Many structures can tolerate substantial downword movement or settlement without cracking. Table 2-1. However, total settlement should not exceed two inches for most facilities. Am I reading that correctly?

DR. OSTADAN: Yes.

Q. And it goes on to say, "Typical specification of total settlement for commercial buildings is one inch. Item 35."

DR. OSTADAN: Correct.

Q. "Structures such as solid reinforced concrete foundations supporting smoke stacks, silos, and towers can tolerate larger settlement up to one foot." Did I read that correctly?

DR. OSTADAN: That's correct.

Q. And that's what the document says?

DR. OSTADAN: Yes.

Q. It represents a table 2-1, Maximum Allowable Average Settlement of Some Structures. Correct?

DR. OSTADAN: Yes.

Q. And it lists the source for the data.

DR. OSTADAN: Yes.

Q. And it says for plain brick walls, depending on the length and height, either three or four inches of maximum settlement; correct?

DR. OSTADAN: Yes.

Q. A frame structure, maximum settlement that is tolerable would be four inches. Correct?

DR. OSTADAN: Yes.

Q. Reinforced brick walls and brick walls

with reinforced concrete, six inches. And the last item, solid reinforced concrete foundations supporting smoke stacks, silos, towers, et cetera twelve inches.

DR. OSTADAN: Correct.

MS. CHANCELLOR: Could we also see the purpose and scope of this document?

MR. TURK: If we have it here, I will be glad to show it to you.

We don't have the complete document with us, but I can give you the table of contents and represent that the document is publicly available. You can find it after today's session.

MS. CHANCELLOR: I want to know what the purpose and scope is for the context in which you are reading this information about settlement.

MR. TURK: May I proceed with the witness?

JUDGE FARRAR: Ordinarily I would want to resolve this issue right now. But in view of the time constraints, let's leave it pending and we will solve it at a later time.

MS. CHANCELLOR: I'd object to this line of questioning. And not knowing the context, whether the Army Corps of Engineers has any

responsibility for the construction of nuclear or the standards for construction of nuclear facilities.

JUDGE FARRAR: We won't determine at this time what weight to give it until we learn more about it.

MS. CHANCELLOR: That's fine. I just wanted the objection on the record, you Honor.

Q. (By Mr. Turk) Of the different categories of structures referenced in this document, would you agree that the three-foot thick concrete pad or the five-foot thick canister transfer building mat -- it is five feet thick?

DR. OSTADAN: Yes.

Q. Those would represent something on the order of a solid reinforced concrete foundation?

DR. OSTADAN: I'd have to get the table back from you.

JUDGE FARRAR: While the witness is looking, Ms. Chancellor, for the entire course of this questioning, we would ask the witnesses to assume that this document is relevant to present purposes and we will find out later if it is.

MS. CHANCELLOR: That's fine, your Honor.

MR. TURK: The purpose for the questioning is in response to Judge Lam's questions the witness stated that --

JUDGE FARRAR: The purpose of the questioning is fine. It's just that we don't know what this document is now. And we don't want to stop and find out. So go ahead with the questioning. The question sounds perfectly legitimate, but we don't know what the document stands for yet. So we will assume the document is relevant for now.

DR. OSTADAN: Yes. I would like to complete the sentence. Solid reinforced concrete foundation supporting smoke stack, silos, towers.

Q. Those are not nuclear facilities?

DR. OSTADAN: I do not think so.

Q. When you said that two inches would be a significant number in geotechnical practice for settlements, were you referring only to nuclear facilities or geotechnical engineering in general?

DR. OSTADAN: I still believe it is the engineering practice in general, and could also seek Dr. Bartlett's opinion on this.

Q. Dr. Bartlett, do you have an opinion on that?

DR. BARTLETT: Generallly when you look at total settlement, one has to take into account what type of structure or facility. Some are more sensitive to settlement and settlement damage than others. I know for highways, which a lot of my practice has been in lately, that the maximum settlement that we allow for bridges total is one inch. We are a little bit more lenient on our pavement structures; the maximum settlement that we would like to see total is about three inches.

Q. Are either one of you aware of the standard for nuclear facilities; how much settlement is considered to be allowable?

DR. BARTLETT: I'm not.

Q. Dr. Ostadan?

DR. OSTADAN: I'm not.

Q. You are not aware?

DR. OSTADAN: No.

Q. Dr. Ostadan, when did you first begin working on this contention, or its predecessor contention, QQ?

DR. OSTADAN: I think my involvement on this project goes back to 1999. Somewhere in 1999.

Q. And how did you happen to get involved with the contention at that time?

DR. OSTADAN: I knew Dr. Bartlett over the years. We have worked together on a number of projects and he asked for my assistance.

DR. BARTLETT: And he didn't hang up.

Q. Were you involved with geotechnical or seismic matters with respect to this facility's application prior to the filing of Contention QQ?

DR. OSTADAN: Yes, I think I was involved in some other activities.

Q. And you mentioned that you were one of the authors of the contention.

DR. OSTADAN: Yes, I am.

Q. And are you appearing under a contract or agreement with the State of Utah?

DR. OSTADAN: Yes, I am.

Q. And with which office are you contracting with?

DR. OSTADAN: Attorney General's office.

Q. When did you enter into that contract?

DR. OSTADAN: Back in '99.

Q. Isn't that a contract for compensation?

DR. OSTADAN: Yes, it is.

Q. Can you describe the task which you were given under that contract?

MS. CHANCELLOR: Objection. This gets

into attorney/client privilege. I mean, the scope of Dr. Ostadan's work is part of the State's litigation strategy.

MR. TURK: May I respond?

JUDGE FARRAR: Yes.

MR. TURK: We have seen that the witness raises numerous problems with the application. His testimony orally has raised additional problems, and I'd like to establish what is the scope of his work and what is the purpose for his work on behalf of the State.

(Board confers off the record.)

JUDGE FARRAR: Ms. Chancellor, you are representing that the answer to this question will get into privileged matters or work product type matters?

MS. CHANCELLOR: Yes, your Honor. I can represent that Dr. Ostadan was retained by the State to assist it in its litigation efforts. But as to the specifics of the scope of his work, I think that that would get into litigation strategy and attorney work product.

JUDGE FARRAR: We are going to uphold that objection, partly in the interest of time.

MR. TURK: Thank you, your Honor.

Counsel's representation helps me. I would have a follow-up question.

JUDGE FARRAR: Go ahead.

Q. (By Mr. Turk) We will see if this raises an objection. Were you tasked with the chore of reviewing the license application and determining its acceptability?

JUDGE FARRAR: Hold on before you answer. Is that all right?

MS. CHANCELLOR: If this is the last question, that's fine, you Honor.

JUDGE FARRAR: Go ahead and answer.

DR. OSTADAN: I can tell you what I have done. As I indicated --

JUDGE FARRAR: No. Just answer the question. That was a yes or no question.

DR. OSTADAN: To the extent that it relates to the supporting design calculation involving seismic loading, yes.

Q. You were tasked to determine the acceptability of the application?

DR. OSTADAN: No. As I indicated, to the extent that it relates to the seismic design issues.

Q. And in that respect were you asked to

determine the acceptability of the application?

DR. OSTADAN: No. I was not asked to review the acceptability of the application.

Q. There was some testimony earlier with respect to differential settlement of the pad. Do you recall that?

Your Honor, this was the subject of a motion to exclude by the Applicant's counsel yesterday. I don't know if you recall this. The witnesses had been discussing potential bowing or concave effect of the pad with respect to how the casks may move in the event of a seismic event.

JUDGE FARRAR: Right.

MR. TURK: At that time, I offered to you some comments which I believe may have led to an incorrect ruling. I would like to ask a few questions and possibly renew the motion to exclude testimony concerning the differential settlement of the pad as it affects cask motion, cask movement.

JUDGE FARRAR: Right. We denied the motion based, in part, on arguments you made.

MR. TURK: It may have been. I believe I represented that the Staff had filed testimony concerning the settlement of the pad.

JUDGE FARRAR: Right.

MR. TURK: And I further offered the opinion that there was still an issue as to fair notice as untimely raising of the issue.

JUDGE FARRAR: Right.

MR. TURK: And I believe my comments might have been confused. And if I may, I'd like to ask one or two additional questions.

JUDGE FARRAR: Go ahead.

Q. (By Mr. Turk) Dr. Ostadan, you stated you had a role in formulating Contention QQ and particularly with respect to Part D contention? Were you one of the authors of that contention?

DR. OSTADAN: Yes, I was.

Q. Can you find any place in Part D of the Contention that explicitly states the issue with respect to potential concave deformation of the storage pad such that storage casks may not be able to move as freely as if the pad was perfectly horizontal?

MS. CHANCELLOR: I'd object, your Honor. We went through this yesterday. The actual wording, we went through those words.

JUDGE FARRAR: Let me cut you off, in the interest of time. You may be right. But Mr. Turk represented that he was going to add something

to what happened yesterday. So let's see if he does or not.

DR. OSTADAN: The question is can I find the actual wording of dishing shape and so on?

Q. (By Mr. Turk) Anything that specifically mentions that concern within the contention?

DR. OSTADAN: Yes, I can. Where it has been expressed, but not the actual wording of dishing. Section D, Part 1 (C) (iii). The evaluation of coefficient of friction of --

Q. Just a second. D (1)(C)?

DR. OSTADAN: (iii).

Q. These are small i's?

DR. OSTADAN: Right. Do you see the, "Due to local deformation of the pad --"

Q. Yes.

DR. OSTADAN: Okay.

Q. You were also deposed in this proceeding; correct?

DR. OSTADAN: What do you mean by that?

Q. Your testimony was taken in a sworn deposition?

DR. OSTADAN: Yes.

Q. I had occasion last night to review the

deposition transcripts and I saw several instances in which you refer to settlement of the pad. But every instance I found you referring to settlement of the pad, you were talking about settlement as it affects the soil cement adjacent to the pad. That was the subject of the concern you expressed in your deposition. Correct?

DR. OSTADAN: It has been expressed in that context, yes.

Q. Are you aware of any place in your deposition that you raise a concern or expressed a concern about whether or not a concave deformation of the pad may affect the ability of the cask to move freely?

MS. CHANCELLOR: Objection, your Honor. Dr. Ostadan would only express an opinion as to the questions asked of him, and if those questions weren't asked of him it wouldn't necessarily appear in his deposition.

JUDGE FARRAR: That is a good point, but he can still answer. All that means is his answer isn't necessarily determinative. You may answer.

DR. OSTADAN: I don't recall, sir.

Q. In fact, the concern you expressed in your deposition was that if the pad settles by some

number of inches, whether it is two or three or four, that could affect its relationship with the soil cement to the side of it; correct?

DR. OSTADAN: That has been a concern, yes.

Q. And you were asked to identify all your concerns with respect to this contention in your deposition?

DR. OSTADAN: I think I have, yes.

MR. TURK: Your Honor, I believe I may have mislead the Board in its ruling yesterday in that there is no specific mention in the contention of the issue, and there was absolutely no mention of it in the deposition on which the witness was asked to identify each of his concerns. And if counsel for the State is aware of something that I am not after my reading of the depositions overnight, I would ask her to identify them.

JUDGE FARRAR: Ms. Chancellor, the point you were making that I cut you off on before was that if he wasn't asked about it, then not mentioning it wouldn't be conclusive. Now we have in front of us a situation where he was asked or it is represented that he was asked if these were all his concerns. Can you address that?

