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NUCLEAR REGULATORY COMMISSION

Title: Private Fuel Storage, LLC

Docket Number: 72-22-ISFSI; ASLBP No. 97-732-02-ISFSI

Location: Salt Lake City, Utah

Date: Thursday, May 9, 2002

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of:	)	
	)	
PRIVATE FUEL STORAGE, LLC,	)	Docket No. 72-22
(Independent Spent Fuel	)	ASLBP No.
Storage Installation)	)	97-732-02-ISFSI
	)	

U. S. Nuclear Regulatory Commission
Sheraton Hotel, Wasatch Room
Salt Lake City, Utah 84114

On May 9, 2002 the above-entitled matter came on for hearing, pursuant to notice, before:

MICHAEL C. FARRAR, CHAIRMAN
Administrative Judge
Atomic Safety & Licensing Board Panel

DR. JERRY R. KLINE
Administrative Judge
Atomic Safety & Licensing Board Panel

DR. PETER S. LAM
Administrative Judge
Atomic Safety & Licensing Board Panel

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I N D E X

E X A M I N A T I O N

Witness Panel:
Steven Bartlett and Farhang Ostadan

Cross Examination by Mr. Travieso-Diaz 7565
Cross Examination by Mr. Turk 7733

-oOo-

E X H I B I T S

No. MRKD/ADMTD

Applicant's Exhibit 96 7568/
Cover page of SHAKE

Staff Exhibit GG: /7828
minutes of Dr. Luk's meetings with
his advisory panel

Staff Exhibit HH: 7784/7802
Excerpts from 5-4-02 deposition
of Dr. Luk, 5/4/02

State's Exhibit 179 /7598
Visual NASTRAN simulation summary

1 Thursday, May 9, 2002 9:00 a.m.

2

3 P R O C E E D I N G S

4

5 JUDGE FARRAR: Good morning, everyone.

6 The Board has a couple of preliminary matters. In

7 terms of tomorrow's oral argument on Utah Proposed

8 Contention Utah SS, the phone number that people in

9 D.C. can dial is (301) 231-5539, or if your people

10 aren't in D.C., (800) 638-8081. And then the pass

11 code you punch in is 8998 pound. Again, we

12 understand Mr. Stewart will be here for the State

13 present?

14 MS. CHANCELLOR: That's correct, Your

15 Honor.

16 JUDGE FARRAR: Mr. Silberg will be

17 calling and Mr. Weisman will be calling.

18 MR. TRAVIESO-DIAZ: I'll be here as

19 well.

20 MR. TURK: I may do the same, Your

21 Honor.

22 JUDGE FARRAR: And there would be a

23 slightly relaxed dress code.

24 In terms of scheduling and so forth,

25 before we get into next week's schedule and when

1 we'll finish, there was some discussion at some
2 point about the parties settling some part of the
3 radiological consequences aspect of the seismic
4 issue?
5 MS. CHANCELLOR: I think we -- our
6 thought was we couldn't address that until after
7 we'd gone through the hearing and then wait and see
8 where we were on that.
9 JUDGE FARRAR: Has there been any larger
10 discussion of larger settlements based, for
11 example, on something like more testing by the
12 Applicant?
13 MS. CHANCELLOR: No, Your Honor.
14 JUDGE FARRAR: Okay.
15 MS. CHANCELLOR: We've been rather busy.
16 JUDGE FARRAR: Right. Then next week,
17 our thought was the week should certainly be
18 sufficient to finish aircraft and therefore -- and
19 do a little bit of seismic. Is there any need to
20 go past the end of the day on Friday the 17th?
21 MR. GAUKLER: Only if we try to get
22 through a couple of witnesses on Utah -- Section E
23 of Utah L QQ.
24 JUDGE FARRAR: Is there anyone who if we
25 don't get to them next week cannot be -- could not

1 be here when we're here from the 3rd to the 7th or
2 could not be in D.C. for follow-up? A part of this
3 has to do with apparently, there's some tightness
4 in flights back, and we need to know if people will
5 be excused next Friday, the 17th, rather than
6 Saturday the 18th.
7 MS. CHANCELLOR: Part of it, I think,
8 Your Honor, depends on whether we can get a full
9 day in on hearing the seismic issues, whether we
10 do, in fact, get through with aircraft crashes by
11 Thursday. Just in terms of scheduling, I don't
12 think there's a conflict. It would be -- it would
13 help the schedule if we could get through, say,
14 Dr. Arabasz on seismic exemptions so that we pick
15 up on the 3rd with Dr. Ostadan and Dr. Bartlett and
16 possibly Dr. Khan and Dr. Ostadan, because there's
17 some testimony -- let me back up. There's still
18 some testimony that needs to be completed for
19 Section D for Dr. Khan and Dr. Ostadan. They could
20 then be followed by Dr. Bartlett and Dr. Ostadan on
21 seismic exemption. So I hate to waffle like this,
22 but if we could reserve Saturday morning, it may be
23 helpful on the 18th.
24 JUDGE FARRAR: Rather than do that and
25 on the notion that there can't be that much left to

1 accidents after all the progress we've made, why
2 don't we plan for now on finishing at the end of
3 the day Friday and only in the direst emergency
4 would we change everything and come back on
5 Saturday.
6 MS. CHANCELLOR: Okay. Could we -- if
7 aircraft crash is finished early, could we plan on
8 doing something Thursday on seismic?
9 JUDGE FARRAR: Oh, sure. Our plan is
10 next week, we put to full use and again, leave it
11 to you all to work out how that would be, and if it
12 involves taking people out of order, we'll take
13 them out of order.
14 MR. TURK: Your Honor, that presents a
15 practical difficulty. We'll have witnesses with us
16 through next Monday on seismic issues. I don't
17 want to keep them here for three days of aircraft
18 hearings, not knowing if they're going to be called
19 or if they're needed as a consultant. So I would
20 ask the Applicant and the State come up with an
21 agreement on how long aircraft will take to
22 conclude, and let's conclude it by that time and
23 start seismic afterwards if that's what we're going
24 to do. In other words, let's try to get a firm
25 projection.

1 JUDGE FARRAR: Let me make sure I
2 understand. They're going to be here on Monday the
3 13th?
4 MR. TURK: What I understand the State
5 wants to do is to take our witnesses, the Staff's
6 witnesses on E Saturday afternoon and Monday.
7 MR. GAUKLER: Monday morning.
8 JUDGE FARRAR: This Saturday, the 11th
9 and Monday?
10 MR. TURK: Yes.
11 MS. CHANCELLOR: A lot depends on how
12 long it takes for Dr. Cornell. So the first
13 witness on Saturday will be Dr. Cornell for PFS,
14 followed by the Staff panel of Stamatakos, McCann
15 and Chin. And the hope was to get through those
16 two sets of witnesses on Saturday and Monday before
17 lunch, so that we could start aircraft crashes
18 after lunch. That's the goal.
19 JUDGE FARRAR: Okay. And, Mr. Turk,
20 you'd send your people home at that point, your
21 seismic people home, would be your hope?
22 MR. TURK: Yes.
23 JUDGE FARRAR: Then we'd have aircraft
24 starting Monday noon?
25 MR. GAUKLER: That's correct.

1 MS. CHANCELLOR: Right after lunch.

2 JUDGE FARRAR: Going through Thursday

3 through when?

4 MR. GAUKLER: Through sometime Thursday.

5 JUDGE FARRAR: Then Mr. Turk's problem

6 is if we want to use Friday for seismic, he's got

7 to bring a mess of people back here for a day.

8 MR. TURK: Or have them stay, if

9 necessary. But I need to know what our schedule

10 is.

11 JUDGE FARRAR: There's no sense having

12 people stay for three days on the chance we might

13 get to them.

14 MS. CHANCELLOR: But would you need your

15 people to stay if we're doing State or PFS

16 witnesses?

17 MR. TURK: Who would be the witnesses

18 Thursday and Friday?

19 MR. GAUKLER: I think the State would

20 actually do Dr. Arabasz for sure, and I see no

21 problem with doing Dr. Arabasz on Friday.

22 JUDGE FARRAR: Let's do this, then. Why

23 don't you all work that out, pick a witness who

24 could be here for Thursday or Friday, and

25 preferably a witness where Mr. Turk might only need

1 to bring one person back on that basis.

2 MR. TURK: What I would propose doing,

3 then, is just discharge our witnesses and perhaps

4 one of them could stay on or come back.

5 JUDGE FARRAR: As an advisor?

6 MR. TURK: Yes, but the others could go

7 home Monday afternoon.

8 JUDGE FARRAR: Yes, then let it not be a

9 Staff witness.

10 MS. CHANCELLOR: That's the goal, Your

11 Honor, is to get through that Staff panel, but it

12 just depends.

13 JUDGE FARRAR: No, but then for Friday,

14 have it be a witness who's not a Staff witness, so

15 all he needs is an advisor to come back.

16 MR. TURK: Yes, so that we would

17 conclude the Staff's testimony on E on Monday.

18 MS. CHANCELLOR: Except for Waters.

19 MR. TURK: Yes.

20 MS. CHANCELLOR: We'll try.

21 JUDGE FARRAR: All right. And keep us

22 posted.

23 All right, then, any other preliminary

24 matters? Then I think we're ready to resume the

25 cross-examination of the State's panel. Gentlemen,

1 you're still under oath.

2

3 CROSS EXAMINATION (Resumed)

4 BY MR. TRAVIESO-DIAZ:

5 Q. Good morning, gentlemen.

6 DR. BARTLETT: Good morning.

7 DR. OSTADAN: Good morning.

8 Q. Let's resume where we left off

9 yesterday.

10 If you could turn your attention to Page

11 14 of your testimony. I believe yesterday we went

12 through question and answer 31, so let's just go to

13 32.

14 On Answer 32, you talk about soil

15 springs and damping. Could you explain for the

16 Board a little bit more of what those concepts are.

17 DR. OSTADAN: Yes. For Holtec, in order

18 to perform the seismic analysis of the cask and pad

19 and soil system, they model the pad, they model the

20 cask, but they needed to represent the soil

21 properties in their model. And the way they chose

22 to do that was to represent the soil area below the

23 pad by a set of soil spring and the so-called soil

24 damping parameters. These were developed by

25 Holtec. These are mathematical model, if you wish,

1 attached to the pad and then the whole system is
2 shaken by the design motion.
3 Q. Now, what do they represent?
4 DR. OSTADAN: Soil spring and damping
5 represents the effect of the soil layers below the
6 pad, and also represents geometry and property of
7 the pad in a complex manner. If I have to explain
8 that physically, if you think of a pad on top of
9 the soil layer system and ask yourself if I have to
10 push this pad down, say, one inch, how much
11 resistance I'm going to encounter. That is the
12 meaning of the stiffness. And how much damping I
13 dissipate if I do it in a cyclic manner. That is
14 the physical meaning of that damping. So it has to
15 do with the pad and the dimension of the pad,
16 whether the pad is rigid or flexible as well as the
17 soil properties.
18 Q. And that damping is -- how does it
19 relate to the radiation damping that you talked
20 about yesterday?
21 DR. OSTADAN: That is the radiation
22 damping.
23 Q. Now, going over to the next question 33,
24 you indicate that the Holtec analysis did not
25 properly consider the frequency dependence of the

1 soil springs and damping with respect to certain
2 important frequencies. First of all, isn't it true
3 that the Holtec analysis is nonlinear and
4 therefore, performs this analysis using time
5 histories and time dependent variables, not
6 frequency dependable variables; is that right?
7 DR. OSTADAN: That's correct, yes.
8 Q. Okay. And is it your understanding that
9 the way they model the system, they use for each
10 set of soil characteristics, one single set of
11 springs and dampers?
12 DR. OSTADAN: That's my understanding,
13 yes.
14 Q. All right. And those were frequency
15 independent, therefore?
16 DR. OSTADAN: No, I think the stiffness
17 is frequency dependent. Damping is not.
18 Q. Thank you for the correction.
19 Now, if I understand the input that
20 Holtec used, it came out of a computer program used
21 called SHAKE; is that right.
22 DR. OSTADAN: As far as the soil
23 properties, yes.
24 Q. Are you familiar with SHAKE, how it
25 works?

1 DR. OSTADAN: Yes, I am.

2 MR. TRAVIESO-DIAZ: Will you pass out

3 the first exhibit.

4 While the exhibits are being passed

5 around, let me identify for the record what they

6 are. This is, I believe PFS Exhibit 95. Well, I

7 think it's actually 96.

8 JUDGE FARRAR: It's 96.

9 MR. TRAVIESO-DIAZ: 96, that's right.

10 And for the record, this exhibit is comprised of a

11 cover page for identification purposes of the

12 SHAKE, as you can see from the second page, it's

13 the SHAKE's use. What I want to talk to you about

14 is the third page, which is one of the pages in the

15 manual.

16 JUDGE FARRAR: Let's pause a moment and

17 let the court reporter mark this for

18 identification.

19 (EXHIBIT-96 MARKED.)

20 Q. (By Mr. Travieso-Diaz) What I'm going

21 to direct your attention to is the plot on Figure 4

22 on top of the last page.

23 DR. OSTADAN: Yes.

24 Q. Is it correct, is my understanding

25 correct, that the way SHAKE works, it provides a

1 frequency domain solution to the response of a soil
2 column to vertical propagating waves?
3 DR. OSTADAN: That's correct.
4 Q. And that plot you see there on Figure 4,
5 would that be a representation of that response as
6 a vertical frequency?
7 DR. OSTADAN: That's correct, yes.
8 Q. And as you can see from that plot, there
9 are a number of peaks. In other words, points in
10 which the value that you are computing in the
11 application, sort of ramps up from preceding
12 values?
13 DR. OSTADAN: That's correct. Yes.
14 MS. CHANCELLOR: Just a point of
15 clarification, that is from a manual, this is not
16 from a PFS site; correct?
17 MR. TRAVIESO-DIAZ: This is all for
18 illustration.
19 MS. CHANCELLOR: Okay.
20 MR. TRAVIESO-DIAZ: I didn't say that
21 this was the right one for PFS.
22 MS. CHANCELLOR: Right, I just wanted to
23 clarify.
24 Q. (By Mr. Travieso-Diaz) And would each
25 of those peaks correspond to a frequency in which

1 the ground response would modify the accelerations
2 from the earthquake?
3 DR. OSTADAN: You could say that, yes.
4 Q. Right. Now, is it also typically the
5 case, as is shown here in this figure, that the
6 lowest frequency is the one that has the greatest
7 amplification?
8 DR. OSTADAN: This is a schematic plot.
9 It has nothing to do with any site or any specific
10 location. Yes, it shows that there's a peak at
11 around 1.213 hertz.
12 Q. Okay. I didn't mean to imply that this
13 applied to a particular site. But I'm asking you
14 now, based on your experience, that is, in fact,
15 the case that typically the largest amount of
16 energy, if you will, comes up as they show here in
17 the first of the responses?
18 DR. OSTADAN: I'm afraid we are mixing
19 apples and oranges here. I can explain. The SHAKE
20 is more as a common industry program that everybody
21 uses. The basic idea for use of the SHAKE is as we
22 discussed yesterday, to recognize that soil
23 material is highly nonlinear during earthquake
24 shaking. So if you perform an analysis of a
25 structure on a soil and do not recognize that the

1 soil properties change during an earthquake
2 excitation, that analysis will be unrealistic. So
3 what is common in the industry is to perform a
4 one-day soil column analysis and this is only a
5 soil column. There is no structure, there's no
6 foundation involved. At this time, we don't even
7 know anything about the building itself. Put the
8 design motion in and represents the soil properties
9 layer-by-layer, often go all the way down to the
10 rock. And then what comes out of the SHAKE -- and
11 you can do various things, but as far as the PFS
12 design is concerned, what comes out of the SHAKE is
13 soil property as impacted by the level of shaking.
14 And let me also take a step back perhaps
15 for the benefit of the Board. We go out in
16 geotechnical practice and measure the soil
17 properties in the field. And there are various
18 geophysical tests to do that. We often measure the
19 shear velocity. But this measurement is always
20 taken at very small level of strength, the way the
21 technique works. But we know that the earthquake,
22 the strain in the soil layers picks up, and as I
23 said, the soil is nonlinear. Therefore, the entire
24 idea beyond SHAKE analysis is to obtain somewhat of
25 a reduced properties, if you will, that will be

1 appropriate to represent the soil column for the
2 purpose of dynamic analysis of the building.
3 Q. I guess I didn't make my question clear.
4 I wasn't -- again, I'm not talking about PFS
5 itself. I thought that if we look at a plot like
6 this that shows the amplification of the soil of
7 the earthquake excitation, you have a series of
8 peaks. And my question was, based on what you
9 know, isn't it typically the case that the first
10 peak, the lowest frequency peak is the one that has
11 the greatest amount of energy as shown here? I'm
12 not talking about PFS, I'm talking generally.
13 DR. OSTADAN: If you're talking about --
14 okay, if you think of a soil column as a model by
15 itself, what you're saying, the first mode, dynamic
16 mode of the soil column is more important -- yes,
17 as far as the soil column itself is concerned, that
18 is the most important mode. But whether this mode
19 necessarily will be the most important mode for the
20 building you are analyzing, it depends on the
21 frequency of the building. The second mode becomes
22 more important.
23 Q. Right, but here we're talking only about
24 the properties or the performance of the soil in a
25 free field; is that right?