MS. CHANCELLOR: Well, your Honor, I think that during the deposition, Dr. Ostadan related to Mr. Travieso-Diaz his major concerns, whether he was asked to identify all his concerns because there are so many, whether he actually gave a laundry list and enumerated every single concern, I think that's a different question. The issue, I believe, is squarely within the unified contention. Mr. Turk wasn't present at the deposition. He is just reading the deposition transcript. And I think that this is the issue we hashed out yesterday and that nothing has changed.

JUDGE FARRAR: Mr. Turk?

MR. TRAVIESO-DIAZ: Could I speak? It happens that I took the deposition.

MS. CHANCELLOR: That's correct.

MR. TRAVIESO-DIAZ: And I can be somewhat pedantic. I went point by point, issue by issue, contention by contention, subparagraph by subparagraph --

JUDGE FARRAR: I get the idea.

MR. TRAVIESO-DIAZ: I asked Dr. Ostadan on each of them, "Please tell us what all your concerns are." Not your main concerns, not your leading concerns, not what you are thinking about

today. I asked him all your concerns.

JUDGE FARRAR: Okay. We got it.

MR. TURK: One last note. I may not have been there, but Mr. O'Neill was, and I read the deposition transcript.

MS. CHANCELLOR: And your Honor, when in doubt, let it in.

(Board confers off the record.)

JUDGE FARRAR: As usual, everyone has a point. We're going to adhere to our prior ruling, notwithstanding the new information, Mr. Turk, you've provided here on the theory that, as we said yesterday, there is, in an issue this complex, we think there's enough linkage here. And this also involves areas that the Board asked questions on, so we will deny the motion, Staff's motion and adhere to our prior ruling.

MR. TURK: Thank you, your Honor. In light of that ruling, I have one follow-up question, then I think it would be good to time to take a break.

Q. (By Mr. Turk) Dr. Ostadan, are you aware of how you would calculate the maximum angle of inclination with respect to the settlement that we've been talking about, the two-inch --

approximately 1.7 or two-inch settlement?

DR. OSTADAN: There's no established measure, but I think engineering judgment needs to be exercised. Calculation needs to be put together. I'm not aware of the standard.

Q. In calculating an angle of inclination, would that be the same thing as calculating a deflection angle, do you know?

DR. OSTADAN: I do not know what you're --

Q. Dr. Bartlett, have you ever heard the term "maximum deflection angle" or "angle of inclination"?

DR. BARTLETT: I think I've seen some textbooks report those. As I recall, it would probably be the settlement divided by some footing or some dimension of the building.

Q. I'd like to show you a chart in which we've written out an equation.

Your Honors, I'm not sure if you're going to be able to see this from where you are.

JUDGE FARRAR: We can see it.

Q. This equation is written out as alpha equals the arctan, and then in parentheses 2 inches over 12 inches times 15 feet. Does that represent

to you in your mind the way that you would calculate the angle of inclination or maximum deflection angle?

DR. OSTADAN: That seems consistent with what I've seen before.

Q. And what you have on top, then, is the two inches that's the amount of settlement, correct?

DR. BARTLETT: Correct.

Q. And on the bottom we're converting that to feet so we put 12 inches?

DR. BARTLETT: Correct.

Q. Times 15 feet, which would be the distance from the center of the pad to the outer edge in the smallest direction, in other words, in the 30-foot direction?

DR. BARTLETT: Correct.

Q. And if you did that calculation -- can you do that for me?

DR. BARTLETT: We trust your calculation.

Q. I'm sorry?

DR. BARTLETT: We'll trust your calculation.

Q. The result would be an angle of 0.64

degrees?

DR. BARTLETT: Seems correct.

Q. That would be approximately the maximum angle of inclination that we're talking about here with two-inch settlement, correct?

DR. OSTADAN: You're ignoring one effect, though.

Q. I'm asking Dr. Bartlett.

DR. BARTLETT: I just had a question. In the denominator you had 15 feet?

Q. Yes, that's 15 feet.

DR. BARTLETT: Okay. It looked like inches to me.

Q. I'm sorry. It's difficult to draw on the board. But would you agree, then, that that is the maximum angle of deflection, 0.64 degrees?

DR. BARTLETT: Sure.

Q. Dr. Ostadan, you indicated you were not aware of the formula, but do you have a comment you'd like to make about this?

DR. OSTADAN: A lot of assumptions you have made in this calculation. First of all, you have assumed the cask is loaded uniformly -- I'm sorry, the pad is loaded uniformly. You have eight casks. And the settlement is uniform, and the

middle was because of the distribution is two inches with respect to the edge. They're all great assumptions. I hope that's what happens in the field.

What you ignored, though, as I indicated some time ago, is, as you load these pads, there will be dragging in dishing of the whole ground itself near the pad, and that also would impact the angle of inclination for the pad.

Q. Dr. Ostadan, it was your hypothesis that the pad sags in the middle much like a mattress, correct?

DR. OSTADAN: Yes.

Q. That would give you the maximum deformation at the center of the pad, correct?

DR. BARTLETT: That's correct.

Q. Can I borrow your marker again, please?

DR. OSTADAN: Sure.

Q. I've drawn on the blackboard a highly exaggerated representation of the storage pad mat. You see there's a horizontal distance of 15 feet leading from the edge of the mat on the outside to a center point? Do you see that?

DR. OSTADAN: Yes.

Q. And then from the center point down to

an angle which faces, up two-inch differential, difference of settlement, correct?

DR. OSTADAN: Yes.

Q. And is it correct that the angle, the arctan -- I'm sorry, the alpha, which is equal to the formula we've discussed before, is represented there as the distance -- I'm sorry, as the angle between the horizontal line and the hypotenuse reaching down to a point two inches below the center of the pad?

DR. BARTLETT: Yes, that's correct. May I draw another --

Q. Would it be correct that that's the maximum deformation if there's sagging at the center of the mat?

DR. OSTADAN: No. Let me draw another figure for you, if I may.

Your Honor, looking at one pad being loaded, this is what really you have in the field. This is loaded and it's doing this, as I indicated. And this has not been loaded, let's say. There will be some tilting of this pad simply because this has been loaded.

JUDGE FARRAR: You're going to have to speak up so the reporter can hear you, or carry the

microphone with you.

DR. OSTADAN: Let me repeat again. We have 500 pads here. You look at the cluster of these pads. Suppose the pad I'm referring to, the upper pad, is being loaded and is going under the deformation that counsel here indicated. By virtue of doing that, it will be dragging this pad down as well. The ground is a continuum. The ground as a whole does the dishing action. And then later on you come in and you load this pad. So this is already tilted, and then this is going to see part of this.

So to answer your question is this the maximum, my answer is no.

Q. How far apart are the pads?

DR. OSTADAN: Five feet in the long direction and 30 feet in the transverse direction.

Q. If we're looking at the 30-foot width of a pad, how close is the next adjacent pad to it in that direction? You're indicating 30 feet in the horizontal direction, or is it 35?

DR. OSTADAN: 30, three zero. I may be wrong. It may be 35.

Q. If an adjacent pad is 35 feet away from the pad of interest and it creates a sagging

effect, is that going to affect the edge of pad of interest more or the center of the pad of interest?

DR. OSTADAN: Both.

Q. Which will be affected more?

DR. OSTADAN: There will be -- edge will be impacted more than the center.

Q. In which case the maximum deflection of the center of the pad of interest would be less than a two-inch differential, correct?

DR. OSTADAN: I don't follow you.

Q. If you have an adjacent pad exerting a downwards force, pulling downwards on your pad of interest located at a distance of 35 feet away, assuming you're correct that there is some effect of that adjacent pad, you've testified that that would have the greatest affect on the edge of the pad of interest, not on the center of the pad of interest, correct? That's your testimony?

DR. OSTADAN: That's correct.

Q. If the pad of interest had a two-inch differential due to the loading of that pad with its casks by itself and then was subjected to this additional downward force caused by an adjacent pad 35 feet away, that force would be exerted mostly on the edge of the pad, not at the center of the pad

of interest, correct? That's your testimony?

DR. OSTADAN: The neighboring pad will be tilting. The amount of movement at the edge will be more than the center, but the angle of inclination, if you will, is the same for the neighboring pad.

Q. I don't think you're answering my question. In the case that you describe of the 35-foot distance between an adjacent pad and the pad of interest, are you going to have more than a two-inch deflection at the center of the pad of interest? Yes or no?

DR. OSTADAN: Yes, you would. You have a superimposing effect here. The pad that's being loaded, as you indicated, you calculated as deflecting two inches, now the neighboring pads are being loaded and it's going to drag the pad down.

Q. But you said that it would drag down the edge of the pad more than the center of the pad of interest.

DR. OSTADAN: Yes, but everybody is moving down.

Q. But you understand that the edge of the pad of interest will be affected more than the center of the pad; so, for example, if there was a

half inch additional deflection caused at the edge of the pad of interest, you would have less than a half inch deflection at the center of the pad. Is that correct?

DR. OSTADAN: No, the pad hasn't been loaded. Let me follow the process again on the board.

Suppose you loaded this middle pad, and you have, as indicated, this kind of settlement. These two pads have not been loaded yet. This goes under the settlement. The result of this settlement, these two casks -- pad will be tilted towards the middle pad. They will settle, they will settle more on the edge, less in the middle, less out there, but nevertheless tilted because of this ground dishing.

Then you come in at some time later and you load this pad. And this pad will do what you just said by itself. So you have this plus what has happened before you load it. That's superimposed.

JUDGE FARRAR: Forgive me for interrupting, but it's not additive. It may be superimposed, but it's not additive to the two inches.

DR. OSTADAN: Your Honor, you're asking whether it's linear or not, I suppose. You add them in a linear fashion or not.

JUDGE FARRAR: Maybe I'm missing something here, but it seems almost just like elemental geometry or something.

DR. OSTADAN: Let me go over this again. Suppose we load the middle pad and it goes under --

JUDGE FARRAR: Wait, wait. Let me try to help. We start with testimony that if we have one pad all out by itself, there's a maximum two-inch sag in the mattress, as it were, and that's what you said yesterday.

DR. OSTADAN: Right.

JUDGE FARRAR: And now I still -- I can't figure out how in the last five minutes anything that happens to the edge of any other pad could make the center of that pad's deflection more than two inches.

DR. OSTADAN: Let me explain. As I indicated early on, we didn't get a chance to elaborate more on this sort of regional settlement, if you will. We concentrated on one cask settling yesterday. But as we talk about it now, and let's say this is a settlement profile, one pad being

loaded as indicated here, and this pad has been loaded. Later on, and I don't know the schedule for loading these pads, say a year later or so we come in and load these. These pads will do the same, but in doing so they drag the ground down under them. The settlement of the ground is not limited to the edge of the pad. It has its own dishing action, the mattress effect. It sags part of the ground around this. And therefore this will settle more because this now has been loaded.

JUDGE FARRAR: You're saying this will have an iterative action back on the first pad and make it more than two inches?

DR. OSTADAN: That's correct. And let me -- this is not new, your Honor. If you design pile foundations and talk to the people who design, for example, pile foundations, piles are usually designed in groups. If you have a foundation, you may have four piles or five piles. You have this group effect, because once one pile is loaded it's recognized that it drags the ground down, and the ground around the pile is being forced down, and therefore the pile next to it will be dragged down. And what we do in geotechnical practice when we have four piles, the capacity of four piles is not

equal to four times capacity of one pile because of this phenomenon.

JUDGE FARRAR: But don't we run into kind of like an infinite diminishing series here, that if it was only two inches to begin with, this iterative impact from its neighbor isn't going to be anywhere near two inches, and then that going back on the second one is going to be even -- I mean, you would get rapidly diminishing returns.

DR. BARTLETT: It does diminish, yes.

MR. TURK: Your Honor, one final question.

Q. (By Mr. Turk) Dr. Ostadan, have you reviewed the Geomatrix calculation with respect to settlement of the pads and pad system? I'm sorry, Stone & Webster?

DR. OSTADAN: I think Dr. Bartlett has done that. I have not.

Q. You're not familiar with it?

DR. OSTADAN: I have glanced at it.

Q. But you're not intimately familiar with it?

DR. OSTADAN: No, I am not.

Q. Dr. Bartlett, do you recall if that analysis takes into consideration the effect of the

adjacent pads?

DR. BARTLETT: I don't really recall the details myself. It's been quite some time.

Q. But if it did, that would take care of the concern that Dr. Ostadan is raising now, correct?

DR. BARTLETT: I'm not sure.

Q. Dr. Ostadan?

DR. OSTADAN: Yes.

Q. It would?

DR. OSTADAN: If it's been calculated. I don't think it has.

MR. TURK: Your Honor, I think this is a good breaking point.

JUDGE FARRAR: Okay. I want to thank our reporters for the change on the fly. It saved us a good bit of time. It's 23 minutes of. Let's just take an eight-minute break, everybody be back here at 3:45 sharp and we'll keep going.

(A recess was taken.)

JUDGE FARRAR: Are we ready? Witnesses ready to resume?

DR. OSTADAN: Yes, we are.

JUDGE FARRAR: Ms. Chancellor, do you need a minute?

MS. CHANCELLOR: No, your Honor.

MR. TURK: I'm ready to move on to another subject, your Honor.

JUDGE FARRAR: Okay.

Q. (By Mr. Turk) Dr. Ostadan, you indicated that you're experienced in soil-structure interaction analyses, correct?

DR. OSTADAN: Yes.

Q. In fact, is that basically the bulk of the work that you do?

DR. OSTADAN: Primarily, yes.

Q. Do you observe in your soil-structure interaction analysis work that earthquakes typically involve a number of different frequencies?

DR. OSTADAN: Yes, I do.

Q. How does that work? Can you explain that mechanism to me whereby different frequencies are produced in a seismic event?

DR. OSTADAN: Not sure I understand you well, but let me explain what I think your question is. Earthquake by itself at its own frequency, the wave energies are concentrated, different frequency bands, and depending on the rupture and magnitude of the earthquake and site soil conditions. So

that's one aspect of it.

Then once we have a foundation and a building and a soil independent from earthquake, this becomes a dynamic system and it has its own natural frequencies and frequencies of vibration. If these two frequencies line up, we have resonance amplification; if they don't line up, the resonance effect will be less, and so on and so forth.

Q. For the 2,000-year design-basis earthquake at the PFS facility, are you aware of the range of frequencies that have been calculated to result?

DR. OSTADAN: I think the ground motion goes to I believe 33 Hz horizontal.

Q. That's the maximum?

DR. OSTADAN: It's typically the maximum. Vertical sometimes they go higher, to 50 Hz.

Q. That's not the maximum frequency that would occur in the event, is it, 33 Hz?

DR. OSTADAN: What do you mean by event? Earthquake rupture, you mean?

Q. Yes.

DR. OSTADAN: No. You could have higher frequencies, but typically very high frequencies

have very small energies. So for design calculations we typically stop at 33 Hz.

Q. How high do the frequencies get for the 2,000-year earthquake at the PFS site? Do you know?

MS. CHANCELLOR: Does Mr. Turk have a document? It's a little unfair to ask the witness to remember a number from --

MR. TURK: I don't. And if he doesn't remember, that's a fine answer too.

MS. CHANCELLOR: Okay.

DR. OSTADAN: If you allow me to look at my notes here, I may be more accurate. I think for horizontal they calculate the motion up to 33 Hz, and for vertical is going to 50 Hz.

Q. 50 Hz?

DR. OSTADAN: Yes.

Q. Now, that's the maximum level of frequency that was considered to be potentially structure significant, correct?

DR. OSTADAN: Yes.

Q. But my question was more general. Do frequencies result in an earthquake event such as the 2,000-year design-basis event at the PFS facility in excess of those frequencies?

DR. OSTADAN: There are frequencies. As I indicated, the energy in those frequencies is very low.

Q. And therefore they're not significant for your structural analysis?

DR. OSTADAN: That's correct.

Q. Do you know offhand how high, typically, a frequency could reach? Are we talking about hundreds of Hz?

DR. OSTADAN: No, I don't think we go to hundreds of Hz. In the east coast and depending on the site, if it's a rock site it has a tendency to become higher frequencies. 50 Hz to perhaps 100 Hz is really the maximum.

Q. And what about on the west coast?

DR. OSTADAN: West coast tends to be a lower frequency due to nature of the earthquakes, so I think the practice has been 33 Hz for horizontal has been sufficient.

Q. I'd like to ask you to turn to Figure 17 in Dr. Luk's report. We've been referring to that until now as a state exhibit, but I'd like to hand you what is Staff Exhibit P, which is the complete report, dated March 31, 2002. And I think you'll find Figure 17 has slipped a page. It now appears

on page 34.

DR. OSTADAN: You want me to look at page 34, all right.

Q. Does that appear to you to be the same Figure 17 that you saw in the state's exhibit?

DR. OSTADAN: Seems to be the same.

Q. Which was the report dated March 8?

DR. OSTADAN: Seems to be the same, yes.

Q. Can you tell me what frequencies are associated with the graph shown on that chart?

DR. OSTADAN: Well, that's a very difficult thing to do. This is a time history plot.

DR. BARTLETT: I think there's spectral accelerations, Dr. Ostadan, on Figure 20.

DR. OSTADAN: Actually the plot to the pad is, as indicated by Dr. Bartlett, Figure 20 is a frequency plot or variable plot. So I can look at that and tell you what we see there. For example, if you look at Figure 20b, there's a freefield point response plotted in green and there's a center of the pad response plotted in red, and if I look at .2 second, which is 5 Hz, I have really number close to six and a half g.

So to answer your question is, at 5 Hz

this pad is responding six and a half g.

Q. What are you looking at on these charts? What are points A' and D'?

DR. OSTADAN: Well, A' is defined to be three feet point, D'is defined to be center of the pad. And there's a figure in the report that shows the physical location of these points also.

Q. And how do you calculate frequency? By looking at these charts?

DR. OSTADAN: Yes. You see the horizontal axis is period. Period is equal to one over frequency. So if you -- for example, .2 second is equal to 5 Hz.

Q. So let's start, on the horizontal axis of Figure 20 -- you're looking at 20a, correct?

DR. OSTADAN: I'm looking at page 36, Figure 20b.

Q. I'm sorry, 20b. If you look at the horizontal axis, right after the number zero you see some very high green lines?

DR. OSTADAN: Yes.

Q. How would you calculate the frequency at that point just after zero?

DR. OSTADAN: You have to guess what the period is. For example, if it's .1, it corresponds

to 10 Hz; if it's .05, corresponds to 20 Hz, so on and so forth. You just invert that.

Q. If we start out with -- let's take like a very minuscule number. Let's assume that your frequency is something like let's say .01.

DR. OSTADAN: Okay. That corresponds to 100 Hz.

Q. I'm sorry. The period is .01.

DR. OSTADAN: Right.

Q. Equals?

DR. OSTADAN: Hundred Hz.

Q. And do you believe that's represented on this chart?

DR. OSTADAN: It goes off the chart, goes about 10 g.

Q. This is not a logarithmic chart, correct? It's linear?

DR. OSTADAN: Yes.

Q. So if you had a period of .01, that would be equal to 100 Hz frequency?

DR. OSTADAN: Yes.

Q. And that would be represented on this chart?

DR. OSTADAN: Yes. You can sort of read it from the horizontal axis.

JUDGE FARRAR: Could I -- I don't follow this. It looks to me linearly with my eyeball that at .01 there's no green line showing.

DR. OSTADAN: That's true, your Honor. If you try to read the green line for .01, it's out of the chart.

JUDGE FARRAR: Oh. You're assuming there's green lines off the chart not shown here?

DR. BARTLETT: Goes off scale.

JUDGE FARRAR: Okay.

Q. (By Mr. Turk) It would be so high that it would not even show up on the chart?

DR. OSTADAN: We are saying it exceeds 10 g because the chart goes up to 10 g only.

Q. But Dr. Luk included all the different frequencies in his analysis, didn't he? To your knowledge he didn't exclude anything, really, because it wouldn't be represented on this neat little chart?

DR. OSTADAN: I haven't reviewed his report carefully. I don't think he excluded, but he should not have.

DR. BARTLETT: It's my understanding these are for the 2,000-year return period earthquake, so that was the input to his analyses.

Q. Whatever frequencies would result would be reflected on his analysis, correct, even if it's not represented on this particular chart?

DR. BARTLETT: Not sure I understand that question.

Q. Well, the fact that the green line may in fact extend up above the top horizontal bar on this chart wouldn't mean that the results are going to be included in Dr. Luk's analyses, correct? It's simply going to be represented on this chart?

DR. BARTLETT: Oh, I think so. I think it's just a matter of plotting here.

Q. Okay. So in fact, then, Dr. Luk considered very high frequencies?

MS. CHANCELLOR: Objection, your Honor. The witness has said that he hasn't reviewed Dr. Luk's report in detail.

MR. TURK: I think Dr. Barrett answered the question affirmatively.

MS. CHANCELLOR: Do you mean Dr. Bartlett?

MR. TURK: I'm sorry, Dr. Bartlett. I apologize to you, Doctor.

DR. BARTLETT: Yeah, it seems to be just a plotting thing. I'm not sure where his cutoff

frequency, as we call it, was in his analysis.

Q. (By Mr. Turk) Dr. Ostadan, I'd like you to turn, then, to Figure 17. Can you tell me from looking at that what frequencies were included in Dr. Luk's analysis?

DR. OSTADAN: That's very difficult. You know, you have to -- you have to see the zero crossing on this, measure from one point to other point, and try to guess what the frequency is. I think I can do a better job to answer your question. Go back to Figure, for example, 20b and see what frequency is included or not included.

Q. Well, let me ask you more generally, then. Do you know whether Figure 17 includes high frequencies such as frequencies that would be higher than represented on the chart on 20b?

DR. OSTADAN: I can't make that judgment.

Q. You don't know?

DR. OSTADAN: I do not know.

DR. BARTLETT: It's hard to tell.

Q. Dr. Bartlett, you were present for Dr. Luk's testimony here in this proceeding?

DR. BARTLETT: I was, yes.

Q. And you were present at his deposition?

DR. BARTLETT: Yes.

Q. Do you recall whether he addressed this point as to whether or not Figure 17 includes very high frequencies?

DR. BARTLETT: I think he mentioned there was high frequency components in this, yes. I don't remember the exact number.

MR. TURK: Your Honor, I'd like to distribute a document that's a copy of a portion of Dr. Luk's deposition from this past Saturday.

JUDGE FARRAR: All right. Is this previously in evidence?

MR. TURK: No, your Honor.

JUDGE FARRAR: Do you want it marked?

MR. TURK: Yes, please. This will be Staff Exhibit HH. For the record, let me indicate that proposed Staff Exhibit HH consists of a cover page indicating that it's a deposition of Dr. Luk on Saturday, May 4th, and it further consists of pages 65 to 72 and pages 77 to 104.

(STAFF EXHIBIT-HH MARKED.)

May we go off the record for a moment, your Honor?

JUDGE FARRAR: Yes.

(Discussion off the record.)

JUDGE FARRAR: All right. The reporter's marked this as Staff HH for identification.