1 DR. OSTADAN: That's correct.

2 Q. It depends on what you have. Now, if

3 you were going to do a modeling of the soil

4 properties to use as an input to your analysis to

5 your computer code, and you picked only one

6 frequency, it would probably be a good idea to pick

7 the lowest mode, wouldn't it be? Now, recognizing

8 that you will be incurring an error but not taking

9 care of the other peaks; is that correct?

10 DR. OSTADAN: No, I would not do that.

11 I would ask -- if I have to pick one frequency, you

12 would have to really twist my arm to do that, and

13 then I would ask myself what is the building

14 frequency, what is the necessary frequency and what

15 is the most important frequency I have to go after?

16 Q. But isn't it true if you went to this

17 plot and say, assume that the frequency response to

18 the building is the third one and you picked that

19 one, you'd be missing the peak energy contribution

20 of the soil in the first column?

21 DR. OSTADAN: Yeah, but that may not be

22 relevant if the building doesn't respond to that

23 frequency.

24 Q. I see. So your view is that regardless

25 of the amplification that the soil provides, as

1 shown in this figure, you would not necessarily
2 pick the first mode, but you would pick whatever
3 mode you thought was more appropriate to your
4 building?
5 DR. OSTADAN: That's correct.
6 Q. But whichever one you picked, you
7 picked, of course, since you are picking only one,
8 you are missing the energy contribution of the
9 other peaks; correct?
10 DR. OSTADAN: That's correct.
11 Q. So I take it that your objection to what
12 Holtec did is that they didn't go to a plot like
13 this and try to figure out which was the frequency
14 response that corresponded to the building -- I
15 mean to the pad and the cask; is that right?
16 DR. OSTADAN: If I may explain that,
17 perhaps. I think -- this really has nothing to do
18 with the SHAKE. I have no objection with the way
19 the SHAKE was handled in this project. It was done
20 by Geomatrix and they did what is typically done in
21 the industry to obtain the soil properties. Like I
22 said, next Holtec needed a set of springs and
23 damping to attach to their model. They needed
24 those values, how do you obtain these values. Now,
25 the SHAKE analysis has already been done, soil

1 properties are established, and now we have to go
2 after the spring and damping values. Now, we have
3 to make a distinction. There's been a side which
4 is fairly uniform to soil layers consistent as you
5 go deeper and deeper versus the soil site that is
6 highly layered, the properties change, which is the
7 case here. There are a number of solutions out
8 there that you can clearly see. There's a big
9 difference in terms of soil spring and damping
10 values, if you have a uniform soil site or you have
11 a layered site. When you have a layer site, the
12 springs and damping change drastically with
13 frequency. They go up and down. And that's
14 because of the reflection of the waves within the
15 layers and the fraction and so on. A good example
16 of it, actually it's in your own own calculation.
17 If you go and look at the soil spring and damping
18 that Stone & Webster calculated for the canister
19 transfer building, and that's a sound technique
20 they used, you can see they have plotted that
21 versus frequency. You can see it changes up and
22 down quite a bit, and it really reflects the
23 layering effect at the site.
24 Now, let's switch back to the pad. Now,
25 because pad is analysis -- pad and cask analysis is

1 nonlinear analysis, they could not use the spring
2 and damping as a function of frequency. I realize
3 that because this works in time domain and we are
4 not working in frequency domain. But what was not
5 done, and that's the point of the comment here, is
6 that calculate the soil spring and damping just the
7 same way it was done, let's say for canister
8 transfer building, but for the size of the pad, the
9 properties of the pad, look at the frequency
10 dependency of the spring and damping and then peak
11 the value. They need a constant value now because
12 this is nonlinear analysis. Peak the value that
13 corresponds to the pad frequency. That hasn't been
14 done. It has not been demonstrated that the spring
15 and damping used in that analysis truly represents
16 the behavior of the foundation, that is the pad
17 here.
18 Q. Before we go on, I need to try to follow
19 one thing that you said in your answer. Am I
20 understanding correctly that the difference between
21 a homogeneous level of soil and a layer level, they
22 are both going to have frequency plots like this,
23 but for the layer plot, the frequencies are going
24 to be shifted because of the fact of the
25 interaction within the waves, is that what you

1 said?

2 DR. OSTADAN: No, I did not say that?

3 Q. Okay.

4 DR. OSTADAN: The frequency would not be

5 shifted. Where a homogeneous soil, if you look at

6 the value of a spring versus frequency, this is a

7 constant line. It changes very smoothly. If you

8 -- the same foundation, if you put it on a layered

9 side and calculate the spring, the spring as a

10 function of frequency, just goes up and down. It

11 depends on the layering, the contrast of the

12 properties of the soil. It is very complex?

13 Q. But you're not saying that if I were to

14 plot a transfer function like the one shown here

15 for a uniform soil, that you wouldn't see any the

16 peaks of frequency, would you?

17 DR. OSTADAN: I really frankly do not

18 see any relevance between that transfer function of

19 SHAKE and what we're talking about.

20 Q. Well, let me just you a few more

21 questions anyway. Answer that one, if you will.

22 Would you see a transfer function for a uniform

23 layer of soil -- aside that the soil was uniform,

24 would you see a plot like this with several

25 frequencies which had mode excitation of transfer?

1 DR. OSTADAN: Well, if you're going to
2 the SHAKE and soil column analysis, again, this has
3 nothing to do with the spring and damping you're
4 talking about. But to respond to your question, if
5 you have a uniform soil and you perform a soil
6 column analysis -- by the way, what this plot shows
7 is what is the ratio of amplification on top of the
8 soil versus a point down below, say, a rock layer.
9 It's like any other -- this column of soil is like
10 any other dynamic system, has several modes. So
11 you see the first mode is this amplification,
12 there's amplification associated with the second
13 mode, third mode and so on. But this is all --
14 again as it relates to PFS, it's all said and done.
15 Geomatrix has done it, they've done SHAKE analysis,
16 they obtain the surface motion. You already have
17 the 2,000-year design motion, all these effects are
18 included, as far as soil properties and the effect
19 on ground motion is concerned?
20 Q. What I was trying to get to, I think you
21 answered it in part is, for a continuous soil
22 layer, it would probably look perhaps like this,
23 and for a known uniform layer soil, it would look
24 differently in the sense that the amplification
25 would be in different places --

1 DR. OSTADAN: Different places and
2 different amplitudes?
3 Q. Thank you.
4 Now, you said something that I don't
5 think you really meant. You meant to say that the
6 SHAKE analysis is not relevant? Isn't that how
7 Holtec, in fact, got the values that it used for
8 its input?
9 DR. OSTADAN: I don't see a direct
10 relevance between SHAKE and what we are talking
11 about, the soil spring and damping. As I said,
12 SHAKE provides the soil properties, and that's all
13 really we obtain from SHAKE in this case, in order
14 to start calculating the soil spring and damping.
15 Q. Isn't it true that what happened was
16 that by giving -- in giving the soil properties to
17 Holtec, Geomatrix had to pick one or Holtec, one of
18 them had to pick one of the values here as to be
19 the one representative -- the most representative
20 of the soil, since they could use only one spring
21 and one damper, they had to pick from this plot the
22 one that was --
23 DR. OSTADAN: I hope they haven't picked
24 from that plot, because this plot has nothing to do
25 -- this plot doesn't know the building, doesn't

1 know the size of the foundation, has no knowledge
2 of what's coming on it whatsoever. It is just a
3 soil column, it's called free field, and free field
4 means free of the presence of building of
5 foundations?
6 Q. I'm sorry, one more question just to
7 finish with this plot. You said that you wouldn't
8 necessarily pick the first mode because it might
9 not be necessarily representative of --
10 representative of the mode that excites the most
11 resonance, if you will, in the pad and the cask for
12 the case of PFS?
13 DR. OSTADAN: That's correct.
14 Q. Now, if -- I'm saying just if, it so
15 happened that the pad and the casks response
16 resonated at a place near the first mode, then you
17 will be okay to use it; right?
18 DR. OSTADAN: I'm not sure I quite agree
19 with that, either. You see, where I am coming from
20 on this comment is -- and I am not so much frankly
21 worried about spring, I'm more concerned about
22 damping. We have a model of the cask and the pad
23 and we have this mathematical model to represent
24 the soil spring and damping under the pad, and this
25 damping have tremendous appetite to absorb energy.

1 And as I said, if they are there and it's perfectly
2 legitimate to use them. But we do know that -- and
3 your canister transfer building calculation clearly
4 shows that this damping changes drastically with
5 frequency. So if I had to do it, I would look at
6 my calculation of the pad response, I ask myself,
7 what is the most important frequency as far as the
8 pad response is concerned, and that frequency is by
9 the way already an ICEC calculation, I can show you
10 those if you wish, the range, and then I make sure
11 the damping I have selected, represents that
12 frequency, but I know the next frequency damping
13 will be drastically different. So that damping I
14 have used will be appropriate for the foundation at
15 the frequency of interest.
16 Q. Pardon my ignorance, but I see kind of a
17 horse and cart pulling here. I see that response
18 based on the impetus that it got; isn't that right?
19 DR. OSTADAN: That's correct.
20 Q. And the impetus that it got were based
21 on the frequencies that Holtec gives
22 DR. OSTADAN: That's correct.
23 COURT REPORTER: Hold it, I didn't even
24 get that question.
25 JUDGE FARRAR: You don't have to listen

1 to me, but you got to listen to her.

2 MR. TRAVIESO-DIAZ: I'll try again.

3 JUDGE FARRAR: Let's start again. And

4 particularly, I know scientists and lawyers are

5 used to rapid fire exchanges, but when we have a

6 court reporter, we can't have two people talking at

7 once.

8 MR. TRAVIESO-DIAZ: Particularly when

9 your rapid fire comes real rapid.

10 Q. (By Mr. Travieso-Diaz) My question was

11 this: You are saying that what you have done is

12 take essentially the output of the ICEC calculation

13 and use that to compute what a good frequency to be

14 used for Holtec in their calculation. My concern

15 was that since that output of the ICEC calculation

16 is already based on the input that they got from

17 Holtec, how can you use an output that could be

18 corrupted by the input to try to improve your

19 input?

20 DR. OSTADAN: No, I appreciate your

21 engineering instincts very much now. What you're

22 saying is we needed to do an iteration here, and I

23 think that -- I wish I would have seen that in this

24 calculation. ICEC obtained the frequency response

25 of the pad, they applied the loads that came from

1 Holtec, you're perfectly right, and they obtained
2 the frequencies. Holtec could have asked, oh,
3 let's see, the damping and the springs are used, do
4 they really correspond to these frequencies that
5 now I see. If not, I'll go back and change my
6 spring and damping and do another round, till I
7 converge. And that's really the basis of this
8 comment here. That appropriateness has not been
9 established.
10 Q. Isn't it true that ICEC tried to handle
11 the problem a little differently by doing one wrong
12 with CEC SAP and the same wrong with SASSI, which
13 is a frequency domain problem and obtain similar
14 results?
15 DR. OSTADAN: Well, similar results,
16 what results? You need to explain the results. We
17 are deviating from the subject again. By the way,
18 Holtec didn't need to go to ICEC to ask what is the
19 frequency of the foundation, they already have the
20 entire system solved. They have the pad response.
21 They could have asked themselves what is the
22 frequency of the foundation response, do a simple
23 calculation and make sure the spring and damping is
24 correct that they use or whether they want to
25 change it or not. There was no need to go back and

1 forth between ICEC. But that's another way of
2 doing it.
3 The main reason ICEC did two analyses --
4 and let me remind you, ICEC did not perform soil
5 structure interaction in its full extent. They
6 received the dynamic forces from Holtec. They
7 simply applied it to the top of the pad and they
8 did it two ways. In order to obtain the stresses
9 in the pad concrete section to design the pad, to
10 decide how much rebar steel they need, so on and so
11 forth. So their goal was not really to come up
12 with the soil structure interaction effects and
13 what they do or what they do not do. They happen
14 to show some of those in their calculations, given
15 the forces coming from Holtec.
16 Q. Now, just to recap, if you will, what I
17 understand to be your concern in this area, is that
18 essentially, Holtec picked out of the set of
19 frequencies that you plot, at least one of them,
20 and your view is they didn't pick the one that was
21 most representative of the performance of the soil,
22 the pad and the cask?
23 DR. OSTADAN: It has not been stated
24 anywhere that this was appropriate, yes.
25 Q. Do you know for a fact that they picked

1 the wrong frequency or your concern doesn't show
2 that they picked the right frequency?
3 DR. OSTADAN: As I mentioned yesterday,
4 unfortunately, Holtec's report is tremendously
5 brief, there's little information there really. So
6 there's no comparison made. They just refer to,
7 you know, which method they used, to the extent I
8 recall. And so I haven't quantified it myself, no.
9 But that's a good check to be done here.
10 Q. But I was trying to get the record clear
11 is, since you don't know how they went about it in
12 detail, you don't know, in fact, how wrong they
13 were if they were wrong?
14 DR. OSTADAN: Well, I know it's going to
15 be different because your canister transfer
16 building spring and pad clearly shows that you
17 could be off quite a bit if you don't pick the
18 right frequency.
19 Q. But you don't know for a fact that they
20 picked the wrong frequency or how far off that
21 frequency they were; is that right?
22 DR. OSTADAN: I know for a fact that
23 they did not check that versus any frequency. They
24 just applied these basic equations to get the
25 spring and damping.

1 Q. I understand. But you don't know
2 whether they chose the main --
3 MS. CHANCELLOR: Objection, Your Honor.
4 Dr. Ostadan has answered the question. He said
5 they're off quite a bit compared to the CTB.
6 Counsel is trying to force a number out the witness
7 and it's getting almost to the point --
8 MR. TRAVIESO-DIAZ: Ms. Chancellor, I
9 think you misunderstood these questions. First, I
10 am not trying to force an answer out of him. I'm
11 trying to get a clear understanding of whether he
12 knows what Holtec did, and if they were wrong. And
13 if they were wrong, by how much. If he can tell me
14 that he doesn't really know that, but because he
15 doesn't have information that allows him to make
16 that determination, he can only express a concern,
17 I think that we're fine. That's what I'm trying to
18 get from him and I don't think that he's answered
19 that question yet.
20 JUDGE FARRAR: Ms. Chancellor, as we
21 said yesterday with another party's objection, you
22 have a point, but not enough of one. These are
23 expert witnesses, and even where there's some
24 repetition, all the witnesses so far have shown
25 themselves able to defend themselves, cling to a

1 position. And so where in a civil case, you might
2 say, you've asked the question, that's the end, we
3 allow a little more leeway here for counsel to
4 press but not badger the witnesses.
5 MR. TRAVIESO-DIAZ: I'm hope I'm not
6 being badgering to anyone.
7 DR. OSTADAN: My answer is, you know,
8 there's not enough information really presented so
9 one can make a comparison. I have not done an
10 independent calculation myself, but I am of the
11 opinion that if it happens to be the right
12 frequency, it's more of a coincidence.
13 Q. (By Mr. Travieso-Diaz) And it could be
14 a coincidence?
15 DR. OSTADAN: Right.
16 Q. Now, let me try something else here. I
17 know that you have not seen the Visual NASTRAN
18 drawings. I believe that Dr. Bartlett has. But
19 maybe Dr. Bartlett can help us based on his
20 recollection.
21 Isn't it true that one of the set of
22 drawings that Dr. Soler explained for the Board and
23 the parties last week, was a case in which -- well,
24 there were two cases for the 2,000-year return
25 period earthquake, is that right? If you can

1 recall.