MR. TURK: Your Honor, I'd like to ask the witness to turn first of all to page 80 of the deposition. I believe there Ms. Nakahara was asking the witness, Dr. Luk, a line of questions similar to what we were just discussing. Actually, you see her question begins at page 79 when she starts asking Dr. Luk about Figure 20a. And on page 80 she asks him, is it correct that this response spectra shows accelerations in excess of 10 g's just after the zero period. Do you see that question on page 80?

DR. BARTLETT: I do.

Q. And I indicated my thought at that time, saying the plot only goes up to 10 g's; and Ms. Nakahara said, "That doesn't look like it stops at 10 g's." Then the witness is asked to elaborate, and he goes on to page 81. Could you read that answer to yourself, please, continuing on to page 82.

Have you had a chance to review that question and answer?

DR. BARTLETT: I have.

Q. Now, I believe, Dr. Bartlett, you were at the deposition but Dr. Ostadan's testimony addresses the Luk report, correct?

DR. OSTADAN: I think --

Q. I'm sorry?

DR. OSTADAN: Yes.

Q. Dr. Ostadan, at the time that you filed your testimony, had you reviewed in detail the March 8 version of this report or the March 31st version of the report?

MS. CHANCELLOR: Objection. The witness didn't have the March 31 report which we got on April 2 when he filed his testimony on April 1.

MR. TURK: All right. So that answers part of the question. And you reviewed the March 8th report in detail before you filed your testimony?

DR. OSTADAN: As I indicated before, I have not reviewed this in detail.

Q. Is it correct, then, that on pages 81 to 82 Dr. Luk explained that the data represented in Figure 17 is raw, unfiltered data?

DR. OSTADAN: That's what he seems to indicate, yes.

Q. It's his report. He would know,

correct?

DR. OSTADAN: It's his opinion.

Q. That's his opinion about his own report?

DR. OSTADAN: That's right.

Q. You don't think he knows the answer?

DR. OSTADAN: If you want my opinion, I will be happy to share with you.

Q. I'm asking you whether Dr. Luk should be familiar with his own report.

MS. CHANCELLOR: Asked and answered, your Honor.

JUDGE FARRAR: Mr. Turk, I hate to interrupt, but it's not a matter of whether Dr. Luk is familiar with his own report. This is a characterization of something in his report, and it would be better to focus on that rather than ask the same -- we seem to be at an impasse here.

MR. TURK: Thank you, your Honor.

Q. (By Mr. Turk) Now, Dr. Luk also describes the fact that he used only one term, I believe it's misspelled here as t-u-r-n, but the testimony had to do with the fact he used one term of damping. Do you see that testimony near the top of page 81 where he says, we use only the mass proportional damping?

DR. OSTADAN: Yes.

Q. And then he says, we omitted the stiffness proportional damping.

DR. OSTADAN: He doesn't explain why.

Q. But it states that he omitted stiffness proportional damping, correct?

DR. OSTADAN: Yes.

Q. And Dr. Bartlett, you were at the deposition and you heard that testimony as well, correct?

DR. BARTLETT: That's my recollection.

Q. And Dr. Luk also goes on to indicate that when you see a high acceleration value, that's not a real value. Do you see that testimony?

DR. BARTLETT: I think his testimony is that it would be decreased somewhat.

Q. You thought he said it would decrease somewhat?

DR. BARTLETT: Yes.

Q. Okay, we'll come back to that. Dr. Ostadan, you indicated you conduct soil-structure interaction analyses. You also use finite element analysis?

DR. OSTADAN: Yes, we do.

Q. You're quite familiar with that analysis

methodology?

DR. OSTADAN: Finite element, yes, I am.

Q. Do you use two terms of damping when you do your FEA modeling?

DR. OSTADAN: No. I do not typically do nonlinear time history analysis.

Q. So what type of finite element analysis modeling do you do?

DR. OSTADAN: I use my own program SASSI, which is the industry standard for soil-structure interaction.

Q. Is that a linear analysis?

DR. OSTADAN: It is a linear analysis.

Q. Do you use damping in your analysis?

DR. OSTADAN: Yes, we do.

Q. What type of damping do you use?

DR. OSTADAN: Two types of damping. One is the material damping and it's used in the context of what you call complex response method, and there's the radiation damping which is incorporated in the SSI effects.

MR. TRAVIESO-DIAZ: Mr. Chairman, at a convenient point I'd like to make a motion.

Q. (By Mr. Turk) And which of those terms do you use in your finite analysis model?

DR. OSTADAN: None of these terms.

Q. You don't use material damping?

DR. OSTADAN: I do use material damping, but I do not approach it the way it's been approached here.

Q. Do you use radiation damping?

DR. OSTADAN: Yes, I do.

Q. So you include both?

DR. OSTADAN: Yes, material and radiation.

Q. Why do you include both types of damping?

DR. OSTADAN: Because they are both there.

Q. Does that tend to filter out high frequencies?

DR. OSTADAN: Damping tends to do that, yes, sir.

Q. And that's important to you in doing your structural analysis, correct?

DR. OSTADAN: That's correct.

Q. Gentlemen, I'd like to ask you to turn now to page 98, going on to 99.

JUDGE FARRAR: Just a minute, Mr. Turk. Can we -- Mr. Travieso-Diaz?

MR. TRAVIESO-DIAZ: As I said, this can wait but I am troubled because on page 18 of his testimony Dr. Ostadan includes a whole paragraph description of his analysis of the Sandia report.

JUDGE FARRAR: Page what?

MR. TRAVIESO-DIAZ: Eighteen. And I must preface my motion by saying that we're reluctant to make it because I know the board disfavors motions to strike. But I believe that Dr. Ostadan said he has not clearly not reviewed this report. However, there's a whole paragraph of opinions in here. And I think that this paragraph --

JUDGE FARRAR: Where are you?

MR. TRAVIESO-DIAZ: Page 18, last paragraph.

JUDGE FARRAR: Oh, okay.

MR. TRAVIESO-DIAZ: And my concern is that we have potentially a deficiency in the record. The witness has testified he hasn't really reviewed the report, and yet he offers a whole paragraph opinion on it. And again, I apologize for raising a motion that actually I know the Board is in favor. But to me, begin the admission by Dr. Ostadan, his testimony on this last paragraph

lacks credibility.

MS. CHANCELLOR: Your Honor, if I may. There's really one sentence in that paragraph. A lot of it is sort of a buildup to what Dr. Ostadan is getting at. "The Sandia analysis really shows that the pad response accelerations are several times larger than the peak accelerations used by Stone & Webster in its stability analysis." I think that's the crux of what Dr. Ostadan is testifying to in that paragraph, and where he is citing to the Sandia report.

JUDGE FARRAR: Let me ask Dr. Ostadan how -- in your response to counsel's motion, how you reconcile what he thinks he heard you say and I think I heard you say, that you hadn't really looked at this report, with the fact that you're offering testimony on the report.

DR. BARTLETT: Yes, your Honor. Let me explain. If you recall, we discussed our concern when it came to the stability analysis of the pads, and I discussed that for the sake of the canister transfer building the designer used the structural response of the canister transfer building and they went and obtained it from another crew and used it for the stability analysis. For the pad, both ICEC

and Stone & Webster had to guess what is the response of the pad.

JUDGE FARRAR: Wait. This goes to the merits of what you're saying. What I'm wondering, maybe I didn't express it clearly, is, if you said to Mr. Turk you'd never really looked at the report, how could you offer testimony on the report?

DR. OSTADAN: I did say I have not carefully reviewed that, because Mr. Turk indicated he was talking about this damping and stiffness mass proportional. To that extent I'm not familiar with it. But to the extent we were concerned what is that missing design parameter, I was able to quickly find out what is reported here. I'm not quoting a number, I'm just indicating it's significantly larger.

JUDGE FARRAR: On that basis we'll deny the motion.

MR. TURK: Your Honor, I may renew the motion after I finish this line of questioning. It was Mr. Travieso-Diaz's motion, but I intend to make my own after completing the line.

JUDGE FARRAR: Then we'll hear from both of you. Or why don't we hold that motion until

after five o'clock.

MR. TURK: We can do that.

JUDGE FARRAR: Okay.

Q. (By Mr. Turk) Gentlemen, I'll ask you to turn now to pages -- starting on page 98, going down to 99. And could you read that testimony by Dr. Luk to yourselves, please.

JUDGE FARRAR: This is, Mr. Turk, of the deposition again?

MR. TURK: Yes.

Q. (By Mr. Turk) Have you had a chance to review that testimony? Dr. Ostadan, I think it's fairly clear, isn't it, that Dr. Luk indicates there again that he only used single term mass proportional damping, correct?

DR. OSTADAN: That's correct.

Q. He omitted the stiffness proportional damping?

DR. OSTADAN: That's correct.

Q. And he was asked at the bottom of page 98 that if he had put that term in the model would he have damped out higher frequencies, and he answered yes, correct?

DR. OSTADAN: I will answer you, but I would also like to express --

Q. No, I'm just asking your confirmation that this is the testimony given by Dr. Luk.

DR. OSTADAN: Yes, it is.

Q. And then going on to page 99, Dr. Luk indicates that he did a sensitivity study?

DR. OSTADAN: Yes.

Q. To compare cases where he used one term of damping as proportional versus cases where he used both, correct?

DR. OSTADAN: Yes.

Q. And he said that if he used both terms of damping -- and this is at line 11, page 99.

DR. OSTADAN: Yes.

Q. He says, quote -- I'm sorry. Let me read the whole statement. He describes that he went through this comparison using one term versus the case when both terms are used, and he says, "And yes, most of the high spikes that's related to the single term case disappear." He makes that statement, correct?

DR. OSTADAN: Yes.

Q. And then he's asked, as an example would he expect that for .4 -- I'm sorry. At the point for D'. I believe that's a typographical error. It should spell out the word "for." At the point

for D', which is approximately 2.9 g, he's asked, would you expect that to disappear, that high spike; and the answer is yes. Correct?

DR. OSTADAN: Yes, it is.

Q. And Ms. Nakahara questioned him, and she said, "Do you mean disappear or would be reduced," correct?

DR. OSTADAN: Yes.

Q. And he then states, "Maybe I used a nonprofessional term, that it disappears. That means the spike will actually have sizable reduction in amplitude." Correct?

DR. OSTADAN: Yes.

Q. Then Mr. Gaukler clarified and he said, It would be up in the nature of some of the other spikes that you see higher up in the graph, correct? And he answered yes, correct?

DR. OSTADAN: That's right.

Q. In fact, isn't he stating there that with respect to Figure 17, that figure includes the high frequencies which were not damped out?

DR. OSTADAN: That's what he includes.

Q. And that if he used both terms of damping the spikes would disappear so that the chart would resemble more of what is reflected

elsewhere there. All those high spikes would disappear, correct?

DR. OSTADAN: I can't say all those high spikes would disappear, but he indicates it would be less.

Q. Substantially less. Is that how you read his testimony? At first he said it would disappear and then he reduced it somewhat, but initially his reaction was it would essentially disappear?

DR. OSTADAN: It says "actually have sizable reduction in amplitude." That's what it says.

Q. All right. And you can't really understand exactly what he meant by sizable, but those are his words?

DR. OSTADAN: Right.

Q. Now, on at least a half a dozen occasions during your cross-examination testimony I've heard you refer to Figure 17 in this report.

DR. OSTADAN: Right.

Q. Until this examination now, I understand that it's your impression that the -- let's take that high spike that appears at minus approximately 2.9 on Figure 17.

DR. OSTADAN: Yes.

Q. I take it until today it was your impression that that was an actual acceleration that was important to you to consider for structural response. Correct?

DR. OSTADAN: My view of it, yes, that was the peak of the acceleration of the pad.

Q. But that's not your view anymore, is it, having read Dr. Luk's deposition?

DR. OSTADAN: Actually, as I indicated before, I have not reviewed this carefully. I don't form the opinion what the actual number should be, but when I look at Figure 17, if you don't pick the highest peak, there are peaks at 1-1/2 g. To me that's also significant.

Q. And again, high frequencies would not have been damped out in this chart, whether for one spike or for another spike, correct?

DR. OSTADAN: That's what it says, yes.

Q. So you can't tell from looking at Figure 17 whether that's a high frequency indication or some structurally significant acceleration, correct? You can't tell?

DR. OSTADAN: Let me complete my answer.

Q. Well, could you answer yes or no and

then explain?

DR. OSTADAN: No, not on that figure. But I can go to Figure 20b at 5 Hz and it reads 6-1/2 g for the pad. Five Hz happens to be a natural frequency of the foundation. That is also listed in the ICEC results.

Q. All right. Can you tell me what that 6.5 g represents in your mind?

DR. OSTADAN: It represents the response of the pad to a single degree of freedom at 5 Hz.

Q. I'm sorry. Which figure are we on now?

DR. OSTADAN: 20b, page 36.

Q. And where do you see the 6.5?

DR. OSTADAN: I'm reading at .2 seconds it's about six and a half.

Q. Okay. And I'm sorry; could you tell me again what you believe that represents?

DR. OSTADAN: This represents, if you had a single degree of freedom on the pad, its acceleration would have been six and a half g.

Q. Are you aware of Dr. Luk's testimony with respect to whether or not this represents a point for a single node in his finite analysis model?

THE WITNESS: I heard --

Q. So this would represent a single node point, correct?

THE WITNESS: Everything in the finite element is a single node. I do not know the basis for his selection of this node, but the chart indicates center of the pad point D'.

Q. Dr. Ostadan, are you involved in design of nuclear facilities?

DR. OSTADAN: Yes, I am.

Q. Do you design based upon single node points of acceleration? Does Bechtel do that?

DR. OSTADAN: I am not representing Bechtel here.

Q. Well, but you work for Bechtel. I'm asking about your professional work for Bechtel. In your professional work.

DR. OSTADAN: I can give you my opinion if you wish.

Q. Well, can you answer that question whether in our professional work for Bechtel you design nuclear facilities based upon a single node point of acceleration?

DR. OSTADAN: No. I would present all the nodal results and find out, if one is higher than others, I have to find out why.

Q. So you would not expect that PFS should design its facility based upon this single node point of approximately 6.5 g, correct? That would be an incorrect way for them to design their facility, yes or no?

DR. OSTADAN: I think this is very high. I would have explored why is it high or whether other points are less and explain that. It's not presented here. I haven't seen it.

MR. TURK: Can you read back my question, please?

(The record was read as follows: "So you would not expect that PFS should design its facility based upon this single node point of approximately 6.5 g, correct? That would be an incorrect way for them to design their facility, yes or no?")

DR. OSTADAN: I would not take this number and run on this. No, I would not.

Q. And in fact, Dr. Luk in his deposition stated that it would be very dangerous, and that word was used explicitly by Dr. Luk, he said it would be dangerous to design based upon a single node point. Are you aware of that?

DR. OSTADAN: I agree with you. I

haven't read that, but I have no --

Q. But you agree that would be correct, it would be dangerous to design a facility based upon single node point accelerations, correct?

DR. OSTADAN: Especially if it's this high, yes.

MR. TURK: Your Honor, at this point I'd like to offer Staff Exhibit HH into evidence.

MS. CHANCELLOR: No objection, your Honor.

MR. TRAVIESO-DIAZ: None.

JUDGE FARRAR: All right, it will be admitted.

(STAFF EXHIBIT-HH WAS RECEIVED.)

JUDGE FARRAR: Mr. Turk, the reason you're introducing this exhibit is that it goes beyond -- his deposition goes beyond things that he said in his testimony?

MR. TURK: It amplifies, your Honor. He wasn't asked precisely the same questions and did not give precisely the same answers during his testimony.

JUDGE FARRAR: Fine.

MR. TURK: But I think it's important that the specific manners of speech that Dr. Luk

used, for instance, his use of the term "disappear," it's important that that be in the record.

JUDGE FARRAR: That's fine.

Q. (By Mr. Turk) Gentlemen, correct me if I'm wrong, but I believe that the only discussion made in your testimony of Dr. Luk's report had to do with Figure 17. Is that correct?

DR. OSTADAN: That's what's cited in this testimony, yes.

MS. CHANCELLOR: Objection, your Honor. If you look at answer 37 --

JUDGE FARRAR: Yeah, it lists a number of figures, 16, 17, 20, 21, 22.

Q. (By Mr. Turk) I'm sorry. I certainly didn't mean to exclude that. That's the one place in your testimony that you refer to Dr. Luk's report, in that one paragraph?

DR. OSTADAN: Testing my memory now.

MR. TURK: May we go off the record for a moment?

JUDGE FARRAR: Yes, we may.

(Discussion off the record.)

Q. (By Mr. Turk) Gentlemen, I've just gone through your prefiled testimony and the only

reference I can find to Dr. Luk's report is in that paragraph on page 18. Is that consistent with your recollection or understanding of your testimony, or is that the only reference you make to it?

DR. OSTADAN: It seems to be the case, yes.

Q. In that same paragraph you refer to Figures 16, 20, 21, and 22.

DR. OSTADAN: And 17.

Q. And 17. We've discussed 17. I'm looking now at the other figures.

DR. OSTADAN: Okay.

Q. Is it correct that Figure 16 in the report, and again I'm looking at Staff Exhibit P dated March 31, 2002. Figure 16 is a description of the node points. It's entitled the Location Definition of Designation Points. Dr. Ostadan, is it correct that the different points represented by letters on Figure 16 are different than node points --

DR. OSTADAN: Yes.

Q. -- in Dr. Luk's finite element analysis?

DR. OSTADAN: That's correct.

Q. Is it correct also that Figures 20, 21, and 22 also referred to in your report relate back

to those node points? Each of those graphs indicates that it's plotting out acceleration versus the period at various stated node points, correct?

DR. OSTADAN: That's correct.

Q. And to the extent that you refer to these other figures in your testimony on page 18, I assume that what you meant in that regard is to indicate that the Sandia analysis shows that there are some very high accelerations as shown in those figures, correct?

DR. OSTADAN: That's fair to say, yes.

Q. And you further indicate that based on your review of the Luk report you reach a conclusion that therefore the seismic, and I'm quoting here, "Therefore the seismic loads used in the stability analysis by Stone & Webster are not correct and significantly underestimate the seismic loads actually occurring on the pads."

DR. OSTADAN: That's correct.

Q. You use the reference to these figures to support that conclusion?

DR. OSTADAN: That's correct.

Q. These figures and Figure 17?

DR. OSTADAN: Correct. Let me also

indicate that in the response, you're referring to my response to question 37 in my testimony, the immediate paragraph before the last I also cite ICEC calculation to arrive at the same calculation -- conclusion that the loads are not sufficient.

Q. That the Stone & Webster calculations are not sufficient?

DR. OSTADAN: Yes.

Q. But with respect to the Luk report, it's just that one paragraph we've been discussing?

DR. OSTADAN: Right.

Q. Dr. Ostadan, is it your conclusion that Dr. Luk believes there will be a 2.5 g acceleration that would affect structural response at the facility? I assume not any more, not after you've read his deposition and we've had this discussion.

DR. OSTADAN: Based on what he has stated, he implies that it will be less than that. Based on all this discussion he had for damping, he indicates that if he takes additional measures the acceleration will be less.

Q. And one last question on this point. Dr. Ostadan, you have not done a finite analysis with respect to the PFS site, have you?

DR. OSTADAN: No, I have not.

Q. And you have not done a soil-structure reaction analysis with respect to the PFS site?

DR. OSTADAN: I have not.

Q. Dr. Ostadan, earlier today you indicated that in your view the use of a single set of time histories is inconsistent with NRC regulatory guidance. Is that correct?

DR. OSTADAN: My interpretation of the NRC regulatory guidance, yes.

Q. I'd like to show you a document that has been admitted into evidence as Staff Exhibit C. This is the consolidated SER. I don't have copies to pass out, but this was prefiled. And I'm going to show the witness the bottom of page 5-13 going on to the top of page 5-14?

MS. CHANCELLOR: I don't have my copy.

MR. TURK: You're welcome to read with us, Denise. I'm sorry for the inconvenience.

JUDGE FARRAR: This is prefiled with seismic or with aircraft?

MR. TURK: Aircraft. It was the first exhibit we submitted in the safety hearings. If you don't have it handy, I'll read the statement into the record once the witness has read it.

MS. CHANCELLOR: Okay. May we go off the record?

(Discussion off the record.)

JUDGE FARRAR: Let's go back on the record, see if we can proceed at this point, and if they need more time to review it, they can.

Go ahead, Mr. Turk, ask your question and see where it takes us.

MR. TURK: With your permission, your Honor, I'll share the book with the witness.

Q. (By Mr. Turk) Is it correct -- I'm going to read this into the record, and tell me, if you would, if I'm reading this correctly. This is a description of the canister transfer building review, correct?

DR. OSTADAN: Correct.

Q. And at the bottom of page 5-13 it discusses the fact that details of the development of the artificial time histories were based on a near-source reporting of a normal faulting earthquake in Irpinia, Italy. They give you the citation of Geomatrix.

DR. OSTADAN: Yes.

Q. (By Mr. Turk) And then I'm going to quote, These time histories were then scaled to the

2,000-year return period design response spectra using both frequency and time domain approaches. The resulting time histories were shown to satisfy the requirements of Section 3.7.1 of NUREG 0800, NRC 1989, and ASCE 4-86 American Society of Civil Engineers, 1986 in terms of the statistical independence of the time histories, envelopment of the shock spectra and the power spectral density levels. The analysis is documented in calculation 05996.02-G(PO18)-3, and again a Geomatrix citation. Did I read that correctly except for my summary of the citation?

DR. OSTADAN: That's correct.

Q. So is it correct, then, that the Staff has concluded that with respect to the canister transfer building the Applicant has satisfied the regulatory guidance in Section 3.7.1 of NUREG 0800?

MS. CHANCELLOR: And ASCE 4-86.

MR. TURK: That's correct, yes.

DR. OSTADAN: No, I think you need to expand your question. What has been stated here, that the Staff has agreed that the requirement of NUREG 0800 and ASCE 4-86 in terms of statistical independence of time histories, envelopment of the shock spectra and the power spectral density

levels. That's the statements.

Q. Okay. Now, we were talking before about Section 3.7.1 of the regulatory guidance, correct?

DR. OSTADAN: Yes.

Q. And do you recall we were talking about the two options mentioned there, and that was using either a single time history or multiple time histories?

DR. OSTADAN: Yes.

Q. Do you have a copy of that regulatory guidance here, or do you want to share again?

DR. OSTADAN: I'll share.

MR. TURK: And your Honor, for information, this is a Staff exhibit.

MS. CHANCELLOR: DD.

DR. OSTADAN: Thank you.

Q. (By Mr. Turk) Commencing page 1 there's a discussion of design ground motion, and it goes on to discuss the design response spectra and then the design response -- I'm sorry, the design time history. And in the section for design time history starting on page 3.7.1-2, Dr. Ostadan, again, am I reading this correctly? It states, "When time history analyses are performed, either of the following options may be considered. In

either case the time histories may be real or artificial." Did I read that correctly?