2 DR. BARTLETT: Please repeat the

3 question.

4 Q. Yes. They ran two cases for the

5 2,000-year return period earthquake and then a

6 number of others for the 10,000-year; is that

7 right?

8 DR. BARTLETT: Yes.

9 Q. And there was one case -- the first case

10 run was the base case, based on what they

11 considered to be the properties on the site.

12 DR. BARTLETT: Yes, I remember that.

13 Q. Okay. I want you to think back if you

14 can of case two.

15 MS. CHANCELLOR: Could the witnesses

16 have the chart that shows those various cases with

17 the description?

18 MR. TRAVIESO-DIAZ: Well, if I had them

19 in my hand, I would be very happy to give them to

20 them. One second. Can we go off the record for a

21 minute?

22 JUDGE FARRAR: Yes. Or still on the

23 record. If anyone in the room has them, we've

24 found that to be helpful in the past. Off the

25 record.

1 (A discussion was held off the record.)
2 JUDGE FARRAR: We're ready to go back on
3 the record?
4 Q. (By Mr. Travieso-Diaz) Yes. The
5 witness has been handed what is already I believe
6 part of the record. Exhibit -- State Exhibit 179.
7 And this is a summary that was provided by Holtec
8 at the State's request, of a description of the
9 conditions for the various cases that were
10 presented as part of the Visual NASTRAN simulations
11 that were given early last week by Dr. Soler. And
12 I was trying -- perhaps Dr. Bartlett by looking at
13 case two of that table, will refresh your memory as
14 to what that case was all about.
15 DR. BARTLETT: I do remember Dr. Soler
16 mentioning a case where he's doing some tuning of
17 the springs.
18 Q. And it does -- just by looking at this
19 table and your recollection what Dr. Soler said,
20 isn't it true that it appears that he tuned the
21 stiffness to resonate a five hertz and reduced the
22 damping to one percent?
23 DR. BARTLETT: The table doesn't say
24 five hertz, but I think my recollection was that it
25 was five hertz.

1 Q. I think that if you take a look at --
2 DR. BARTLETT: Oh, resonance of five
3 hertz, I see in the stiffness column, excuse me?
4 Q. All my point is, based on your
5 recollection, do you remember the results of these
6 two cases?
7 DR. BARTLETT: No, I wasn't paying much
8 attention to the results, frankly.
9 Q. Well, why don't you look at the last --
10 Page 13 or 14, which is the next-to-the-last page
11 of that document.
12 DR. BARTLETT: Yes, I can see now it's
13 plotting maximum excursions of the casks?
14 Q. Are you looking at Page 13, it's a
15 table?
16 DR. BARTLETT: Yes.
17 Q. And you take a look at case one and
18 compare the maximum excursions against case two.
19 DR. BARTLETT: I see that, yes.
20 Q. And again, of course, I'm not asking you
21 to affirm that these are correct results, but if
22 you are to believe the results that Holtec obtained
23 using Visual NASTRAN, doesn't it appear to you that
24 the results for a tune frequency, if you will,
25 case, are similar to those obtained without tuning?

1 DR. BARTLETT: I can't make a judgment
2 in this matter.
3 Q. Well, just look at the numbers. Do they
4 appear to you that they are similar? Again, I'm
5 not asking you to vouch for the voracity of the
6 accuracy.
7 DR. BARTLETT: Then what's the point of
8 my opinion? I don't understand. It's not an area
9 of my expertise, so I'm not sure I can really offer
10 an opinion.
11 DR. OSTADAN: May I?
12 Q. Yes, sure.
13 DR. OSTADAN: If I can comment here.
14 I'm still not sure we are talking about the same
15 thing. I understand they tuned the stiffness here
16 to five hertz. The damping I'm talking about, as I
17 said a few minutes ago, I'm not concerned about
18 stiffness. I'm concerned about radiation damping
19 in this comment. They indicate one percent
20 damping. Maybe you can clarify that. Is this the
21 radiation damping or is this the structural damping
22 you're talking about?
23 Q. Now, I can tell you I cannot testify to
24 that.
25 DR. OSTADAN: I'm afraid this is the

1 structural damping, because they used the five
2 percent and then change it to one percent, but you
3 can clarify that.
4 JUDGE FARRAR: We have found that a
5 little irregularity in the proceeding sometimes
6 shortens things. I saw the hand of a student go up
7 in the audience. Maybe you could help the
8 professors here. Professor Soler.
9 MR. TRAVIESO-DIAZ: It certainly wasn't
10 mine.
11 JUDGE FARRAR: You consider yourself
12 still under oath. If you could address this
13 question.
14 DR. SOLER: The model of the soil in all
15 of those simulations consisted of springs and
16 dampers. The spring constant, in particular
17 direction was, quote, tuned to five hertz. So it
18 was a value that was then known because the total
19 mass is known. So you have known K and a known
20 mass and therefore you can calculate critical
21 damping two times the square foot of KM. The
22 damping associated with that problem was then set
23 at one percent of that two times the square root of
24 KM. I would not characterize it as radiation
25 damping or structural damping. It is simply a

1 damper that has the value one percent of critical
2 damping for that system of a total mass of eight
3 casks plus a pad, vibrating with a spring constant
4 that's tuned to give a natural frequency of five
5 hertz.
6 JUDGE FARRAR: If the witness would like
7 to ask a question of Dr. Soler. Again, it's
8 irregular, but effective, so if you need to ask him
9 a question.
10 DR. OSTADAN: Yes, I do, please, Your
11 Honor. It's getting a bit more complicated now. I
12 understand this model is a nonlinear model and
13 works in time domain. You have added the spring,
14 as you indicated, but I suppose you have used
15 dashpots, and you can define what dashpot is. What
16 did you do to that dashpot specifically? Did you
17 change it, reduce it, increase it?
18 DR. SOLER: I used the dashpot value or
19 the damper value equivalent to one percent of
20 critical damping as I just explained, whereas in
21 the -- I guess you would call them the design-basis
22 runs submitted using DYNAMO, the dampers, the
23 damping constants were whatever was appropriate in
24 accordance with ASCP 486. So it was a much smaller
25 damping value.

1 DR. OSTADAN: Yes. Let me ask you
2 differently. Originally before you did this study,
3 you used a formula by Rosenblue, as is indicated in
4 your calculation, and you obtained the stiffness
5 and the dashpot parameters?
6 DR. SOLER: Correct.
7 DR. OSTADAN: It's not damping
8 coefficient, it's a dashpot parameter at that time.
9 And now my question is, after you did what you did,
10 how much of that dashpot coefficient got reduced?
11 DR. SOLER: A very large amount. I
12 can't tell you the exact numbers, but it was
13 reduced considerably.
14 DR. OSTADAN: Do you have any
15 calculations that I could go to?
16 DR. SOLER: I don't have a calculation
17 here. I can only speak from memory. My
18 recollection is that at least an order of
19 magnitude, a factor of 10, whatever the number was
20 before, it was about one-tenth of that afterwards.
21 Again, that's only from memory.
22 DR. OSTADAN: I am a bit puzzled because
23 on the one hand, I think your side and our side are
24 quite in agreement that soil structure interaction
25 effects are very important. On the other hand, you

1 are saying what's represents soil structure
2 interaction, which is nothing but that spring and
3 damping, you're changing them drastically and still
4 will get similar results. So that logic doesn't
5 quite hold. I'd be happy to review that
6 calculation.
7 DR. SOLER: I guess actually, if you
8 look at -- now that I think about it, you have the
9 numbers for dashpots in front of you, because just
10 look at the numbers for case one and case two, and
11 I guess draw your own conclusions.
12 MS. CHANCELLOR: Does Dr. Ostadan -- do
13 you need any other calculations such as how Holtec
14 calculated the soil springs and --
15 DR. OSTADAN: Well, what I have in front
16 of me is not dashpot.
17 DR. SOLER: Look at the table in the
18 first page -- the second page.
19 MS. CHANCELLOR: Do you need to look at
20 Holtec's beyond design-basis analysis, Dr. Ostadan?
21 DR. OSTADAN: Let me see for a moment
22 here.
23 JUDGE FARRAR: And remember, one at a
24 time here.
25 DR. OSTADAN: Maybe you can walk me

1 through this table what you mean.

2 DR. SOLER: Well, I guess, may I

3 approach the witness, Your Honor?

4 JUDGE FARRAR: Certainly.

5 DR. SOLER: If you look on Page 2 of 14,

6 the numbers there at the bottom of the page are the

7 six springs and six dashpot constants for the lower

8 bound design-basis case. And on Page 3, those same

9 set of numbers are given for the tuned case with

10 one percent damping. I'll call your attention for

11 the moment, let's take C to X, which is the second

12 line of the -- not the second line of data, but the

13 damper associated with the X direction motion in

14 table one or in the input values for case one, that

15 has the value of 9.249 times 10 to the seventh

16 pounds mass per second, whereas in table -- the

17 next table, it has a value of 2.408 times 10 to the

18 fifth. So it is reduced by I guess about four

19 orders of magnitude. You can compare all the

20 damping values and see that they are considerably

21 reduced between table -- the second table and the

22 first table.

23 MR. TRAVIESO-DIAZ: I appreciate the

24 break. However, I'm ready to move onto something

25 else unless the witness has more explanation to

1 give or more answers to give. I don't think we
2 have a pending question.
3 JUDGE FARRAR: All right. And we will
4 instruct the court reporter to put this last few
5 minutes under seal, so that nobody gets the idea
6 that the middleman lawyers can be eliminated from
7 the proceedings.
8 Seriously, I think this shows a good
9 example of allowing some flexibility, not for the
10 witnesses to argue with each other, but to exchange
11 information so that we can all move forward with a
12 common understanding of what's going on. So I
13 commend the witness and Dr. Soler, our past and
14 future witness, for helping clarify the record.
15 But when it comes to pressing a client's position,
16 that is the job of the lawyers, so let's get back
17 to that. Thank you.
18 MR. TURK: Your Honor, may I make a
19 procedural point. I think I had objected to the
20 introduction of this exhibit because at the time I
21 wasn't aware who prepared it or whether it was a
22 valid document. Hearing Dr. Soler's explanation of
23 it makes me conclude that he's comfortable with
24 this document, and I would withdraw my objection to
25 its introduction at this time.

1 JUDGE FARRAR: Had we withheld ruling at
2 that point?
3 MR. TRAVIESO-DIAZ: Yes.
4 JUDGE FARRAR: And that's State's 179?
5 MR. GAUKLER: Yes.
6 JUDGE FARRAR: Then thank you, Mr. Turk,
7 and with that objection removed, we will admit
8 State's 179 at this point.
9 (EXHIBIT-179 ADMITTED.)
10 MR. TRAVIESO-DIAZ: I would like to move
11 onto a new subject, if you will.
12 JUDGE FARRAR: Go ahead.
13 Q. (By Mr. Travieso-Diaz) Let's go to
14 Question 34. And Question 34, I believe on the
15 following questions and answers refer to a
16 different set of calculations; is that correct?
17 DR. BARTLETT: That's correct.
18 Q. And Dr. Bartlett, whose calculations are
19 these that we're discussing in Question 34?
20 DR. BARTLETT: These are Stone &
21 Webster's calculations.
22 Q. What calculations are they?
23 DR. BARTLETT: They were the
24 calculations performed for the stability of the
25 cask storage pads and for the canister transfer

1 building.

2 Q. And I take it, then, these are the

3 calculations that seek to predict how the casks and

4 the transfer building are going -- the cask and the

5 pads on the one hand and the transfer building on

6 the other are going to behave in the event of a

7 design-basis earthquake?

8 DR. BARTLETT: Yes, my recollection is

9 is that they look at the three major mechanisms of

10 failure. One would be sliding, one would be

11 bearing capacity. The last would be overturning,

12 though they do discuss a little bit of some sliding

13 analyses that were presented -- or displacement

14 analyses.

15 Q. Thank you. And now let's move to

16 question and answer 35. In question and answer 35,

17 if I understand you, you say that you have two

18 overriding concerns with the stability calculation

19 for the pads and the casks?

20 DR. BARTLETT: Yes. That's concerns

21 that Dr. Ostadan and I both have.

22 Q. All right. Who should I be asking these

23 questions to? To you or him or both?

24 DR. BARTLETT: I'll start.

25 Q. All right. This is one case in which I

1 see two names, so it's hard to figure out who.
2 What did you mean by overriding?
3 DR. BARTLETT: There could be other
4 lesser concerns maybe, but we feel that these are
5 two important concerns.
6 Q. Would it be your view that if we address
7 these concerns totally, that would be sufficient
8 for your purposes?
9 DR. BARTLETT: I'm not sure I remember
10 all the other concerns, so maybe we'll have to take
11 them one at a time and maybe if you would ask me,
12 I'll give you an opinion of whether they're lesser
13 or -- but these, I think are important concerns.
14 Q. All right. I was just trying to make
15 sure that the state of your mind was correctly
16 reflected in the use of the word.
17 The first concern that you address in
18 the following answers starting, I believe with
19 Answer 36, is the potential for pad-to-pad
20 interaction. Is that a subject that we were
21 talking about yesterday?
22 DR. BARTLETT: Yes, we started in that
23 discussion.
24 Q. Uh-huh. And as we discussed yesterday,
25 your concern, as you expressed it, was the same,

1 whether the pads did actually slide or not; is that
2 correct? I mean the concern was there regardless
3 of the movement of the pad?
4 DR. BARTLETT: Yes, we think there will
5 be pad-to-pad interaction and do not necessarily
6 believe that sliding is a prerequisite for
7 pad-to-pad interaction.
8 Q. Now, in Answer 36, you say in the first
9 line that, "Stone & Webster assumes that for a
10 longitudinal column of pads, resistance to sliding
11 is provided by adhesion of the cement treated soil
12 to the native soils beneath the pad, and that the
13 soil cement around the pads is moving in unison
14 with the pads."
15 Now, in fact, the base case assumes, in
16 fact, or shows no motion at all; is that correct?
17 DR. BARTLETT: No motion, I'm not sure I
18 understand.
19 Q. No sliding, I mean. As I read the first
20 part of your answer, you seem to indicate that
21 Stone & Webster is assuming that the pads move in
22 unison, and I thought that the fact you agreed or
23 you expressed yesterday, in our understanding, that
24 Stone & Webster's analysis indicates that the pads
25 don't move at all. So my concern is how do you get

1 to the point that they move in unison if they don't
2 move?
3 DR. BARTLETT: Well, they move, because
4 the Bonneville clay is a deformable body, so the
5 materials underneath the pads are moving, deforming
6 and as they are being pushed by the earthquake,
7 they're developing shear strains, they're
8 mobilizing their strengths, so there is movement
9 going on.
10 Q. I'm sorry, perhaps it is that I didn't
11 clarify or maybe understand what you're saying.
12 You're saying that when you're saying moving,
13 you're saying as the ground moves, the pads move
14 with it and everything moves with it with the
15 ground; is that right?
16 DR. BARTLETT: Everything is moving yes.
17 Q. So you're talking, when you say motion,
18 you don't mean relative motion of the pads
19 vis-a-vis the ground, you're talking about the
20 whole area?
21 DR. BARTLETT: The whole system moving
22 and deforming, and that deformation may not be the
23 same from point to point in the system, either.
24 Q. Okay. And now I understand what you're
25 saying, but then I don't understand how the second

1 line follows on that concept because you're talking
2 resistance to sliding. And I understood that the
3 comment that you were making a while ago, the
4 motion that you were talking about here is the
5 motion with everything, not deformation motion. I
6 would appreciate you to clarify that.
7 DR. BARTLETT: When we look at a series
8 of pads, maybe a row of pads, there's a few
9 calculations that look at rows or series of pads.
10 I think what we're trying to point out in this case
11 is it's unrealistic to even look at this row of
12 pads resting within this soil cement and underlain
13 by the cement-treated soil as acting all in unison
14 and in phase. That there will be potential for
15 out-of-phase movement, even though we haven't
16 reached shear failure.
17 Q. In other words, your comment is not
18 addressing directly to the case of the various
19 cases that Stone & Webster analyze in which it was
20 assumed that the entire row of pads was sliding and
21 figuring out how they move, is it?
22 DR. BARTLETT: Well, I know there's
23 cases where they assume sliding and tried to
24 calculate the displacement, but that's not what I'm
25 addressing here.

1 Q. So your concern is not with that case,
2 your concern is more general. It is regardless of
3 whether the pads slide relative to the ground, they
4 are still going to move, and your view, because of
5 the properties of the ground underneath the pads,
6 it's unrealistic to assume that as they move, they
7 are going to move the same way?
8 DR. BARTLETT: Right. It's not only
9 just the properties, the clays underneath the
10 cement-treated soil, it also has to do with the
11 heavily loaded pad areas that have the weight of
12 the casks and then we have adjacent areas that
13 don't have any load on them at all essentially.
14 This causes inertial interactions. These are going
15 to have different frequencies of vibration, and
16 it's those tendencies of wanting to vibrate out of
17 phase which will cause relative motions, even
18 though we haven't initiated a sliding failure on
19 top of the Bonneville clays.
20 Q. So you are saying, just so the record is
21 clear, all these pads are going to move with the
22 ground, but because their loadings are different
23 and the soil underneath may be different, they're
24 not all going to move the same way?
25 DR. BARTLETT: Yes, there's going to be

1 a tendency by the earthquake to cause them to move
2 differently.
3 DR. OSTADAN: If I may add to that
4 comment. The numbers are there to help the matter.
5 For the case of the cask and pad, the top of the
6 soil cement has acceleration in the horizontal of
7 .71g. This is in Geomatrix's calculation. The top
8 of the pad, we have to believe whose calculation.
9 If you believe Dr. Luk's calculation is 2.5g or so.
10 I don't know, Holtec doesn't show the results, so I
11 can't comment on it. So if you think of a pad
12 accelerating multiple g's, let's say, next to it,
13 you have a soil cement, which is accelerating 2.7g,
14 this is not the same motion. So something is
15 kicking something else. And that's the concern
16 here. Because when Stone & Webster look at the
17 stability, they look at one pad, apply the loads of
18 the one pad, and they look at the resistance they
19 have for one pad. What the comment is trying to
20 say here is that five feet away, there's another
21 pad, and because these motions are different, this
22 pad is going to be kicking the other pad, and that
23 kicking, that additional force has not been
24 considered.
25 Q. Do you want to add something?

1 DR. BARTLETT: Yeah, I think what
2 Dr. Ostadan means by kicking is that there will be
3 a transfer load from one pad to the next pad
4 through the soil cement.
5 Q. Let's -- since you are talking about two
6 or three different mechanisms, let's see if we can
7 divide them for a clear understanding. First, you
8 are talking about potential -- you are talking
9 about potential differences in pad motion due to
10 deformation of the soil beneath?
11 DR. BARTLETT: Yes, we call those
12 effects, inertial kinematic effects that create
13 that chance for differences in motion.
14 Q. Are you, yourself, familiar with the
15 results of Geomatrix's SHAKE analysis?
16 DR. BARTLETT: I am.
17 Q. Okay. I thought that the SHAKE analysis
18 that Geomatrix conducted showed the strains, the
19 shear strains on the soil --
20 DR. BARTLETT: Yes, I've reviewed that
21 calculation and looked at the shear strains, but we
22 must keep in mind as Dr. Ostadan pointed out, those
23 are free field shear strains. They do not have any
24 influence of the pads?
25 Q. All right. But I need to ask the

1 question. I didn't finish the question. So people
2 who read this are not going to know what I was
3 asking.
4 DR. BARTLETT: All right, let's finish
5 the process?
6 Q. The problem is that you know my
7 question.
8 DR. BARTLETT: I know where you're
9 headed before you got there. I apologize.
10 Q. I don't think anybody will -- actually,
11 just for efficiency, what do you think I was about
12 to ask you?
13 DR. BARTLETT: You were going to point
14 out that the shear strains were low.
15 Q. See, great minds think alike.
16 JUDGE FARRAR: Careful, we may get to
17 eliminate that middleman.
18 Q. (By Mr. Travieso-Diaz) Dr. Bartlett,
19 you are saying that you don't necessarily attach
20 credibility or significance for purpose of this
21 discussion to the SHAKE ground because they're only
22 for a free field?
23 DR. BARTLETT: They're only the free
24 filed conditions, so when we got to a point maybe
25 away from the pads where there wasn't the influence

1 of the pads themselves, those strains may be
2 appropriate in the clays. But here now when we
3 approach a pad and get under a loaded pad,
4 obviously, those free field conditions no longer
5 exist, and really we don't know what those strains
6 are that are developing in the clays right
7 underneath the pads.
8 Q. Is it your view that the strains will be
9 significantly different underneath the pads with
10 respect to what they will be in the free field?
11 DR. OSTADAN: Dr. Ostadan may have more
12 experience in this than I did, but my sense is they
13 could be quite different.
14 Q. All right. Now, the second thing that
15 we were talking about as a potential mechanism for
16 this pad-to-pad interaction, was the loading
17 condition. In other words, where you have
18 different number of casks, if you will, of the pads
19 and one cask could even be empty, is that what you
20 were talking about?
21 DR. BARTLETT: That could be a case
22 where you get differences, contrasting differences
23 of masses between two adjacent pads, which would
24 tend to cause inertial interaction.
25 Q. I hate to pick on you, but since you

1 have been here all along, you're the only one who
2 knows what anyone else has testified to. Don't you
3 recall that Dr. Luk was asked a number of questions
4 by everybody as to whether it would make any
5 difference to his results whether the pads were
6 loaded one way or the other, and he did a
7 barometric study and, in fact, he concluded that
8 the loading conditions of the pads had very little,
9 if anything, to do with the results that you got?
10 Do you remember that testimony?
11 DR. BARTLETT: Well, I think Dr. Luk
12 focused primarily on the response of the casks.
13 What we didn't see in Dr. Luk's analysis is the
14 forces transmitted between pad-to-pad. Also, again
15 we're still somewhat evaluating Dr. Luk's report
16 because we really only learned about these cases
17 somewhat in deposition. But also, I recall that
18 Dr. Luk's model, as he stated, at least the
19 morning -- the second morning of his testimony,
20 that he didn't include any interface elements at
21 those adjacent pads. Now, how that affects this
22 analysis, I'm frankly not going to try to
23 second-guess a nonlinear analysis. I guess we're
24 not sure it fully captured our concern here.
25 Q. Let's move on, then, to another aspect

1 of this analysis, which is, what happens when these
2 two pads start moving out of phase? Now, is it
3 true that there are essentially two possibilities
4 when they start moving, they're either going to
5 move towards each other or away?
6 DR. BARTLETT: Now, we're not
7 introducing slide, we're still talking about
8 deformation without sliding?
9 Q. Well, but I thought the interaction
10 would be in the nature of the pad acting on the
11 other pad as it moves with the soil and moving sort
12 of different.
13 DR. BARTLETT: Right, so we're probably
14 still talking about the case where we haven't
15 reached the condition yet of yielding and sliding
16 of the soil, but we're still getting some
17 interaction, though the clay is still behaving
18 somewhat elastically?
19 Q. Exactly. But even they don't slide,
20 vis-a-vis the soil, I understood your concern to be
21 that they might be moving with the soil at
22 different phase to each other?
23 DR. BARTLETT: They could still be out
24 of phase and there still could be some transfer,
25 yes.

1 Q. Okay. But what I was trying to get to
2 is this: In order for pad A to transmit forces to
3 pad B, their out-of-phase motion has to be such
4 that, if you will, the force for pad B has to be
5 directed at pad A, if you will?
6 DR. BARTLETT: If they're out of phase
7 and they're going this direction, then there would
8 be really no significant transfer. As we come back
9 in and close, then that's where the transfer would
10 occur.
11 Q. Exactly. So it's not in every case --
12 JUDGE FARRAR: And when you said this
13 direction at the beginning there, you were
14 gesturing?
15 DR. BARTLETT: Outward. Both pads
16 moving outward, and inward is when they would be
17 moving together to try to close the gap between
18 them.
19 Q. (By Mr. Travieso-Diaz) Now, my question
20 was going to be, in the case where they're moving
21 away from each other, then it's not a problem
22 essentially, if I understand what you're saying; is
23 that right?
24 DR. BARTLETT: Well, it is somewhat of a
25 problem in what it does to the soil cement, because

1 the soil cement has really very poor tensile
2 capacity, so as we go this direction, it could
3 cause some gapping.
4 Q. Okay. But the effect wouldn't be on the
5 pad, it would be on the soil --
6 DR. BARTLETT: No, no.
7 MS. CHANCELLOR: Just for clarification,
8 this direction, you mean --
9 DR. BARTLETT: I mean outward, sorry.
10 DR. OSTADAN: Let me qualify Dr.
11 Bartlett's comments. It would not be a problem for
12 the two or three that we are looking at, but if you
13 go to a bigger population, it may be a problem for
14 the next two or three out there.
15 Q. (By Mr. Travieso-Diaz) But, of course,
16 the farther away you are, you would expect that
17 interaction to be smaller; is that right?
18 DR. OSTADAN: That's true.
19 DR. BARTLETT: But we can constrain our
20 conversation to a two-pad system if you want, if
21 that makes it easier.
22 Q. I think it might make it easier.
23 So let's concentrate on the other case,
24 with respect to pad-to-pad interaction, that they
25 are essentially moving in the same direction

1 although perhaps a different phase.

2 DR. BARTLETT: Okay, so you're saying

3 they're moving together, but maybe a little bit of

4 out of phase, so it's not fully 180 degrees out of

5 phase coming inward?

6 Q. Well, isn't that a case or the range of

7 cases in which you are going to have interaction

8 that you're talking about?

9 DR. BARTLETT: Yeah, the worst case

10 would be completely 180 degrees out of phase and

11 coming together?

12 Q. Right. And that means that sort of, to

13 use a very blunt or very irregular analogy, pad A

14 would be pushing on pad B?

15 DR. BARTLETT: And pad B will be pushing

16 on pad A, via the soil cement in between them.

17 Q. Correct. But again, if that's the way

18 it works, don't the two motions of forces -- with

19 respect to the pads, ignoring the soil cement for a

20 moment -- tend to cancel out?

21 DR. BARTLETT: The two forces in the

22 soil cement tend to cancel out?

23 Q. No, ignoring the soil cement in between.

24 I could see you're being concerned with, in fact,

25 the soil cement in that case is getting in from

1 both ends; right, from the pad in front and the pad
2 behind?
3 DR. BARTLETT: I just don't understand
4 the concept of forces cancelling out. There's
5 still force transfer to both pads now.
6 Q. Okay. So there will be transfer from
7 forces from one pad to the other and the same
8 amount applied?
9 DR. BARTLETT: Right. And in an ideal
10 world, you could take that total force transfer and
11 divide it by two and you'd get the individual
12 transfers to each pad?
13 Q. And my question is now, wouldn't those,
14 since the forces are sort of in opposite
15 directions, wouldn't they tend to compress the soil
16 cement in between?
17 DR. BARTLETT: They would put the soil
18 cement in compression, yes.
19 Q. And the soil cement is picked precisely
20 because it has a fairly high compressive force,
21 doesn't it?
22 DR. BARTLETT: Yeah, but there's a
23 little bit of a danger there. It has a higher
24 strength than the surrounding native soil, but
25 because of that higher strength, it has more

capacity to transmit the force without crushing it.

Q. Well, what I'm trying to understand is, are we worried about what is going to happen to the pads or are we worried what is going to happen to the soil cement between them?

DR. BARTLETT: Well, the soil cement in the case of the pads isn't required in the design to resist sliding. So I think the more concern is the transfer of this unexpected force to the two pads, and what that does to the casks.

Q. I understand that. But what I was trying to figure out is if, in fact, it so happens that because the worst case is when the two pads are sort of pushing against each other, trying to compress the soil cement in between, isn't the effect of that compression going to be absorbed by the soil cement which is very efficient in the soil compression?

DR. BARTLETT: No, I would say it might be the opposite. An efficient material that would absorb the energy would be something that's not stiff. In the case where we put soil cement in between and add cement, we've stiffened the soil cement quite a bit. It could be stiff enough that it doesn't even fail in compression, so its energy

1 absorption capacity would be reduced.

2 Q. As long as we are talking about soil

3 cement, a portion of your discussion here on

4 pad-to-pad interaction, starting on the bottom of

5 Page 15, has to do with the creation of gaps, the

6 separation or gapping of the soil cement from the

7 pads during this process that we're discussing.

8 DR. BARTLETT: Yes.

9 Q. Could you explain to me how that would

10 work based on what you just said?

11 DR. BARTLETT: If we're again looking

12 just at the case where we're having deformation yet

13 without sliding as the pads move outward possibly

14 180 degrees out of phase, the soil cement now is

15 very weak in tension. In fact, it may already be

16 precracked, so there will be some slight gapping

17 that would be occurring either in the soil cement

18 as these try to move out of phase and outward.

19 Q. So your concern is that if the forces,

20 if you will, from one pad to another are acting

21 compression, the soil cement, in fact, is going to

22 pass through, if they're acting compression, they

23 may not have an effect on the pads, but they may

24 cause the soil cement to separate?

25 DR. BARTLETT: Yes.

1 Q. Okay. And again, you have not tried to
2 figure out how much of an actual contribution in
3 this case the phenomenon you're talking about
4 makes?
5 DR. BARTLETT: I did. I tried to
6 understand maybe how the dimensions of this
7 potential gapping that we're talking about.
8 Q. Please go ahead.
9 DR. BARTLETT: It's difficult, because
10 when I look at the test data, what I need to
11 understand really is before we reach shear failure,
12 how much shear strain is really developing in the
13 Bonneville clay. And that's difficult because we
14 can't use the free field analysis like we've
15 discussed just previously, because it doesn't
16 represent -- it doesn't have the mass of the pads
17 and the casks. So I guess one thought I had was,
18 well, the design assumption is that the peak shear
19 strength of the Bonneville clays need to be
20 mobilized to -- or near full mobilization to resist
21 sliding and what strains are available to do that.
22 Unfortunately, the direct shear test doesn't really
23 give us a way of calculating strain directly. So
24 my engineering judgment as we're talking, may be
25 something in the order of a few inches.

1 Q. Thank you. I'm going to resist the urge
2 to pursue this, since we're going to be talking
3 about it again sometime.
4 DR. BARTLETT: Okay.
5 Q. With that thought in mind, why don't we
6 move onto Paragraph 19. I'm sorry, strike that.
7 To question and answer 37, which is on Page 18, and
8 I believe this question deals with the other
9 concern you have about the stability calculation;
10 is that correct?
11 DR. BARTLETT: Yes, this has to do now
12 more with the calculation of the dynamic forces.
13 Q. Would you explain for our benefit what
14 your concern is?
15 DR. BARTLETT: I'll let Dr. Ostadan do
16 this. I see FO there, so I'll let him take the
17 lead.
18 DR. OSTADAN: I think this was discussed
19 quite a bit yesterday. As I mentioned, we have to
20 make a distinction here between canister transfer
21 building and the pad sliding stability calculation.
22 In the case of canister transfer building, the team
23 that did that, they went and obtained the structure
24 response of the building, structure response of the
25 foundation and they used that in their stability

1 calculation. In the case of the pad, as I
2 mentioned before, Holtec doesn't show whether the
3 acceleration of the pad for Stone & Webster ended
4 up guessing what those accelerations are, and they
5 happen to use the .71g for the pad, to calculate
6 the inertial load of the pad.
7 Q. All right. I'm sorry, I need to go back
8 to the previous concern, because I noted there was
9 one question or a set of questions that in my
10 effort to move ahead, I forgot to ask you about.
11 If you don't mind going back for a
12 moment to Page 17. First of all, on Page 17, you
13 were talking a moment ago about sizes of gaps and
14 so on.
15 DR. BARTLETT: Yes, that was before
16 sliding was initiated, yes.
17 Q. On top of Page 17, you indicate that you
18 disagree with Mr. Trudeau's opinion that cracking
19 would be vertical and that passive resistance will
20 not be diminished. Do you disagree with both or
21 with one? I mean there are two things that you
22 could be disagreeing with.
23 DR. BARTLETT: Yes, both the statement
24 of vertical and passive resistance is not
25 diminished.