DR. OSTADAN: Yes.

Q. And then it goes on to give you two options, correct?

DR. OSTADAN: Yes.

Q. And it gives you option number one, single time history?

DR. OSTADAN: Yes.

Q. And option two, multiple time histories?

DR. OSTADAN: That's correct.

Q. Now, I believe it was your testimony that when you have a nonlinear analysis you should be using only option 2, multiple time histories?

DR. OSTADAN: That's correct.

Q. Can you find anything in this section that indicates that for nonlinear analysis only option 2 should be utilized?

DR. OSTADAN: Okay. Under option 2, second paragraph, in some instances a nonlinear analysis of structure, system and components may be appropriate in the evaluation of existing structures, et cetera. And then the next sentence, multiple time history analysis incorporating real earthquake time histories are appropriate when such

analyses are performed."

Q. Let's focus on a few of the words that you just read. It begins by stating "in some instances," correct?

DR. OSTADAN: Correct.

Q. It doesn't state in all instances. Do you agree?

DR. OSTADAN: It does not state that.

Q. And then it goes on to say that in those instances, those some instances, the use of a nonlinear analysis may be appropriate. Correct?

DR. OSTADAN: That's true.

Q. It doesn't say is necessary or required or mandatory or anything along that line, correct?

DR. OSTADAN: That's correct.

Q. And the example they give in the guidance as to when you would use multiple time histories for a nonlinear analysis, they say e.g., for instance, the evaluation of existing structures, close parentheses, correct? They give that as an example.

DR. OSTADAN: It's an example.

Q. That example doesn't apply here, does it?

DR. OSTADAN: No, it doesn't.

Q. And there's nothing else that indicates a mandatory requirement or guidance to say that only a multiple time history can be used if you're doing a nonlinear analysis, correct?

DR. OSTADAN: There's one more thing.

Q. Are you looking at the regulatory guide that I'm looking at?

DR. OSTADAN: No, I'm looking at ACSE 4-86.

Q. Oh. Let me come back to your point, or Ms. Chancellor can do that later.

MS. CHANCELLOR: But you haven't given him a chance to review all of NUREG 0800. You just had him look at areas of review. There's also a section here on acceptance criteria. So I think it's unfair for you to just cherry pick from NUREG 0800.

DR. OSTADAN: If the witness would like to read the other section, I have no objection.

MR. TRAVIESO-DIAZ: May I have clarification of counsel's objection? Is she referring to the entirety of NUREG 0800?

MS. CHANCELLOR: No, I'm referring to the exhibit. Mr. Turk was referring to review responsibilities. The next section is acceptance

criteria. And what he's doing is just picking out certain sections of this document without letting the witness examine the entire document and give him his view on the entire document, not just on a portion of it.

JUDGE FARRAR: The entire exhibit, not --

MS. CHANCELLOR: Excuse me. The entire exhibit.

MR. TURK: I have no objection to that, your Honor. We did have some time off the record where I thought there was time for reading, but I have no objection if the witness wants to look at the rest of Exhibit DD.

JUDGE FARRAR: All right, let's --

MR. OSTADAN: I found this part, and may I read that? On page 3.7.1-7 there's a description of multiple time histories, the review capacity. Let me read the third paragraph. "The review of real time histories used in the nonlinear analysis is conducted on a case-by-case basis. Some of the specific items of interest are number of time histories, frequency content, amplitude, energy content, duration, number of ground motion cycles, and the basis for selection of time histories."

Q. Is that the part you want to focus on?

DR. OSTADAN: Yes.

Q. Thank you. In that section you just read, did you find anything of a mandatory nature that states that multiple time histories shall be used or must be used?

DR. OSTADAN: He indicates it will be reviewed on a case-by-case basis.

Q. Thank you. Dr. Ostadan, in your work at Bechtel are you involved at all in demonstrating compliance with Section 3.7.1 of this regulatory guide?

DR. OSTADAN: Yes. I deal with that quite a bit.

Q. And your role is with respect to providing soil-structure interaction analyses?

DR. OSTADAN: Correct.

Q. But you don't make the ultimate determination as to whether one time history or more than one time history should be used? Someone else in Bechtel would make that decision when you're involved in a project?

DR. OSTADAN: I don't know we have a decision making process for selection of how many time histories. I can tell you when there are

nonlinearities involved there will be multiple sets of time histories.

Q. But you're not involved in making the decision whether that's the approach to follow or not; correct?

DR. OSTADAN: I am one of the members who discusses that, along with the seismologist and structural engineers.

May I offer another explanation, or is not appropriate? I don't know.

Q. If you don't mind, I'll continue to ask questions. If there's a point that Ms. Chancellor needs to make in redirect, she can always do that.

JUDGE FARRAR: But since we won't get to that for some time, the witness can go ahead if there's something right on this point that he wanted to add.

DR. OSTADAN: Yes, your Honor. The citation I just read in Section 3.71 clearly indicates that the review of the time histories indicated that three requirements of SRP and ASCE 4-86 were met. These three requirements were clearly indicated what they are.

However, I would like to refer you to ASCE 4-86, Section 3.2.3 -- I'm sorry, Section

3.2.2.3 under Nonlinear Methods, under item (d), and I read now. "In general, more than one set of acceleration time histories, meeting the requirements of Section 2.3, should be used, and the results of analysis shall be averaged."

Q. (By Mr. Turk) Are you reading from the document that we provided to you?

DR. OSTADAN: Yes, ACSE 4-86.

MS. CHANCELLOR: Your Honor, this is also State's Exhibit 118 from ASCE 4-98 section number, and the wording is exact as to what Dr. Ostadan read from ACSE 4-86.

JUDGE FARRAR: All right.

MR. TURK: I'd like to come back to this later, your Honor. I haven't had a chance to read it myself. I've given the witness my copy.

Q. (By Mr. Turk) Dr. Ostadan, are you familiar with how other architect engineer firms utilize time histories when they submit applications on behalf of nuclear facilities?

DR. OSTADAN: As I indicated, most of these analyses are based on linear analysis, and they always use one set of time histories, which is allowed for linear analysis.

MR. TURK: I'm sorry, your Honor, for

the pause. I'm looking to see which of these questions need to be asked today. I'm skipping around off the cross-examination plan.

JUDGE FARRAR: All right.

Q. (By Mr. Turk) Dr. Bartlett, I totally forgot to ask you any questions. I'm sorry.

DR. BARTLETT: No problem.

MR. TURK: Your Honor, I was hoping to complete with Dr. Ostadan, but I won't be able to do that today. So unfortunately I'll have to expect the witnesses to come back on this panel.

Q. (By Mr. Turk) You've mentioned in your professional qualification statement and earlier that you worked at Savannah River.

DR. BARTLETT: That's correct.

Q. And you were involved with the high-level waste stored in silos, I believe?

DR. BARTLETT: The facility that I was involved with is underground storage tanks of high-level waste.

Q. Was that liquid storage?

DR. BARTLETT: Yes. I had it described to me as somewhat the consistency of Vasoline. If that's a liquid, I guess.

Q. In the event of a rupture of that tank,

I take it the radioactive contents could be spilled?

DR. BARTLETT: They -- it was below ground storage, so it would seep into the soils and groundwater. That was the primary concern.

Q. And for that reason, because it was liquid and because the tank was above ground and it tipped over and ruptured, resulting in a release, is that a reason that went into deciding to store them underground? Do you know?

DR. BARTLETT: I really don't know. I think Savannah River from its inception put everything underground as much as possible, or constructed sometimes at ground level and a berm built around it, as I recall, either of those two methods. But I just really don't know. I think they chose that to, you know, obviously prevent at least -- not prevent but reduce the potential for release and used also the mass of the soil for shielding.

Q. You also were describing the Diablo Canyon application for an ISFSI.

DR. BARTLETT: Yes.

Q. I believe you expressed your opinion that the fact that they had a seven and a half foot

concrete pad embedded in rock seemed to you to be a good solution. I take it you're talking about the potential for a seismic event occurring?

DR. BARTLETT: I think, as I recall the discussion was, is what are the consequences of anchoring a cask that would -- like Diablo Canyon chose to do. That would cause more problems with overturning and uplift because you've anchored, and it seems that Diablo Canyon has chosen to resist those extra overturning and uplift forces due to the anchorage of the casks by embedment seven and a half feet, as I recall, in bedrock.

Q. Has that application been reviewed by the NRC Staff yet or by the Commission itself?

DR. BARTLETT: As I understand, it's still in the submittal process. I'm not sure its status.

Q. So we don't know whether the design will be accepted by the NRC?

MR. BARTLETT: No, I don't know those details.

Q. Or if some modifications in that design would be required after NRC staff review?

DR. BARTLETT: Yes. I don't know those details.

Q. Are either one of you familiar with the Waterford nuclear power plant?

DR. BARTLETT: I'm not.

DR. OSTADAN: I'm not.

Q. Are either one of you aware of the soil conditions in the New Orleans, Louisiana area?

DR. OSTADAN: I'm not.

DR. BARTLETT: I'm not, but given its location, I could probably guess.

Q. Well, would you guess --

MS. CHANCELLOR: Instruct the witness not to guess.

DR. BARTLETT: Well, I doubt there's much bedrock there.

Q. I think you're probably right. If I said to you bedrock might be as much as 500 feet below surface, would that surprise you?

DR. BARTLETT: That wouldn't be surprising.

Q. Would that be consistent with your general understanding of that area?

MS. CHANCELLOR: I'd instruct the witnesses not to --

MR. TURK: I wouldn't ask him to guess, but I'd ask if he has an understanding of that

nature --

JUDGE FARRAR: If you have an awareness, fine, but don't speculate on what you think might be --

DR. BARTLETT: I would suspect bedrock would be at some depth below the ground surface. What depth I don't know, but could be considerable.

Q. A substantial depth below surface?

DR. BARTLETT: Could be.

JUDGE FARRAR: We've probably gotten as much as we can of this witness on that point.

MR. TURK: Thank you.

Q. (By Mr. Turk) Are you aware of the design of the base mat at that facility?

DR. BARTLETT: I'm not aware of the facilities. I don't know anything about it.

Q. If I refer to --

MS. CHANCELLOR: Objection.

MR. TURK: Well, I'm trying to test his recollection. If I use a term and he recalls it, then maybe we can establish something. If not, we can't.

MS. CHANCELLOR: The witness is unfamiliar with the facility, he's unfamiliar with the soils. To put a hypothetical or to test his

recollection is a nullity in this instance.

JUDGE FARRAR: Yes, he's about as unfamiliar with this as he can be.

DR. BARTLETT: I know --

MR. TURK: We're not in Louisiana.

DR. BARTLETT: I know where Louisiana is.

JUDGE FARRAR: I lived there for several years, Mr. Turk. I'll be happy to take the stand.

MR. TURK: For the record --

DR. BARTLETT: I'll vacate my position.

MR. TURK: For the record, it was the very first proceeding that I was involved in many years ago, and I remember --

MS. CHANCELLOR: Your Honor, could we take a break so that Dr. Ostadan doesn't miss his plane?

MR. TURK: That's fine, your Honor.

JUDGE FARRAR: Dr. Ostadan, we extend to you the same courtesy as the other witnesses, so if you -- knowing what the airport situation is, we'll be happy to excuse you at this time. Look forward to -- thank you for your contribution so far, and look forward to seeing you at a future time.

DR. OSTADAN: Thank you, your Honor.

JUDGE FARRAR: Do we want to continue with Dr. Bartlett for a few minutes, or do we have motions we can deal with?