1 Q. Yes.

2 DR. BARTLETT: The vertical cracking, if
3 it occurs, is predominantly going to be shrinkage
4 cracking, but because now we have kinematic and
5 inertial interaction going on, the way -- and also
6 bending and torsion going on, the way that cracking
7 occurs may not necessarily be vertical. And so
8 there could be subvertical cracking appearing.
9 Now, if we get this subvertical cracking, it's
10 going to be very detrimental to providing passive
11 resistance.

12 Q. What do you mean by subvertical?

13 DR. BARTLETT: Vertical would be
14 obviously 90 degrees up and down. Subvertical
15 would be some angle inclination of the vertical.

16 Q. Are you talking a small angle as opposed
17 to like 45 degrees or so?

18 DR. BARTLETT: Frankly, I don't know.
19 Again, the interactions could be quite significant
20 here between the pads and the soil cement as this
21 out-of-phase motion is initiated. And how that
22 cracks and affects the soil cement has really been
23 undetermined, and I can only speculate about what
24 the angles would be.

25 Q. And your view would be that the passive

1 resistance of the soil cement would be diminished
2 if the cracking is subvertical?
3 DR. BARTLETT: If that cracking is
4 subvertical, there would be a potential for
5 diminishing of the passive resistence, yes?
6 Q. Okay. I am going to resist going
7 further into this line and take you back to where
8 we were, Dr. Ostadan.
9 DR. OSTADAN: Yes, and where was I?
10 Q. Well, sorry I threw you off. Let's go
11 back to Page 18, and you were beginning to tell me
12 about your concerns about the dynamic force
13 calculation. And if I recall, you said that -- we
14 talked a little bit about this yesterday. And
15 again, so that we can pick up where we were, would
16 you repeat your answer to my last question.
17 DR. OSTADAN: Yes, my answer was they
18 estimated some accelerations for the pad, which
19 happens to be .71g horizontal and .659g vertical.
20 But what is the basis for that estimate? Why the
21 Holtec results were not used? These are the
22 appropriate results to use, because they have
23 obtained the pad's response. That's basically the
24 concern.
25 Q. Are you familiar with the testimony that

1 Dr. -- Mr. Trudeau presented, first in writing and
2 then orally at a hearing here on this contention?
3 DR. OSTADAN: Maybe you can elaborate on
4 it. I'm not sure I know all of it.
5 Q. Yes, I think that might be better. One
6 second, please.
7 Again, this doesn't need to be marked as
8 an exhibit because it's already part of the record.
9 Could you look at what I have given you
10 is the cover page for certification and the answers
11 to questions 28 and 29.
12 DR. OSTADAN: Yes.
13 Q. Are you familiar with this testimony
14 now?
15 DR. OSTADAN: I think I have seen this
16 discussion of high damping values on Page 14
17 before, yes.
18 Q. Yes. Well, if I -- rather than putting
19 words in your mouth, what's your understanding of
20 what Mr. Trudeau's position is?
21 DR. OSTADAN: Okay. What Mr. Trudeau is
22 trying to indicate here is that I estimated the pad
23 acceleration -- pad response to be, say, in the
24 case of horizontal .71g, which is a motion of the
25 free field ground surface at the very high

1 frequencies, peak ground acceleration. In his
2 view, it's not a bad estimate, because if you think
3 of this pad and interaction with the soil, there is
4 tremendous radiation damping. And even though my
5 pad response may correspond to other frequencies
6 and therefore higher accelerations, but since there
7 is so much radiation damping, and if you think of a
8 response spectrum of high damping values, even at
9 other frequencies, I'm not too far from .71g.
10 That's what I understand.
11 Q. All right, what's your disagreement, if
12 any, with that line of thinking?
13 DR. OSTADAN: Well, first of all, I have
14 not seen any calculation to justify the 48 percent
15 or 52 percent damping. I have quite a concern that
16 such a high level of damping could exist for a
17 surface foundation. It's unusual to see such a
18 high number. And when I go to my basic principle,
19 why are we doing all that? Holtec has already
20 analyzed how the acceleration of the pad, why don't
21 we just get in and use it? Why do we go around
22 circles here?
23 Q. Can I interrupt you for a second here. I
24 don't mean to cut you off, but there's an important
25 thought here that maybe we need clarified. You

1 wouldn't be concerned if, in fact, you had such a
2 high level of damping, that would be good; right?
3 DR. OSTADAN: I'd still have to make a
4 comparison and see what it means.
5 Q. No, but what I'm saying is, your concern
6 that that may not be an accurate value because you
7 think it's too high, is that your concern?
8 DR. OSTADAN: If -- that's a
9 hypothetical question. You're saying if indeed
10 such high levels of damping exist, my concern would
11 be less, yes.
12 Q. Okay. And your concern is that you are
13 not sure that you believe this?
14 DR. OSTADAN: I don't think we can have
15 such a high level of damping?
16 Q. That's what I was trying to get at.
17 Please go ahead. You were answering something.
18 DR. OSTADAN: Well, I mean this is
19 really trying to solve the problem in a very
20 awkward way. I wish that Mr. Trudeau would have
21 chosen to ask Holtec what is the pad response.
22 After all, this is what you got, let me use it, let
23 me show it. It would close the loop there.
24 Q. Not to get into a digression here, but
25 you really don't know why Mr. Trudeau used this

1 number, do you? I mean, do you have any
2 information on that?
3 DR. OSTADAN: Use which number?
4 Q. The value that he used, he used PGA
5 instead of getting those values from Holtec?
6 DR. OSTADAN: I have no idea why he used
7 that.
8 Q. Now, assuming that, in fact, these
9 damping values were correct -- and I know you have
10 some concern as to whether they are -- would the
11 rest of the conclusions presented by Mr. Trudeau in
12 this answer on the first Page 14 be accurate?
13 DR. OSTADAN: You know, this is quite a
14 hypothetical question, you know. I would not
15 characterize it as accurate. I would say my
16 concern would be less. But let me tell you also
17 this: As you indicated yesterday yourself, you
18 have the canister transfer building, and this
19 building is more massive and you expect more soil
20 structure interaction, but nevertheless when you go
21 to your own results, you see pad acceleration of 1
22 g. And you can argue all these things you're
23 saying here, that you have 48 percent or 52 percent
24 damping, yet the pad response is 1 g. Now we come
25 to the pad, suddenly the entire concept logic

1 changes. The pad is not --

2 Q. Pardon me, I think you misspoke. You

3 meant to say that the CTB response is 1 g, is that

4 what you're saying?

5 DR. OSTADAN: CTB foundation response is

6 over 1 g.

7 Q. Okay, I'm sorry.

8 DR. OSTADAN: And this is the same soil

9 side, same input motion. I suppose Mr. Trudeau's

10 argument could apply there, it may be a high

11 damping, too. Nevertheless, you see the foundation

12 is responding of 1 g level. So I can't see a

13 reason why pad should respond to something less.

14 DR. BARTLETT: Furthermore, we look at

15 Dr. Luk's analyses and see potential for

16 amplification in the horizontal direction, which

17 would be contrary to what we're seeing here.

18 Q. Are you saying that the results that

19 Mr. Trudeau presented here are inconsistent with

20 amplification in the horizontal direction?

21 DR. BARTLETT: That's correct.

22 Q. How so?

23 DR. BARTLETT: Because they are just

24 barely above PGA. While we see the canister

25 transfer building in the horizontal direction

1 having an acceleration just slightly over 1 g, and
2 when Dr. Luk looked at this problem, though we have
3 put a lot of qualifiers on his results because of
4 some of the things that he explained to us,
5 nevertheless, they indicate significant
6 amplification of the ground motion in the
7 horizontal direction.
8 Q. But so that we know who we're talking
9 about, all of us, what you are saying small
10 amplification, you are talking about the number
11 that he has underlined at the bottom of the page
12 where it says the maximum acceleration should be
13 .757g?
14 DR. BARTLETT: Correct, yes. That's
15 relatively small compared to .711g.
16 Q. All right. But there is some
17 amplification there?
18 DR. BARTLETT: Very minor.
19 MR. TURK: May I ask for clarification.
20 I hate to interrupt, but you're talking about
21 Dr. Luk's report. You're talking about amplitude
22 or acceleration in the horizontal direction?
23 DR. BARTLETT: Acceleration in the
24 horizontal direction shown in Figure 17.
25 Q. (By Mr. Travieso-Diaz) Do you recall

1 -- and again, I hate to pick on you, but you were
2 here throughout.
3 DR. BARTLETT: I was.
4 Q. If you can think all the way back to the
5 first day of hearing, when Dr. Tseng testified -- I
6 believe that he did -- and also in his written
7 testimony, that there will be some energy
8 absorption or loss of energy due to the pad actual
9 sliding in the case the pad slides.
10 MS. CHANCELLOR: That's Dr. Wen Tseng,
11 right, not Kris Singh?
12 MR. TRAVIESO-DIAZ: T-S-E-N-G.
13 MS. CHANCELLOR: Okay.
14 Q. (By Mr. Travieso-Diaz) And I'm talking
15 about the cask sliding of the pad. Do you remember
16 that?
17 DR. BARTLETT: There will be some
18 absorption of the energy of the casks sliding on
19 the pad due to the pad sliding on the soils, is
20 that --
21 Q. No, due to the -- let me just try this
22 again. There will be some loss of energy through
23 the process of the cask sliding on the pad; is that
24 correct?
25 DR. BARTLETT: I am getting a little

1 confused because we've been focusing here on pad
2 response, now we got cask and pad response.
3 Q. Maybe I'm confused myself. I thought
4 that there was testimony by Dr. Tseng that as the
5 cask slides on the pad, to the extent that it does,
6 some of the energy that will be transmitted back to
7 the pad from the cask is absorbed or lost by the
8 very process of moving; is that right?
9 DR. BARTLETT: That is true.
10 Q. Could that account for some of the
11 reduction -- of having a value of acceleration not
12 being as high as it could be in the case of
13 something that doesn't move the way as the canister
14 transfer building?
15 DR. BARTLETT: Well, I think we need to
16 revisit the calculation the way Mr. Trudeau did it.
17 The cask accelerations and their response was
18 received from ICEC, which had that effect in it.
19 We're focusing now on use of PGA for the inertial
20 response to the pads, and that's where PGA was
21 estimating.
22 DR. OSTADAN: Let me also add to that if
23 I may. I think the answer to your question, if you
24 accept Dr. Luk's report, is he already included the
25 cask sliding on the pad, so whatever energy

1 dissipation is there, is there in his model. And
2 then yet he still shows the pad acceleration is
3 about two, two and a half gs. So based on that
4 result, the answer is yes, even though energy
5 dissipates, there is amplification as far as the
6 pad response is concerned.
7 Q. But what I was getting to -- I'll get
8 back to Dr. Luk in a second. But going back to
9 Dr. Bartlett, isn't it true that Dr. Trudeau --
10 Mr. Trudeau, I keep on calling him doctor, I think
11 highly of him -- that Mr. Trudeau's calculation --
12 maybe Dr. Luk's calculation did have that effect
13 taken into account, but Mr. Trudeau's calculation
14 doesn't have that effect taken into account, does
15 it?
16 DR. BARTLETT: It does.
17 Q. His 7.7 includes the effect of --
18 DR. BARTLETT: Because in the
19 calculation that Mr. Trudeau did, for the inertial
20 forces of the casks, he used the forces coming from
21 the ICEC calculation, which would already have
22 included any effects of sliding in them. For the
23 acceleration of the pads, he used PGA times the
24 weight which gave the inertial force of the pads?
25 Q. So your understanding is that this

1 figure of .757g --

2 DR. BARTLETT: Is still deficient?

3 Q. Is still -- and it does include built in

4 the effect of the cask sliding?

5 DR. BARTLETT: The way the sliding

6 calculation was done by Mr. Trudeau, he looked at

7 the inertial forces due to the casks and got that

8 from ICEC. Then for the inertial forces of the

9 pads, simply took PGA in the horizontal direction

10 times the weight of the pads. The forces coming

11 from the casks, from ICEC calculation, had already

12 included any sliding effects in them because those

13 forces were obtained from Holtec.

14 Q. Let's move to the next page in the

15 document you have in front of you, Page 15. Since

16 it starts with the words at any rate, do you

17 understand this page to talk about a different

18 concept that he's applied?

19 DR. BARTLETT: Yes. It seems like he's

20 talking about a response spectrum technique.

21 Q. And what is your understanding what he's

22 trying to do here?

23 DR. BARTLETT: I'm not quite sure. I

24 think our position is that the most preferable way

25 of doing this is to obtain the forces, the inertial

1 forces of the pads directly from the Holtec
2 calculation. Sometimes in building code design, we
3 would go -- if we're calculating a base shear, one
4 could go to a response spectrum and get the
5 horizontal frequency of a system and then apply,
6 once you know the frequency, go to the response
7 spectrum and get an acceleration. But that wasn't
8 done here in this case, and I'm not sure we're
9 exactly implying that that needs to be done.
10 Q. I thought maybe you had read his
11 calculation differently. I thought what he tried
12 to do was to calibrate, if you will, the accuracy
13 of his results using the method that we have been
14 talking about versus what the factor of safety that
15 would be obtained using Holtec's values, and that
16 comparing the two numbers, he came away with a
17 factor of safety of 1.27 for his method and 1.25
18 for Holtec's method. Is that your understanding
19 what he was trying to do? What I'm referring you
20 to is the discussion at the bottom of Page 15,
21 going onto the top of Page 16.
22 DR. BARTLETT: Yes, I think this is a
23 time history that we didn't have. An acceleration
24 time history that was given to us a day or two ago.
25 We're still somewhat looking at this, but as I

1 understand it, this particular time history would
2 be a force time history, and according to this, the
3 maximum inertial loadings again coming from the
4 casks and pads was 3310 kips. Am I understanding
5 this correctly?
6 Q. Well, again, I'm not asking you to
7 endorse Mr. Trudeau's numbers, particularly as you
8 are still reviewing them. But assuming that the
9 values of the time histories that he used and that
10 the forces that he calculated are correct, would
11 it, in your mind, give you some degree of comfort
12 knowing that when you compute the factor of safety
13 using either method, you come up with similar
14 answers, almost identical answers?
15 DR. BARTLETT: Well, again we need to
16 review those time histories and see how this 3310
17 kips was derived, which for what cases it was for.
18 Maybe Dr. Ostadan could comment. He does this more
19 than I do, but I don't see SSRS being used here.
20 DR. OSTADAN: Yeah, I'm confused in
21 looking at these numbers. Yesterday, we had a
22 discussion of RCC horizontal reaction force, and
23 you indicated that reaction force could correspond
24 to the eight casks only and it does not include the
25 pad itself. Nevertheless, that number was, as I

1 recall, 2,200 kips. Okay. Now I see in this right
2 up here, that the reaction force is now 3,300 kips.
3 So roughly speaking, we are left with 1,000 kips
4 for the pad. Now, if I assume the pad is close to
5 1,000 kips itself, that means the pad is
6 accelerating to 1 g almost, and then I look at
7 Dr. Luk's report, which says the pad has
8 accelerated to two and a half g. So this is a
9 factor of two, three here missing in my mind. I
10 haven't reviewed this carefully. The numbers
11 doesn't seem to add up.
12 Q. I thought your concern is raised by the
13 difference between the 1 g that you see in this
14 calculation that you derive from looking at it and
15 the 2.5g that you read off Figure 17 of Dr. Luk's
16 calculation?
17 DR. OSTADAN: Yes, and let me add
18 another concern now, because I did a quick
19 calculation. This tells me the pad is 1 g, but
20 then on the previous page here, Dr. --
21 Mr. Trudeau's opinion was the pad is
22 accelerating -- what was the number?
23 DR. BARTLETT: .757.
24 DR. OSTADAN: .757. Again here is
25 another mismatch here. Because if he believed that

1 3,300 kips, if he believed at 2,200 kips, then we
2 have to believe the pad is 1 g. And this argument
3 on Page 14 doesn't seem to hold. And then both
4 arguments doesn't seem to be consistent with the
5 Luk report.
6 MS. CHANCELLOR: A point of
7 clarification, could you describe why the pad is
8 accelerating at 1 g?
9 DR. OSTADAN: I did a quick calculation.
10 You see, they are showing the reaction force in the
11 horizontal, based on some forces obtained, is 3,310
12 kips on this Page 15 of this exhibit. Yesterday we
13 discussed ICEC calculation, they obtained the
14 forces from Holtec, and it was conveyed to us that
15 the 2,200 kips is the total force only from the
16 eight casks. So what it means is that the
17 difference between this number, 3,300 and 2,200 is
18 about 1,100, is the addition of inertial load that
19 comes from the pad itself. Now, if you think of a
20 pad being 900 kips, in order to have 1,000 kips
21 inertial load, the pad needs to accelerate to
22 something slightly more than 1 g. That's just my
23 logic.
24 And so then on questioning Mr. Trudeau's
25 opinion on Page 14, I don't see a relation. One

1 time you're saying it's .76g based on some
2 calculation that has been done. On the other hand,
3 the next page, we are saying effectively, we're
4 saying it's 1 g. So which one should we go with?
5 Q. (By Mr. Travieso-Diaz) Let me just ask
6 you, I guess we have three different questions
7 suggested by your answer. The first question will
8 be if, in fact, it's 1 g, as you quickly
9 calculated, that will make it consistent with the
10 value for the canister transfer building you are
11 talking about before, wouldn't it?
12 DR. OSTADAN: That's right. And that's
13 what I was hoping to see along the road myself,
14 yes.
15 Q. But your concern is if that is correct,
16 it isn't consistent with the other number on the
17 other page?
18 DR. OSTADAN: Yes, that's obviously
19 inconsistent, yes?
20 Q. And I guess only Mr. Trudeau can clear
21 this up at this time.
22 The other question I have for you is,
23 you refer again to Figure 17 of the Luk report.
24 DR. OSTADAN: Yes.
25 Q. And Dr. Bartlett, again I hate to pick

1 on you, but you were here.