MS. CHANCELLOR: Could I have a couple of minutes? I want to make sure Dr. Ostadan doesn't escape without --

JUDGE FARRAR: Yeah, let's take a -- like a five-minute break.

MR. TRAVIESO-DIAZ: Mr. Chairman, may I suggest, it's not my witnesses, but it may be unfair to Dr. Bartlett, since they are co-sponsors to testimony to testify alone on things I think that Dr. Ostadan might know.

JUDGE FARRAR: Well, we can -- there may be some areas we can cover. If not, we'll do procedural things. But let's give Ms. Chancellor a chance to work with her witness.

(A recess was taken.)

JUDGE FARRAR: Let's see where we are. We've finished nine days of seismic issues, and according to my score card, we've finished six panels, we've got an incomplete on two panels, and you all were going to stipulate as to the Solomon testimony.

MS. CHANCELLOR: We're not there on that

one yet, your Honor.

JUDGE FARRAR: Okay. So we've got -- even if we throw that in, we don't have our nine panels in nine days, so we're falling behind. Not sure it's anyone's fault.

Saturday we're going to do two panels and finish them?

MR. GAUKLER: The idea is to do the two panels Saturday/Monday morning.

JUDGE FARRAR: Okay.

MS. CHANCELLOR: I think Ms. Nakahara believes that she will take longer than she anticipated with Dr. Cornell, and we'll do our best to see where we can get.

MR. TURK: I frankly don't think it's realistic. I don't see how we'll finish two panels in a day and a half. I mean, it goes to the heart of the case on the exemption. Unless the State doesn't intend to do much cross-examination, which I can't tell.

MS. CHANCELLOR: Your Honor, all we can do is say that we will work towards meeting the Staff's schedule, because we understand Dr. McCann has limited availability. We're willing to do our best.

JUDGE FARRAR: I'm not talking about that. I'm just trying to get an idea of how -- we know where we stand and so forth.

MR. TURK: For planning purposes, I think realistically we should expect to take all Saturday and Monday on those two panels, and then go to aircraft Tuesday and Wednesday.

JUDGE FARRAR: But we're going to -- Mr. Gaukler?

MR. GAUKLER: That would present a problem in completing aircraft crashes, given my understanding on the availability of Lt. Col. Horstman.

JUDGE FARRAR: Do they fly here, Southwest?

MR. GAUKLER: He flies Southwest, yes.

JUDGE FARRAR: No, do they fly here?

MS. NAKAHARA: Oh. They do fly here, but Col. Horstman is not based out of Salt Lake so he has to fly to the location that he's going to fly out of.

MS. CHANCELLOR: I suggest we see where we are on Monday lunch.

JUDGE FARRAR: Who does Dr. McCann work for?

MR. GAUKLER: The Staff.

JUDGE FARRAR: Is he an employee? He's not an employee?

MR. TURK: No, he's head of his own company and he's giving us consulting services. He was involved a couple years ago with the seismic hazard analysis for us, but he's not employed by us or somebody whose time would be controlling us.

JUDGE FARRAR: Okay. Well, let's just keep plugging.

A couple of the witnesses have used the term "capable faults." As far as you know, are they using those in their own context or in the NRC definitional context?

MR. TURK: I don't think we know.

MS. CHANCELLOR: Dr. Bartlett may be able to answer that.

DR. BARTLETT: Your Honor, I can't remember what the NRC definition is of capable fault. We would call it an active fault.

JUDGE FARRAR: But this is like the disability laws, every law defines it differently. The whole point of my question was, did everyone concede that if a witness uses "capable," that that's capable within the NRC definition? I take

it the answer is no.

MR. TURK: Unless we've established it through the witness, we can't assume that that's what they mean. There is a colloquial sense to it.

JUDGE FARRAR: Right.

MR. GAUKLER: It's not an issue that's subsumed within the PFHA that everybody --

JUDGE FARRAR: I just wanted -- because I remember the old days there is a definition, and sometimes it's crucial. I didn't know if everyone had agreed that the definition -- okay, so we'll just bear in mind when we get to that we'll have to deal with it.

There was an Exhibit GG, Staff GG, the minutes of Dr. Luk's meetings with his advisory panel. Has the State had a chance to think about that yet?

MS. NAKAHARA: Yes. We may have questions, but we have no objection to the admission of that.

JUDGE FARRAR: Okay, then we'll admit that.

(STAFF EXHIBIT-GG WAS RECEIVED.)

JUDGE FARRAR: Are there any other -- oh. You all were going to -- the people over here

were going to -- or had mentioned wanting to move to strike portions of Dr. Ostadan's testimony. Is that something we could --

MR. TURK: We could do that now.

JUDGE FARRAR: We could probably excuse Dr. Bartlett.

MS. CHANCELLOR: I may need him for the argument.

JUDGE FARRAR: No, no, I mean -- oh.

MS. CHANCELLOR: I mean on the motion.

JUDGE FARRAR: Does he need to advise you, or do you need him to speak to it -- or need him to testify?

MS. CHANCELLOR: I'd like to put Ms. Nakahara on the stand, actually.

JUDGE FARRAR: Everyone should have a turn.

MS. CHANCELLOR: Just as an advisor, I think.

JUDGE FARRAR: What I meant was, contrary to what I might have indicated before, it's probably not good practice to try to continue with half of a panel. I thought we might get some work done. But on second thought, no.

Then let's hear the motion, and

Dr. Bartlett, you can stay in that chair or move to Ms. Chancellor's side, depending as circumstances warrant.

MR. TRAVIESO-DIAZ: May I?

JUDGE FARRAR: Yeah. You had mentioned a motion which we had denied based on what was in front of us at the time, but now there's -- Mr. Turk had indicated there would be more in front of us. So why don't the Applicants speak first, then the Staff, and we'll see where we are.

MR. TRAVIESO-DIAZ: First, to clarify for our movement to strike. I am not moving to strike the first sentence of that paragraph.

JUDGE FARRAR: Okay, what paragraph are you talking about?

MR. TRAVIESO-DIAZ: We're talking about the last paragraph on answer 37.

JUDGE FARRAR: Okay. That's on page 18?

MR. TRAVIESO-DIAZ: Correct. The first sentence clearly does not deal with the Sandia report, but the rest of the paragraph does. Let me explain to you why I make the motion, and as I said at the beginning, I'm very reluctant because I know that the Board doesn't favor motions to strike. But I think in this case this goes to integrity of

the process here.

If you recall, when I began questioning the witnesses I asked them, contrary to my normal practice, whether they had reviewed the testimony proffered by other witnesses in this case to see if they wanted to make changes to their testimony. The reason why I did that is, I have found the testimony in this paragraph to be totally inconsistent with the clear testimony of Dr. Luk, both in his deposition and on the stand. And as I continued to ask questions to Dr. Ostadan that related to this paragraph, and this was over the course of two days, he continued to make statements and take positions that were inconsistent with the statements that were in the report.

I couldn't understand why he was doing it, but of course every witness is entitled to his views and his opinions. But when I hear him say that he's not familiar with the report, I am presented with a situation that a witness is giving testimony on something he hasn't really read, maintaining his position and arguing about it over the course of two days, and I think that that leads to a record that is unreliable if you're going to rely on his answers, and a situation which I don't

think should be tolerated.

If the witness didn't really read the report, he shouldn't provide testimony on it. And in particular when I asked the witness whether he would want to make a change based on what has been testified to, it wasn't as if he had not been put on notice that there was something potentially wrong with the testimony.

To give you further background, the week after that report Dr. Ostadan had reports on another state witness, Dr. Mitchell. At the beginning of the deposition I noticed that a document that I was going to ask him questions about had a paragraph that was clearly wrong. And I said, Dr. Mitchell, will you look at the testimony and see if you still agree with what you said. And he told me, quite frankly, that he liked the new information that had developed, he wanted to change his answer. And I figured that this today, yesterday or today will be an opportunity for Dr. Ostadan to do the same thing.

I am quite frankly personally appalled that he didn't take this opportunity, but perhaps he didn't understand. And that's what I'm going to, the inconsistency between his testimony and the

report. And that leads me to believe that in fact he's honest when he said he's never read it, which means that the testimony that he gave, both in writing and verbally, is totally unreliable, and that's why I feel compelled to move to strike.

JUDGE FARRAR: Mr. Turk, you had indicated you might want to make your own motion.

MR. TURK: Yes, your Honor.

Mr. Travieso-Diaz has repeatedly referred, or not repeatedly, but on several occasions referred to 10 CFR Section 2.743, which is the regulation governing admission of evidence. Under 10 CFR Section 2.743C, admissibility of evidence, "The Commission has established as a standard that only relevant material and reliable evidence which is not unduly repetitious will be admitted."

I think the questioning by Mr. Travieso-Diaz and by myself established very clearly that the witness was not familiar. I think in his own words, he had not reviewed it in depth or he had not reviewed it in detail with the report by Dr. Luk. In cross-examination his understanding of that document was shown to be incorrect. And I think therefore the testimony that he proffered in

which he says that the report by Dr. Luk shows something is not reliable, and on that basis it should be excluded.

JUDGE FARRAR: Ms. Chancellor?

MS. CHANCELLOR: First of all, your Honor, I think you have to look at the context of answer 37. Answer 37, the whole crux of answer 37 goes to Stone & Webster's use of peak ground acceleration for the sliding analysis, and we make the point that peak ground acceleration has nothing to do with the cask and pad response because it doesn't consider resonance.

So what we are -- what we are doing is we're looking for missing acceleration. And the only thing, as Dr. Ostadan testified, the only thing that was available where something showed acceleration of the pad was the Luk report, in particular, Figure 17. He took Figure 17 at face value. It -- one nodal point is better than none when you're looking for missing acceleration, and it wasn't until Dr. Luk's deposition on Saturday that all these qualifiers came out as to what was at issue in Figure 17.

Furthermore, in Dr. Luk's testimony he said, "Other than Figure 17, the report has no

accelerations in the horizontal direction on the bottom of the cask on the 2,000-year event, and he couldn't quantify the maximum accelerations in the horizontal direction for a 2,000-year at the base of the cask."

So it is unfair to expect Dr. Ostadan to quantify the accelerations based on the Luk report. What Dr. Ostadan is doing is looking at the Luk report to explain why these missing accelerations are important and why you can't use peak ground acceleration, because that's taken in the free field and it doesn't show the interaction response of the structure, so you have missing accelerations. And that is why he refers, Dr. Ostadan refers to these various figures of the Luk report.

Dr. Ostadan is very bright, he is quite capable of looking at those graphs to see what it is they mean. It is correct that he did not review the report in detail, and he did agree that the accelerations may not be as great as indicated in the Luk report, but he doesn't -- he doesn't rely on a particular number in the Luk report, just says the Sandia analysis clearly shows that the pad response acceleration is several times larger than

the peak acceleration used by Stone & Webster in its stability analysis.

So in other words, this missing acceleration that Dr. Ostadan is looking for to show that PGA is the wrong acceleration to use in the sliding analysis of the pad can be gleaned from the Sandia report.

Now, whether Mr. Turk thinks that the Sandia report doesn't stand up, that's a different matter. But for purposes of illustrating Dr. Ostadan's concern with the use of peak ground acceleration by Stone & Webster in the sliding analysis, this is relevant and on point.

MR. TRAVIESO-DIAZ: Mr. Chairman --

JUDGE FARRAR: I'll hear from you both again in a minute.

(The Board confers off the record.)