2 DR. BARTLETT: Yes, I remember the

3 discussion of this figure?

4 Q. We discussed yesterday and also at the

5 time that Dr. Luk testified, that he made it clear

6 that you shouldn't use those numbers at face value

7 because they represented only the value at one node

8 and the way the program works, you have to average

9 sort of a square before you could actually use

10 those values?

11 DR. BARTLETT: Fair enough, I remember

12 that discussion, yes.

13 Q. So Dr. Ostadan here taking credit for

14 the 2.5 acceleration in the Luk report, would not

15 be appropriate, would it?

16 DR. BARTLETT: If we remember

17 Dr. Ostadan's comment yesterday, and I think it's

18 an important one, that when we look at the

19 horizontal direction in a system like, he wouldn't

20 expect large differences in the horizontal

21 acceleration from point to point along the pad. We

22 talked with Dr. Luk in deposition -- when I use

23 talk, it was more through the process of deposition

24 -- to see if there was some way that we could

25 obtain what the actual accelerations of the pads

1 are. That cannot be extracted from his report.
2 Those data, as I understand it, were not routinely
3 output by him, and you would have to repeat the
4 runs to reproduce what exactly the accelerations of
5 the pads are. It's an important issue. His
6 report, though we may not be able to use it
7 quantitatively, it certainly shows, and I think
8 Dr. Luk's conclusions are, that soil-structure
9 interaction effects are important and there is some
10 amplification in the horizontal direction.
11 Q. Well, my point was and I think you will
12 agree with me, that it is probably not right to
13 take credit for the values shown in the figure as
14 represented in the rapid acceleration; is that
15 correct?
16 DR. BARTLETT: I would not use them for
17 design.
18 Q. Okay. Or for testimony?
19 MS. CHANCELLOR: Objection, testimony
20 and design are not the same thing.
21 MR. TRAVIESO-DIAZ: That's why I'm
22 asking two questions.
23 JUDGE FARRAR: Objection overruled. You
24 can answer.
25 DR. BARTLETT: We are using the results

1 of Figure 17 at face value. We've heard the
2 qualifiers put on them. The amount that the
3 accelerations will go down, we understand will go
4 down somewhat. It has not been quantified.
5 Q. (By Mr. Travieso-Diaz) Dr. Luk also
6 said, and again I think we talked a little bit
7 about this yesterday, that it isn't only a problem
8 of having only one node considered, but having one
9 -- or the damping terms not included at all, and he
10 testified that by putting the second term in, his
11 values would also go down more; is that right?
12 DR. BARTLETT: They could go down more.
13 But nevertheless, the accelerations are higher than
14 peak ground acceleration.
15 Q. What you are saying is that Dr. Luk
16 confirms your testimony, I don't think there was a
17 discussion -- well, Dr. Luk's testimony confirms
18 the point that the acceleration would be higher by
19 some amount in that peak ground acceleration?
20 DR. BARTLETT: Some unquantified amount,
21 but it could be extremely important, that amount.
22 MR. TRAVIESO-DIAZ: Mr. Chairman, this
23 would be a good point to take a break if we are at
24 that point.
25 JUDGE FARRAR: Let me check chat my

1 colleagues on something.

2 (Judges conferred off the record.)

3 JUDGE FARRAR: It is a good time for a

4 break. But before we do that, the Board would like

5 to make an observation. I said facetiously halfway

6 through this session that the court reporter should

7 put something under seal so the lawyers didn't get

8 in trouble for having the witnesses talk to each

9 other. Having concluded the first session of the

10 morning, I think -- we think exactly the opposite

11 is true. This morning's session should be

12 publicized as an example of a couple of things:

13 When you're in a long hearing, lawyers' and

14 participants' sense of humor and willing to be

15 self-effacing is very important for keeping things

16 going. These are very complex, very serious

17 issues. The State takes them seriously, the

18 Company takes them seriously, the Staff takes them

19 seriously, as do we. But it's nice when

20 participants are willing not to take themselves too

21 seriously and to have a self-effacing attitude.

22 Far more important than that, there were

23 a lot of critics at the two limited appearance

24 sessions of the Commission's procedures and of the

25 hearing process. There are critics at other

1 locations of these procedures. We think that this
2 morning's session shows those procedures at their
3 absolute best. It's happened other times during
4 the proceeding, but here we have counsel
5 well-prepared, witnesses highly competent and --
6 and this is an adversary process, the State wants
7 its results, the Company wants its results. These
8 are State's witnesses, Company lawyers. But the
9 level of this discourse, even though it's
10 adversary, it was non hostile. It was a search for
11 the truth, it was by people well-prepared who were
12 willing to make concessions when they had to, but
13 it points out how this process and the
14 cross-examination process can help the search for
15 truth on some very complex issues. It also points
16 out that while we on the Board pride ourselves on
17 our ability to make sure the record is properly
18 developed where there are missing pieces, where
19 there are things that we think haven't been well
20 developed, there's a limit to what we can do
21 without the assistance of counsel. And I just
22 think it ought to be noted for all the
23 participants, all the clients and critics here,
24 there and everywhere, that this is the way the
25 process ought to work. We'll eventually get to the

1 truth. Each of you has a different version of what
2 that truth ought to be, and eventually we'll have
3 to decide. But this is the way the process ought
4 to work, and I want to compliment -- the Board, the
5 entire Board wants to compliment everybody on their
6 approach to this.
7 Thank you. It is five of. Let's take a
8 break until ten after.
9 (A recess was taken.)
10 JUDGE FARRAR: All right, let's
11 continue, and I hope in the same frame that the
12 court described the morning session.
13 MR. TRAVIESO-DIAZ: Let's hope so.
14 Q. (By Mr. Travieso-Diaz) Gentlemen, I'd
15 like to go back for one second to the items that we
16 were talking about before the break, which was
17 Dr. Trudeau -- Mr. Trudeau's answers that you have
18 before you. And my question is very simple. Is it
19 your understanding, Dr. Ostadan, that the figure of
20 3310 that you used and that you referred to in this
21 calculation, was obtained directly by Mr. Trudeau
22 from Holtec?
23 DR. OSTADAN: That's how I read that,
24 yes.
25 Q. Okay. So to the extent that earlier on

1 we're talking about Stone & Webster not using
2 Holtec's inputs, that concern doesn't apply
3 necessarily to this particular calculation; is that
4 right?
5 DR. OSTADAN: I would say still not
6 using. I mean whether this number we agree with or
7 not, is a different matter, as you know. But to
8 the extent it's been fully used or not, I still
9 don't quite agree. Mr. Trudeau has looked at one
10 direction, it appears, but as you know, earthquake
11 has acting in all three directions, so there is
12 other directions that need to be considered. And
13 it just so happened, when it comes to the sliding
14 of a pad, you know, mother nature doesn't care how
15 we orient ourselves. These forces add up in two
16 directions. So I think that needs to be improved,
17 if you will, augmented with other directions.
18 Q. All right. So your concern is not
19 whether he used the Holtec input but whether he
20 used enough of it?
21 DR. OSTADAN: That's correct.
22 Q. All right. Let's go back just for one
23 quick minute, and I think this is for Dr. Bartlett,
24 but either of you can answer. We were talking
25 yesterday about the long-term settlement of the

1 pads and I have two things to ask you about. The
2 first one is, if I remember -- this is for you
3 Dr. Bartlett. You remember that you broke down the
4 long settlement of the pad as essentially having
5 three periods or three components?
6 DR. BARTLETT: Yes, I do.
7 Q. And we talk about first the very
8 immediate settlement that happens when we apply the
9 loads?
10 DR. BARTLETT: Yes?
11 Q. And then the second was the primary
12 consolidation phase?
13 DR. BARTLETT: Yes.
14 Q. And you said that that would take a
15 couple of years, the second phase?
16 DR. BARTLETT: It's somewhat a function
17 of what we call the pre-consolidation stress of the
18 clays. If we place them into normal consolidated
19 behavior, it could take that long. If they're
20 heavily consolidated, it may be relatively quickly,
21 also.
22 Q. Could it also depend to what level of
23 saturation the clays have?
24 DR. BARTLETT: Yes, it could have an
25 effect. Clays like this, if they're quite

1 unsaturated, it would probably happen quite
2 quickly. If they're approaching maybe roughly 80
3 percent saturation, then they may behave somewhat
4 like they were saturated.
5 Q. There the reason I'm asking that is
6 because I took a look last night at the calculation
7 that Stone & Webster performed on settlement, and
8 they have the second phase taking place in two
9 months.
10 DR. BARTLETT: That indicates to me it's
11 probably the clays are somewhat over-consolidated,
12 and because of that fact, then that part of the
13 consolidation settlement is occurring relatively
14 quickly.
15 Q. So the difference between the number
16 that you estimated and theirs, could be the
17 assumptions as to what level of consolidation or
18 saturation the clays have?
19 DR. BARTLETT: I'm not sure I understand
20 that question?
21 Q. Okay. I'm saying, that would account
22 for the difference or the potential difference of
23 the two years or two months or something in
24 between?
25 DR. BARTLETT: In the time range, you're

1 correct.

2 Q. Okay, thank you.

3 One more question with regard to

4 settlement. And this one I have to ask you again.

5 Do you remember that the issue of pad deflection

6 was brought up in the testimony that Dr. Luk gave,

7 I guess now a couple of days ago, and if I recall

8 his testimony, he said that having one inch or

9 thereabouts of settlement of the pad did not seem

10 to affect at all his results. Do you remember

11 that?

12 DR. BARTLETT: Well, again, we must keep

13 in mind what type of settlement and where it's

14 coming from, not knowing a lot about Dr. Luk's

15 model. So I understand any settlement he would

16 have predicted or used in his model would have been

17 primarily what we would say elastic settlement due

18 to just loading of the pads and their response in

19 the elastic range. This type of settlement we're

20 talking about primarily, if we talk about

21 consolidation settlement and long-term settlements,

22 actually is a different mechanism than what Dr. Luk

23 would have had in his model.

24 Q. Thank you. Let's move back to the

25 testimony, and let's go to Question 38 on Page 19.

1 And the answer to that question extends for a page
2 and a half. Could you just first of all, so that
3 we can be efficient here, describe to me what are
4 you concerned about in this answer and what the
5 nature of the concern is.
6 DR. BARTLETT: Yes. In fact, maybe to
7 speed things along, looking at this last night, the
8 first two sentences really don't seem to be clear,
9 and probably not referenced to what we're talking
10 about, so I would offer that we delete the first
11 two sentences of this.
12 MR. TRAVIESO-DIAZ: Ms. Chancellor?
13 MS. CHANCELLOR: No objection.
14 MR. TRAVIESO-DIAZ: Okay. So we will
15 not look at the first --
16 DR. BARTLETT: Right. Why it's unclear
17 is really because we're talking about sliding here,
18 and there's a reference here to overturning. And
19 maybe it's one of those things that you just don't
20 understand why those first two sentences are there.
21 JUDGE FARRAR: For the clarity of the
22 record, let's provide a page and answer reference
23 here.
24 Q. (By Mr. Travieso-Diaz) Yes, I believe
25 you are talking about the first paragraph of Answer

1 38 on Page 19?

2 DR. BARTLETT: That's correct.

3 MS. CHANCELLOR: I believe it's we

4 believe in the last sentences of the first

5 paragraph; correct?

6 DR. BARTLETT: Right, that's just a

7 definition of what factor of safety is, so I don't

8 see any harm in that.

9 Q. (By Mr. Travieso-Diaz) So all the text

10 that precedes the words the factor of safety, FS,

11 the text preceding that last on that answer, they

12 are suggesting that should be removed.

13 JUDGE FARRAR: Beginning with another

14 concern?

15 MS. CHANCELLOR: Another concern down to

16 Rev.9 at 14 Footnote 8.

17 JUDGE FARRAR: Right. And,

18 Ms. Chancellor, you have no objection?

19 JUDGE FARRAR: I have no objection, but

20 Footnote 8 should stay in.

21 MR. TRAVIESO-DIAZ: Well, that's just a

22 citation.

23 MS. CHANCELLOR: Because otherwise, you

24 don't describe State's Exhibit 116.

25 MR. TRAVIESO-DIAZ: Well --

1 JUDGE FARRAR: Hold on a second.

2 MS. CHANCELLOR: So down to the 14, but

3 not the Footnote 8. Because Footnote 8 describes

4 what Exhibit 116 is.

5 DR. BARTLETT: Correct. And in the

6 second paragraph, the first sentence we refer again

7 to that same calculation, so maybe the Footnote 8

8 could be added to that first sentence.

9 MS. CHANCELLOR: Would you like me to

10 give you a substitute page, Your Honor?

11 JUDGE FARRAR: No, I'm just trying to

12 make sure we leave enough so that we -- couldn't we

13 just take out the first sentence?

14 DR. BARTLETT: No, the second sentence

15 is actually I think the most confusing because it

16 refers to overturning, and in this case, we're

17 really talking about sliding stability, not

18 overturning, and that's what's confusing.

19 MR. TRAVIESO-DIAZ: I would suggest a

20 clerical solution would be to move this Footnote 8

21 to the end of the paragraph, after where it says

22 see Exhibit 116, and that would do it, I think.

23 JUDGE FARRAR: Okay. Does that make

24 sense, Ms. Chancellor?

25 MS. CHANCELLOR: That's correct. Do you

1 want the first sentence deleted?

2 DR. BARTLETT: I think it's restated

3 later on in the question, so I don't see any value

4 to it.

5 JUDGE FARRAR: All right. Then we'll on

6 Answer 38 on Page 19, delete the first two

7 sentences at the witness's suggestion, and make

8 Footnote 8 -- attach Footnote 8 to the end of the

9 next sentence.

10 MS. CHANCELLOR: So Footnote 8 would

11 come after State's Exhibit 116?

12 JUDGE FARRAR: Right.

13 MS. CHANCELLOR: Thank you.

14 DR. BARTLETT: And may I also offer,

15 since Mr. Diaz gave me a chance to use my

16 calculator yesterday, I'm going to respond and say

17 this is more of a secondary issue to us. You asked

18 me to identify primary concerns and secondary

19 issues.

20 Q. (By Mr. Travieso-Diaz) Thank you. In

21 fact -- well, I guess let's leave it at that. In

22 the interest for sake of time, we'll move on.