JUDGE FARRAR: Counsel for the Applicant and Staff, if you would address a couple of things when we hear from you again. 2.743C, if I recall correctly, simply mirrors the Administrative Procedure Act. It's a general truism that we would follow even if it weren't written. I'm wondering how much it helps us. Obviously if you're faced at the outset with evidence that's unreliable, and

we've talked about hearsay, whether it's documented or a witness whose testimony from the outset is unreliable, obviously you don't admit it. So we clearly have no quarrel with the regulation.

The issue here, though, I -- there are two things at work. One, I thought we gave Dr. Ostadan a chance to reconcile what appears in this paragraph that we're arguing about with what he said today, the degree -- which comes down to the degree to which he read this report. So we need you to deal with that.

Second, to the extent that you think your cross-examination got him to change his views or not to change his views or to say things that you think are wrong, we don't view that as ordinarily a reason to strike a person's testimony, and the entire record reflects what, if any, weight to give it. So can you address our thoughts on why the remedy here should be striking the testimony rather than reading it in the context of the entire discussion that's gone on today?

MR. TRAVIESO-DIAZ: If I may. First I want to make an additional point that Ms. Chancellor's argument totally misses.

JUDGE FARRAR: Wait, wait. Totally

misses?

MR. TRAVIESO-DIAZ: Totally misses what we're trying -- what this motion is about. She was arguing as to what the substantive point of this paragraph was. That's not the reason why I make the motion. My reason was that it's not that the testimony has been discredited, which I believe it has. It is that this testimony that the witness admitted ultimately, that it was based on a document that he had not reviewed. And this is not a question of hearsay as we're asking Dr. Ebbeson, how you found information on the cranes. That is a different problem, how you establish the reliability of the basic underlying information that was relayed.

JUDGE FARRAR: Well, wait a minute. He didn't say he hadn't reviewed -- here's my characterization of what he said, and I'm -- my characterization may be wrong. But I think he said, I got it, I glanced at it, and I read -- you know, glanced at it to the extent I thought I needed to at the time; and then when you pinned him down you may well have discredited some of the conclusions he drew based on that glancing.

But to me, your point earlier about the

integrity of the system, obviously if someone comes in here and says, I looked at something, or I was present at the deposition, I, you know, they weren't present, you know, something that goes to the, as you call it, the integrity of the process, that's one thing. But all of us have been in a position where there's too much to read so you read what you think you need to at the time, and then later you may wish you'd read it a little more carefully. Isn't that the situation we have here?

JUDGE LAM: As a matter of fact, I had heard Dr. Ostadan responding to Judge Farrar's question was that he had not carefully reviewed the report. I don't think I heard him saying he had not read the report.

MR. TRAVIESO-DIAZ: I don't recall, of course, the precise words that he used, but the number of questions that were asked of him after the one that was made by Dr. Turk could have allowed him to explain the extent of his review.

My concern is that there are a number of very specific, direct statements of fact that are made in this paragraph that I don't believe that, even if Dr. Ostadan had given some review of the report, could not support the statements that he's

making. Again, as I said, it is not my concern whether --

JUDGE FARRAR: Well, let's take, for example, what may be the next to the last sentence which, you know, the Sandia analysis clearly shows it. Well, if I glance at that graph, it does clearly show it. When somebody explains it to me, then no, it doesn't clearly show it.

Isn't that what we're dealing with here? You look at the graph and there are these peaks. So to me, that clearly shows something. But now when I get into it a little more and someone explains it to me, says, oh, no, I should disregard those peaks.

MS. CHANCELLOR: But your Honor, Dr. Ostadan would contend that even if the peak was at a half, 1.5 g, it would clearly show it.

JUDGE FARRAR: That's the merits.

MS. CHANCELLOR: Okay.

JUDGE FARRAR: And that's where -- that gets to the merits of what he said up here.

MS. CHANCELLOR: On the stand.

JUDGE FARRAR: On the stand. And I remember that. But I think the motion is based on if he had really studied this report, he wouldn't

have made that statement. But that doesn't show that there's a lack of integrity in that statement at the time he made it.

MR. TRAVIESO-DIAZ: Excuse me. When I used the word "integrity," I wasn't accusing him of lack of integrity.

JUDGE FARRAR: I know.

MR. TRAVIESO-DIAZ: I said integrity on the record, which is something else.

JUDGE FARRAR: Right.

MR. TRAVIESO-DIAZ: As I read the statements, a person who made a superficial review, as it indicates, as Dr. Lam seems to remember, he couldn't have made a statement based on a superficial review. This is an independent report similar to the Holtec report for dynamic analysis of the pads and casks. The imputed soil design models used are the same as those used in the Holtec analysis. The Sandia analysis clearly shows that the pad response accelerations are several times larger than the peak ground acceleration used by Stone & Webster in its stability analysis.

And I don't see these things as accelerations. It may have been just the words. He's making what I consider to be, particularly for

an expert with his qualifications, to be a statement of facts that could only be the result of a thoughtful review of the document. And that's my problem, really.

I mean, again, it is not a question as to ultimately the probative value of this statement. It's just that I don't believe it should be on the record based on his testimony as to the extent to which --

JUDGE FARRAR: But didn't -- okay, here -- let me tell you how I think I see it. This statement about the Sandia analysis, I think he later said that was his superficial reading of that graph, that figure. You all cross-examined him extensively, and he -- I thought he conceded, which was your point, that those really high peaks should be eliminated. So in other words, to me the integrity of the record is preserved by the fact that he made a concession that you were trying to get him to make.

Then Ms. Chancellor has a point that he came back and pointed to some other peaks and said, well, those account for something. So to me the process worked the way it should have. Now, the only thing that didn't work is he probably wishes

he'd done a more careful reading at the beginning. But a lot of us are always in that position. I mean, to me, when you're worried about -- the process worked fine. He did a quick review, he said something that you attacked and discredited, and there we are. What's wrong with that?

JUDGE LAM: Doesn't that also help your case? You know, you have now demonstrated that Dr. Ostadan, based on very superficial review -- as a result of that superficial review, he had made very strong statements and had expressed a very strong opinion which later he somewhat conceded was not quite the way he thought it was. Doesn't that enhance your argument, Counsel?

MR. TRAVIESO-DIAZ: I may very well save this argument for a future date. But my concern is that still this is on the record and submitted as evidence. Proposed findings are going to be written. The Board and the Commission may look at it, and, you know, again, as I think -- it in my mind becomes a faulty record. Ultimately I believe you're right.

JUDGE FARRAR: Well, there -- we can't be in the business of at the end of every day saying, okay, let's take this 30-page testimony --

and remember I gave you an A for your argument the other day, you know, give each line an A or a B or a failing. Here's what's going to happen. Suppose we deny your motion. You'll write proposed findings of fact and conclusions of law that say, don't give this any weight; we'll either agree with you, or we'll neglect everything that happened here and we'll say, we rely on this sentence right here.

Well, then you all will do as you all are entitled to do. You'll go to the Commission and say, these people ignored everything that happened this afternoon and they relied on this sentence. And I assume the Commission will say, you're right, the Board was wrong to do that.

So I'm not worried -- given the caliber of lawyering we have here, I'm not worried that something that's been discredited is going to somehow sneak into a final decision and neither we or the Commission or the Tenth Circuit just is, you know, is ever going to catch it again.

MR. TRAVIESO-DIAZ: My only point, your Honor, as I said, you both may be very well right that at the end of the day that this may come out to be a non issue. But my point is if he hadn't said that he hadn't reviewed it, as I heard him

say, but perhaps it's reviewed carefully, I wouldn't be making this motion. Because as Judge Lam has very astutely derived, I have more to gain by having this on the record to discredit him than I have to lose by having it stricken. So this is not for my benefit.

JUDGE FARRAR: Right. So maybe we need to protect you from yourself, Mr. Travieso-Diaz.

MR. TRAVIESO-DIAZ: I have to tell you that this is the first time that --

JUDGE FARRAR: In layman's language, be careful what you ask for.

Mr. Turk, do you want to add something here?

MR. TURK: I've already expressed my view on the reliability of the evidence. I would hazard a further statement. That is, whether you'll admit it or exclude it, I don't think that the case is going to turn on it. I think the Luk report itself speaks for itself, Dr. Luk's deposition explaining it is in evidence, the cross-examination is before you, and I think the record is fairly complete at this time.

Maybe as a precedent for the future, if we find things that we think are unreliable we

should do voir dire and exclude it before we go into full cross-examination. Although I don't know that it would be any less time consuming than what we did now.

JUDGE FARRAR: Yeah, I guess I have maybe a different, you know, view of these things than you all have expressed in your motion. To me, and assuming that the discrediting you think occurred did in fact occur, which is something we have to deal with, and we have not all read the transcript, we'll all have to read it, the process worked. It is what it is, and that's the key. Some prefiled testimony is going to make it into the opinion and it's going to be the gospel, and some prefiled testimony is going to have been partially discredited, and some we're going to give no weight to at all. And it seems you do that at the end of the case, not as you go along.

So even if -- to me, even if your points, and I'm speaking not only for myself but my colleagues. Even if your points are well taken, the remedy is not appropriate. And motions to strike are -- well, you said at the outset, you know, we disfavor them. And that's been our consistent position throughout. Your motion as

heard -- certainly your motions have served certainly one purpose: this is very much highlighted in our minds. It's highlighted today, it will obviously be in our minds when we write an opinion.

Ms. Chancellor, do you want to add anything?

MS. CHANCELLOR: It depends on how you're going to rule, your Honor. I think I'll wait.

MR. TRAVIESO-DIAZ: Your Honor, they say that prudence is a very -- I withdraw my motion.

JUDGE FARRAR: You can't fire me, I quit.

MR. TURK: I'll take mine like a man, your Honor.

JUDGE FARRAR: To the extent there are any motions pending, we will deny them, but that's not to say that the points made are not valid points. And this is something that, Ms. Chancellor, you'll have a chance obviously later to try to do some rehabilitation if you think that's necessary, and we'll just see where that leads us.

MS. CHANCELLOR: And I believe we'll

also have a chance to call Dr. Luk back, because we haven't finished that cross-examination.

MR. TURK: That I'm not willing to agree to, your Honor. He was excused as a witness and the State was going to look to see if they had anything else that they wanted to ask him in light of developments. I don't think that we have anything further.

JUDGE FARRAR: Let's not have arguments today about things we may not have to deal with. But I think, Ms. Chancellor, you can consider yourself warned by Mr. Turk that he --

MR. TURK: I would make an offer also, your Honor. If there are questions that they need answered, if she gives me the questions, I can get her answers and avoid a hearing on it.

JUDGE FARRAR: I think that's an excellent point, that as -- since we are in this mode of trying to accommodate witnesses, we are going to get to the end of the road and find that there are some things left undone, and it may be that we can do those by written questions or by telephone appearances or something rather than haul witnesses back to appear for five minutes or ten minutes. So we're willing to do whatever needs to

be done there.

Is there any other business we can conduct tonight? All right, then we'll see you at -- or see some people at nine o'clock tomorrow morning for the oral argument on SS, and we will see you here at nine o'clock Saturday morning for PFS witness Cornell and the Staff panel on the exemption.

MR. TURK: Your Honor, may I ask you a question off the record?

(Discussion off the record.)

JUDGE FARRAR: If there's no other business, we'll recess for the evening.

(The proceeding was concluded for the day at 5:35 p.m.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Private Fuel Storage, LLC

Docket Number: Docket No. 72-22-ISFSI

ASLBP No. 97-732-02-ISFSI

Location: Salt Lake City, Utah

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

/s/ Diana Kent

Diana Kent
Official Reporter
Neal R. Gross & Co., Inc.