23 Then in that case, we can move to what I

24 believe is Question 39 on Page 20. And if I

25 understand the question and answer there, you're

1 talking about a different calculation?

2 DR. OSTADAN: That's right.

3 Q. And which calculation is this?

4 DR. OSTADAN: This is a stability

5 analysis of canister transfer building.

6 Q. And should I assume that you are the

7 best person to answer questions of this?

8 DR. OSTADAN: For the first one yes and

9 then it changes to Dr. Bartlett:

10 Q. And so let's start from the beginning.

11 I believe that the first concern that you have on

12 -- I think your concerns start on Answer 40; is

13 that right?

14 DR. OSTADAN: Would you repeat the

15 question.

16 Q. Yes. The substance of your discussion

17 about concern starts with Answer 40 on Page 21?

18 DR. OSTADAN: That's correct.

19 Q. And I believe the first concern that you

20 express in Answer 40 is that PFS has not supported

21 the site assumption that the soil cement, what you

22 call buttress, the soil cement area surrounding the

23 building will provide the adequate passive

24 resistance against sliding with the requisite

25 calculations or analysis or testing; is that right?

1 DR. BARTLETT: Yes, that's correct.

2 Q. And again, the underlying basis for that

3 concern is that you have some concerns that the

4 soil cement may crack and not perform as intended?

5 DR. BARTLETT: That's correct.

6 Q. All right. And again, one of you, I

7 don't know which, could you explain to me what

8 would be your concern should the soil cement crack?

9 DR. BARTLETT: The cracking, again

10 depending on its nature and its angle of

11 inclination, could affect the passive resistance

12 provided by the soil cement. The assumption here

13 that was used in the design is that essentially the

14 soil cement would be -- remain uncracked, or if it

15 did crack, that it would be primarily vertical

16 cracking and be in place as the canister transfer

17 building is sliding back and forth, or attempting

18 to slide back and forth may be better terminology,

19 and be in place to provide this resistance to

20 sliding. However, if the cracking is severe or

21 particularly if it's nonvertical cracking, then the

22 ability to provide this passive resistance could be

23 quite diminished.

24 Q. When you say the cracking is severe, you

25 are talking about the size of the crack, the width

1 of the crack?

2 DR. BARTLETT: I'm not sure it's

3 necessarily the size of the crack. Just the fact

4 that it's there and may be somewhat continuous.

5 Q. I'm sure you're familiar with what I'm

6 going to ask you, because you have attended both of

7 the depositions of Mr. Trudeau, and also you have

8 I'm sure reviewed his testimony, haven't you?

9 DR. BARTLETT: Yes, I have.

10 Q. And the position that Mr. Trudeau takes

11 with respect to this concern, in fact, I'll

12 paraphrase it, if you have a crack, the result will

13 be that they will open, perhaps cause the building

14 to slide slightly and then crack again. Do you

15 understand his position?

16 DR. BARTLETT: As I remember the

17 discussion in deposition that we had about this, I

18 think we posed a case to Mr. Trudeau where there

19 was bending, and bending is similar to an arching,

20 and there would be tensile cracks forming at the

21 top of the soil cement. I think Mr. Trudeau's

22 position was if that did occur, some of these

23 tensile cracks, they might be induced by the

24 earthquake itself or they may be occurring along

25 preexisting shrinkage cracks that are in the soil

1 cement. And his view was as the canister transfer
2 building attempted to move back and forth, that any
3 of this gapping or cracking that may occur would
4 just simply open and close during the earthquake.
5 That's at least my recollection of Mr. Trudeau's
6 testimony.
7 Q. Without trying to object or that sounds
8 unreasonable to me, do you have any concerns --
9 DR. BARTLETT: Yes, I don't think that's
10 exactly what may happen here. Again, the inertial
11 effects of the canister transfer building are
12 large. It's a large massive structure, heavily
13 loaded, and the adjacent surrounding the canister
14 transfer building, cement -- soil cement in this
15 case, is not loaded heavily. So there would be a
16 tendency of this out-of-phase motion that
17 Dr. Ostadan explained, we see differences in
18 acceleration between the canister transfer building
19 of approximately 1 g horizontal acceleration versus
20 free field accelerations which are about .711g. So
21 this is going to create a situation for potential
22 out-of-phase motion. So then we have inertial
23 interaction now going on.
24 Also, the mat of the canister transfer
25 building is a reinforced concrete mat, relatively

1 stiff compared to the soil cement. And because of
2 these strong stiffness contrasts between a
3 reinforced concrete mat and a soil cement which is
4 not nearer as stiff as concrete, then these
5 differences in stiffness will tend to concentrate
6 forces So the cracking could be quite complex.
7 In addition, there's concerns not only
8 about the shrinkage cracks but potential settlement
9 cracking that may occur as the canister transfer
10 building over time settles. So, in essence, the
11 idea that the cracks are solely vertical and just
12 simply open and close as the canister transfer
13 building tries to move back and forth, seems an
14 over-simplification of what really may happen
15 during an earthquake?
16 Q. Assuming you have a better side of the
17 technical argument of this issue, the result might
18 be that the canister transfer building would slide
19 in an earthquake; is that right?
20 DR. BARTLETT: It would slide some, yes?
21 Q. And as we discussed yesterday, there
22 is -- itself, there is no safety significance to
23 that slide; is that correct, at least that you know
24 of?
25 DR. BARTLETT: I haven't heard of any.

1 I'll leave it to others' judgment on whether they
2 would allow a canister transfer building to slide.
3 My practice, at least as an engineer, is I would
4 not design a building to slide. In fact, being a
5 professional engineer, I would hold liability if
6 there was any results of sliding by not -- that was
7 incurred by the building. So it's not just my
8 framework in mind to really design a building to
9 have controlled sliding.
10 Q. But once again, let's be fair to PFS
11 here. They are not designing this building with
12 the intention it will slide, are they?
13 DR. BARTLETT: That's my understanding,
14 they're trying to meet the intent by using the soil
15 cement buttress as an additional restraining force
16 around the canister transfer building and trying to
17 demonstrate that that factor of safety is indeed
18 1.1.
19 Q. So if the sliding occurs because your
20 side of the argument happens to be more correct, it
21 will be an unintended consequence, not a design
22 goal?
23 DR. BARTLETT: That's a correct
24 calculation.
25 Q. Okay. Let's take a look, I think if I

1 can paraphrase, the second paragraph on Answer 40.
2 I think this is Dr. Ostadan. You are concerned
3 that there has been a failure to analyze the
4 dynamic interaction of the soil cement with the mat
5 foundation of the building. Is that your concern?
6 DR. OSTADAN: Yes, with the soil cement
7 around, yes.
8 Q. Okay. Could you explain what the nature
9 of your concern is and the consequence that you
10 see.
11 DR. OSTADAN: All right. Again, I see
12 the whole thing in the context of how much margin
13 we have here, and this is a very slim margin after.
14 What has been done here, they calculated the soil
15 spring and damping parameters for the purpose of
16 soil structure interaction analysis of the
17 building. And that calculation is fairly rigorous
18 to the extent, as I indicated before, it reflects
19 the layering soil properties at the site, and it
20 shows highly because of the dependency of the soil
21 springs and damping.
22 However, what was not considered in that
23 calculation is that there is a layer of the soil
24 cement around the building that goes out one
25 building dimension, and that could trap the

1 radiation energy inside in the soil and would
2 reduce the radiation damping, because we have this
3 cap around the building. And I could cite you a
4 couple of technical respected papers if you wish to
5 look at how much the radiation damping can be
6 reduced once you have a cap around the foundation.
7 Q. You have mentioned respective papers a
8 couple of times. Are you referring among those
9 papers, a paper by Iguchi and Luco?
10 DR. OSTADAN: Just a second. Let me get
11 that citation.
12 JUDGE FARRAR: While the witness is
13 looking for that, could we see Mr. Turk
14 Mr. Travieso-Diaz and Ms. Chancellor up here off
15 the record.
16 (A discussion was held at the bench with
17 counsel.)
18 JUDGE FARRAR: Back on the record.
19 We've discussed a collateral matter with counsel
20 while we were off the record, and they will be
21 working on that, and we're ready if the witness has
22 the documents ready to resume.
23 DR. OSTADAN: Yes, thank you, Your
24 Honor. The paper that I'm going to cite now by two
25 authors, Dr. Wong and Dr. Luco, which I agree with

1 your witnesses are quite respected in our industry
2 for their publications and the solutions they
3 provide. This paper is titled Dynamic Interaction
4 Within Rigid Foundations in a Layered Half Space.
5 It was published in the Journal of Soil Dynamics
6 and Earthquake Engineering, 1986, Volume 5 No. 3.
7 What they have solved here, they look at
8 two foundations, two pads, if you will, on the
9 surface of the soil, and they ask themselves, what
10 would be the soil spring and damping parameter or
11 dashpot parameter for this foundation, say, on the
12 right, and how would that be impacted as I move the
13 foundation closer or some distance away. So they
14 provide solutions for different spacing and
15 separation of these foundations. You can think of
16 it as it relates to PFS or canister transfer
17 building. The soil cement cap around the building
18 as it relates to the pads, you know, the pads that
19 you have all over.
20 In any case, for example, I can cite the
21 damping curve they provide in vertical directions,
22 say, in Figure 5 and what you say, you will see in
23 the figure, a series of curves provided damping for
24 radiation damping associated with the foundation on
25 the right. There is one curve with the separations

1 of this much, there is another curve associated
2 with the separation of a larger distance and so on
3 and so forth. But what can be observed there is
4 that as you bring this foundation closer to each
5 other, you do not let the radiation damping of the
6 foundation of your interest to dissipate freely,
7 because now you have to use another foundation,
8 another cap, if you will, which traps the energy.
9 Therefore, the radiation damping would be less if
10 you have other foundations around you.
11 So that aspect of the soil cement cap
12 around the canister transfer building has not been
13 considered, and that is the purpose of the comment.
14 Q. I appreciate that. But I had a pending
15 question that I guess we better get an answer for,
16 otherwise the record will be incomplete. About a
17 different paper by Iguchi and Luco. Are you
18 familiar with that?
19 DR. OSTADAN: I'm familiar with that
20 too, yes.
21 Q. And that's one of the respected papers?
22 DR. OSTADAN: This is also one of the
23 respected papers.
24 Q. Okay. Now, let's go back to your
25 answer. Are you -- I'm sure you are aware of the

1 fact that PFS used three different sets of
2 impedance functions to cover possible variations in
3 soil properties; is that right?
4 DR. OSTADAN: In soil properties, yes.
5 Q. And, in fact, of the three sets of
6 values, they used the one that would be least
7 favorable in terms of impedance and damping for the
8 purposes of their analysis; is that right?
9 DR. OSTADAN: I understood what they
10 did. They used all three and they enveloped the
11 results, which is a typical approach, yes.
12 Q. And wouldn't you think that in doing
13 that, they may have taken into account the
14 phenomenon that you described?
15 DR. OSTADAN: No, that phenomena I just
16 described is not intended to be represented by
17 variation of soil properties. It's a completely
18 different phenomena. If you don't have any
19 foundation next to your foundation, you still do
20 what you did. You will run upper bound system and
21 lower bound and envelope the results. The
22 phenomena I'm explaining here is that you have a
23 different condition now by presence of the soil
24 cap, the soil cement cap.
25 Q. I apologize, I didn't make myself clear.

1 What I meant to say is understanding that they are
2 different thoughts, different phenomena, and -- but
3 isn't it, in fact, the effect that you are talking
4 about, one that would tend to reduce the damping
5 that would be available, and by picking least
6 favorable soil properties, you would be doing the
7 same thing?
8 DR. OSTADAN: I have no way of judging
9 that. I think the intention of changing the soil
10 properties is to cover the variation of soil
11 properties, because soil properties are not a
12 single number. They vary foot by foot. So the
13 practice is to cover the range by doing analysis of
14 upper bound, lower bound base estimate to ensure
15 that this variation is incorporated in the results.
16 And I think this issue I'm talking about is
17 something different from soil property.
18 Q. So you're saying that that practice with
19 respect to use in conservative soil property
20 values, cannot be given, if you will, double duty
21 by allowing it to be used for accounting for this
22 phenomena?
23 DR. OSTADAN: I think as a minimum, it
24 hasn't been quantified. What you're saying, if I
25 may rephrase your statement is, we varied the soil

1 properties but we probably didn't have to and
2 therefore, we did more than we should, and that
3 that additional variation we considered, covers
4 what we have not considered. In the calculation,
5 this has not been considered. The variation that
6 you have considered for soil properties is in
7 accordance with ASCE 4 requirements, and it had to
8 be done, has been done. I don't know how we can go
9 and do the rest of that.
10 Q. Thank you for that clarification. And
11 again, as I asked Dr. Bartlett, if your technical
12 judgment here prevailed, the result would be
13 sliding of the building?
14 DR. OSTADAN: Yes. I mean if these
15 numbers do not add up, then there will be sliding.
16 Q. Okay. Let's move, then, into the next
17 -- I think this is for you, Dr. Ostadan, the last
18 of the three concerns that I see expressed in
19 Answer 40. Talking about the last paragraph of
20 Answer 40 before the start of Question 41. Could
21 you explain that one?
22 DR. OSTADAN: Yes, this question and the
23 follow-up questions have to do with the
24 requirements that for nonlinear analysis,
25 recognizing these analyses are a necessity to inner

1 parameters. One of the requirements in ASCE 4 is
2 that the Applicant or designer needs to use
3 multiple sets of time histories rather than one set
4 of time history, since various characteristics of
5 these time histories could be different, and a
6 nonlinear analysis could be sensitive to these
7 characteristics. And so this is basically pursuant
8 to that point, and PFS has chosen to use only one
9 set of time history.
10 Q. I'm sorry, I think I probably gave you
11 the wrong direction. I was talking about the last
12 concern expressed at the end of Answer 40.
13 DR. OSTADAN: I'm sorry, then.
14 Q. I think you're talking to something on a
15 different page.
16 DR. OSTADAN: Okay. I was on 41. Let
17 me go back to 40.
18 Q. Okay.
19 DR. OSTADAN: Oh, I see, this is another
20 aspect of damping again. This is a fairly large
21 mat, 200 odd feet versus 200 odd feet, and the
22 assumption in calculating the soil spring and
23 damping parameters, again, you would assume that
24 the foundation mat is rigid. It has not been shown
25 that it is indeed rigid. If it was not rigid, it

1 was acting in a flexible manner, the radiation
2 damping associated with this foundation would be
3 less, and as a result of that, the seismic load
4 could be higher.
5 Q. And this will be the same phenomenon, if
6 you will, that we're talking about with respect to
7 the pads?
8 DR. OSTADAN: Exactly, yes.
9 Q. Now, again, you personally don't have
10 any information that leads you to believe that this
11 foundation mat or the building is anything other
12 than rigid; is that right?
13 DR. OSTADAN: I have not any
14 calculation, but I have, based on my experience,
15 such large mats tend to be acting in flexible
16 manners.
17 Q. Now, I also remembered that you have
18 expressed an interest or a suggestion that maybe
19 Stone & Webster should try to figure out how much
20 of the flexion of that building are?
21 DR. OSTADAN: Yes, I made a suggestion
22 that somewhere in the series of calculation, one
23 can look at the mat and see how it responds and
24 make a decision whether it's acting in a flexible
25 manner or a rigid manner.

1 Q. Are you familiar with the testimony that
2 Mr. Bruce Ebbeson filed in the direct testimony in
3 this proceeding?
4 DR. OSTADAN: I barely remember that
5 now, yes. You need to cite me a certain page.
6 Q. Let's do better than that, let's give
7 you a copy of what we're talking about.
8 I have handed you -- and again, this
9 doesn't need to be marked because it's already part
10 of the record -- a portion of Mr. Ebbeson's
11 testimony comprising the first page, and pages 12
12 and 13. And what I'm going to direct your
13 attention to is the second full paragraph in Answer
14 24. Now, the Board will recall that we had some
15 discussion as to this paragraph and the attachment
16 that went with it and the input into the
17 calculation and so on. But -- so this relates to
18 that.
19 What I'm going to ask you, Dr. Ostadan,
20 is simply to read the second paragraph?
21 MS. CHANCELLOR: Could the witness have
22 Exhibit YY if you're going to read the second
23 paragraph?
24 MR. TRAVIESO-DIAZ: Absolutely. Just
25 take a second, but sure.

1 MS. CHANCELLOR: Okay. Your Honor,
2 while that's going on, could we approach the bench
3 for one second?
4 JUDGE FARRAR: Yes.
5 (A discussion was held at the bench with
6 counsel.)
7 JUDGE FARRAR: We're back on the record.
8 Do the witnesses have the exhibit that we talked
9 about?
10 DR. OSTADAN: Yes.
11 JUDGE FARRAR: Okay, go ahead,
12 Mr. Travieso-Diaz.
13 Q. (By Mr. Travieso-Diaz) My question to
14 you Dr. Ostadan, have you had an opportunity to
15 look at that second paragraph?
16 DR. OSTADAN: Yes, I did.
17 Q. And the exhibit that goes with it.
18 Again, we're not asking you to vouch for the
19 accuracy or appropriateness of the numbers that are
20 cited in that Answer 24, but you assume for
21 purposes of my question that those numbers are
22 right. And the numbers that I see cited in the
23 testimony are maximum displacements of .164 inches
24 over the length of the building which is 280 feet.
25 And the deflection of .334 inches over the width of

1 the building which is 240 feet. If those numbers
2 are correct, would they, in your mind, justify a
3 conclusion that for such small displacements and
4 such a large mat, that you'd be justified as
5 treating it as rigid?
6 DR. OSTADAN: Yes. Let me remind you,
7 we had a discussion on this with respect to the
8 pads yesterday, and the same question came up. And
9 the answer is still the same. For the purpose of
10 radiation damping, it's not important how big or
11 small amplitude of displacement is as opposed to
12 how many times it occurs. If I have this variation
13 of, say, .164 taking place every few feet, then the
14 pad -- mat is flexible. But if it's taking place
15 only at two extreme points and in between, I don't
16 see that, then it tends to be more rigid.
17 Now, I happened to look at this
18 calculation that you just handed out, limited
19 analysis of canister transfer building. If I may
20 refer you to a figure presented here in Attachment
21 6, Page 2 that shows the deflected shape of the
22 mat. And you can clearly see that figure, what I
23 mean. That no matter how small the number is, it
24 is taking place along the length of the pad, and
25 this clearly shows the pad is not rigid.

1 Q. And are you talking -- are you referring
2 to the figure -- which of the figures that you have
3 on Attachment 6, the first one or --
4 DR. OSTADAN: The first one, yes.
5 Q. The first one. And your view is that it
6 is not rigid because there are a set of
7 deflections?
8 DR. OSTADAN: You can see the
9 deformation as you move along the mat, yes.
10 Q. And I see that all this information is
11 in the same direction?
12 DR. OSTADAN: I beg your pardon.
13 Q. I'm saying, if you assume that the area
14 under the hash line is the soil or the surface?
15 DR. OSTADAN: That's right.
16 Q. Aren't all the deformations shown here
17 seem to be going in the same direction? In other
18 words, not up and down, but all going the same way?
19 DR. OSTADAN: Yes, I hope that's what
20 happens, because they will not go up, they all go
21 down. But what you see there is that it's not
22 going down uniformly. As you go around the pad,
23 you can see the shape of the mat here.
24 Q. And your testimony is that these
25 deformations here, which I take it are a fraction

1 of an inch, will cause this building 240 feet times
2 300 some feet to be flexible as opposed to rigid?
3 DR. OSTADAN: My testimony is in light
4 of the 10 percent margin that we have for sliding,
5 these little set of differences in radiation
6 damping, could take away our margin quickly. And,
7 you know, we're discussing this in a difficult way,
8 I think the designer could use the simple industry
9 standard program such as SASSI, and calculate the
10 damping, the concrete properties versus rigid
11 conditions and evaluate that.
12 Q. Dr. Ostadan, are you familiar with
13 concrete construction, the construction of concrete
14 mats?
15 DR. OSTADAN: Somewhat, yes.
16 Q. If you are laying a mat that is 240
17 times 280 feet, are you going to expect that the
18 surface is going to be totally uniform along the
19 entire surface, or are you going to have this
20 weight in excess of a fraction of an inch?
21 DR. OSTADAN: Yes, but this is the
22 construction issue, yes. There could be a ridge.
23 Q. But what I'm saying is, in fact, if the
24 theory that you are propounding here is true, there
25 will be no structure ever constructed anywhere that

1 would consider to be rigid because there is no way
2 that you could have a 280 feet building, as far as
3 I know, that you cannot have a variation in the
4 order of .3 inches; is that right?
5 DR. OSTADAN: Yes, but I think you need
6 to recognize that this design calculation is not
7 affecting construction. What they have done, they
8 assume a flat rigid foundation, they represented
9 soil with the soil springs. That was the start of
10 the analysis, and by the time they went through the
11 calculation and applied all the loads, the
12 foundation is acting, as you see in this figure.
13 So it has nothing to do with the construction. The
14 foundation is reacting to the forces applied to it,
15 and it is not reacting in a rigid manner.
16 Q. What I was trying to do, see if I could
17 get some sense of reality here, whether you could
18 reasonably expect in real life that having this
19 kind of deformation on top of the soil, in this
20 type of building, could really have any significant
21 impact. Do you believe that to be the case, or is
22 just a theoretical or analytical concern more
23 appropriate?
24 DR. OSTADAN: No, the issue of large mat
25 being flexible, acting in a flexible manner, is a

1 known issue in all practices. I'm not nitpicking
2 here. Every time -- the larger the mat is, the
3 more is the concern. They tend to act in a
4 flexible manner. Again, I go back to the margin we
5 have. If you had a factor of safety of two, this
6 comment would not be here, I can assure you. But
7 when you have 10 percent, then I'm asking all the
8 damping you are using radiation damping in light of
9 this issue, is this really accurate, we should have
10 been using a smaller damping.
11 Q. I also could refer you to, I believe
12 you're very familiar with this, to Sections 3.316
13 of the ASCE 4-98 code? Do you have that?
14 DR. OSTADAN: Yes. I'm sorry, did you
15 have a question? Go ahead.
16 Q. That Section 3.3.1.6 is entitled Effect
17 of Mat and Lateral Wall Flexibility, and it reads,
18 "The effect of mat flexibility for mat foundations
19 and the effect of wall flexibility for embedded
20 walls, need not be considered in the exercise
21 analysis performed to establish seismic responses."
22 Why wouldn't this code section itself
23 say that you don't have to worry about this
24 flexibility?
25 DR. OSTADAN: I can provide you my view

on it. This is written, you know, for conventional nuclear facilities and buildings. In cases that, as I indicated yesterday, most of these buildings, especially in soil site subjected to severe ground motions, go below ground 10, 20, 30 feet. This here, we have a building which is practically on the ground surface and subjected to ground motion, and we have a margin of about 10 percent. So in my view, there's a set of differences that could make a difference in the conclusion.

MS. CHANCELLOR: Just a point of clarification, the this you're referring to is ASCE 4-98, which you say this is written for?

DR. OSTADAN: Yes, that's correct.

MS. CHANCELLOR: Thank you.

Q. (By Mr. Travieso-Diaz) Where do you find on ASCE 4-98, the provision that says your mat is less than 30 feet deep, if this exception doesn't apply? Does it have any caveat like that?

DR. OSTADAN: No, I haven't seen any caveat like that.

Q. So this is your interpretation of how this code section would be applied or should be applied?

DR. OSTADAN: This is my view of the

1 interpretation of the code and the intention of
2 that paragraph.
3 Q. One more question on this. Again, the
4 consequence that you're prevailing on this
5 particular assumption of concern will be that the
6 building might slide a little?
7 DR. OSTADAN: I would say the building
8 would be moving somewhat.
9 Q. Okay.
10 MR. TRAVIESO-DIAZ: For those of you who
11 are keeping track, we're now moving into Section 4
12 of my outline.
13 Q. (By Mr. Travieso-Diaz) Now, let's go to
14 Question 41 that we were talking about a moment
15 ago, and if you could explain for me what the
16 nature of your concern there is.
17 DR. OSTADAN: Right. There are a bunch
18 of questions here, but I think they're all talking
19 about the same thing. Basically, as I indicated
20 about 10 minutes ago, is the ASCE requirements, and
21 also common industry practice, that whenever you do
22 an nonlinear analysis, since these analysis are
23 sensitive, it is required to use more than one set
24 of time histories. The practice in the industry
25 has been at least three sets, sometimes there have

1 been four sets have been used. And in this case,
2 PFS has chosen to use only one set. One set, and
3 that's what the concern is.
4 Q. Again, you were not here yesterday,
5 but -- I mean you were here yesterday but not last
6 week. I recall Dr. Pomerening testifying for the
7 Staff on this point and stating that it is
8 acceptable to NRC to use one single set of time
9 histories. Dr. Bartlett, do you remember him
10 saying that?
11 DR. BARTLETT: I do. May we see the
12 regulation again please?
13 MR. TURK: I think you want to see the
14 regulatory guidance?
15 DR. BARTLETT: Yes. Is it 3.7.1?
16 Q. (By Mr. Travieso-Diaz) Yes, 3.7.1.
17 DR. BARTLETT: Yes, that's what I
18 recall.
19 Q. While we're doing that, do you recall
20 that testimony?
21 DR. BARTLETT: Yes, I recall that
22 testimony.
23 Q. All right. And he did say that?
24 DR. BARTLETT: Yes, I recall that.
25 Q. Okay.

1 MR. TRAVIESO-DIAZ: Can we go off the
2 record for a second?
3 JUDGE FARRAR: Certainly.
4 (A discussion was held off the record.)
5 Q. (By Mr. Travieso-Diaz) Dr. Bartlett,
6 just so the record is clear, there is no question
7 pending. I take it you're looking at Section 3.7.1
8 of the Standard Review Plan to amplify your last
9 answer?
10 DR. BARTLETT: Yes, that's what we're
11 reviewing right now.
12 Q. Thank you, I just wanted the record to
13 reflect what's going on.
14 DR. OSTADAN: Okay, I'm quite familiar
15 with 3.7.1, I use it all the time. We need to make
16 a distinction between linear and nonlinear system.
17 When we deal with the linear system and linear
18 analysis, my interpretation of this guidance is you
19 have a choice. You can use one set of time
20 histories as long as this one set meets certain
21 requirements in terms of spectrum matching -- power
22 spectrum matching, et cetera. And that's fine.
23 But when you deal with nonlinear systems, you're
24 doing nonlinear analysis, then you need to have
25 several sets of time histories to make sure the

1 effect of sensitivity results to the characteristic
2 of time histories are covered.
3 Q. Are you reading from any particular text
4 on the 3.7.1, or is that your interpretation of how
5 it should be done?
6 DR. OSTADAN: Well, if I have to read, I
7 will read Page 3.71-3, and it provides two options.
8 As I indicated, these options are dealing for
9 linear systems. But the second paragraph in option
10 two now I read, "In some instances, in nonlinear
11 analysis of the structures, systems and components
12 may be appropriate. Multiple time history analysis
13 incorporate in real earthquake time histories are
14 appropriate when such analysis are proposed."
15 Q. Well, but the option one, which is the
16 one immediately above, that talks about use of a
17 single time history, is justified by satisfying the
18 target power spectra density, (PSD) requirements.
19 In addition to the design response spectra envelope
20 of requirements. Did I read that right?
21 DR. OSTADAN: You read that right, yes?
22 Q. And does that option one place any
23 constraints on a distinction between linear or
24 nonlinear analysis?
25 DR. OSTADAN: I can only give you my

1 opinion on the industry practice in my view. This
2 option one is only available to you when you do
3 linear analysis.
4 Q. But what I'm trying to keep the two
5 thoughts separate here, one is what you understand
6 the practice to be and two, what the NRC Staff
7 considers to be acceptable?
8 DR. OSTADAN: I think industry standard
9 in my view, is what is intended here in this
10 write-up. If you do linear analysis, you have a
11 choice, either use one set or several sets, and
12 they meet corresponding requirements. But if you
13 do the nonlinear analysis, you need to use several
14 sets of time histories.
15 Q. But when you say it is intended that
16 industry standard is applied, where do you find
17 that?
18 DR. OSTADAN: Well, I just read the
19 second paragraph of option two. In some instances,
20 in nonlinear analysis of structure system and
21 components, may be appropriate and then point,
22 multiple time history analysis incorporating real
23 earthquake time histories are appropriate when such
24 analysis are proposed?
25 Q. But if that interpretation were correct,

1 why wouldn't be that in Paragraph 1? You would
2 think that would be a more clarifying on one than
3 on two, because on two, you already had the option
4 of using three sets?
5 DR. OSTADAN: I'm not sure I understand
6 your question. That's probably should be directed
7 to NRC if you want to interpret the paragraph.
8 Q. Well, my problem is that the person who
9 interprets this regulation is not here and he says
10 that one time history was fine by him, and you're
11 saying that you had to use three and use your
12 interpretation of this document. So either you
13 know more than he does or you have information that
14 he didn't have, and that's what I'm trying to get
15 to.
16 DR. OSTADAN: I can only comment to you
17 what has been done and interpreted in the industry
18 practice of what's being done today. I'd be happy
19 to cite several examples. This is how it's
20 interpreted, how it's been reviewed, and if it's
21 not done so, it's not been acceptable.
22 Q. Let me ask you a different question,
23 though. Are you aware that Holtec has presented --
24 I think Dr. Soler testified in his testimony -- 60
25 different cases of licensing cask designs to the

1 NRC or so? Are you aware of that?

2 DR. OSTADAN: No, I'm not.

3 Q. Spent fuel casks. Subject to check, and

4 I think the testimony will speak for itself, he has

5 a table in which the testimony of the practice in

6 which he or they state or indicate that there have

7 been over 30 cases in which they use a single set,

8 and there have been a similar number in which they

9 use three sets.

10 MS. CHANCELLOR: Your Honor, is there a

11 question here?

12 MR. TRAVIESO-DIAZ: Yes, I'm getting to

13 it if you let me finish.

14 Q. (By Mr. Travieso-Diaz) In all

15 instances, the analysis has been accepted by the

16 NRC. If I gave you that information and that

17 information was true, would that tend to make you

18 believe that NRC will accept either one or three?

19 JUDGE FARRAR: Before you answer, now do

20 you want to object?

21 MS. CHANCELLOR: Objection, the question

22 doesn't require a narrative in order to set the

23 premise of the question.

24 MR. TRAVIESO-DIAZ: I apologize if my

25 style is not perfect, but I think I got my point

1 across.

2 JUDGE FARRAR: Okay. But you're not the

3 witness. The objection is overruled, but the -- I

4 suppose the less narrative, the easier it is to

5 follow, but each counsel is entitled to ask his

6 questions his own way.

7 MR. TRAVIESO-DIAZ: I could take a

8 second crack at rephrasing my question more

9 perfect.

10 JUDGE FARRAR: Do the witnesses have it

11 in mind?

12 DR. OSTADAN: I'm afraid, Your Honor, I

13 cannot have an exact answer to this question

14 because I'm not familiar with the cases you

15 referred to, and I don't know in what context NRC

16 has accepted or not, whether it has to do with the

17 displacement of the cask being insensitive or the

18 issue that we have on hand here, seismic loading on

19 the foundation on a very soft soil with a slim

20 margin, I think I need to have all of that

21 information before I could answer.

22 Q. (By Mr. Travieso-Diaz) One last

23 question, because again, we're getting close to

24 beating a dead horse.

25 Your view here reflects, as I understand

1 your last answer, what you think the NRC ought to
2 be doing in this case; is that right?
3 DR. OSTADAN: With respect to the use of
4 multiple time histories?
5 Q. Right.
6 DR. OSTADAN: Yes, my view is that this
7 is what has been interpreted and used in the
8 industry, yes?
9 Q. Okay. But it's not -- your view is not
10 what the NRC practice is?
11 DR. OSTADAN: That's what you are
12 telling me, yes.
13 Q. Thank you.
14 JUDGE FARRAR: I'm -- I might pursue
15 that last question for a moment. I'm not sure I
16 heard the answer. You said that his view was this
17 is what NRC should be doing, and I don't know if he
18 said yes or no to that.
19 MR. TRAVIESO-DIAZ: Well, he can answer
20 that, but I thought I heard him say that yes, for
21 this situation is what he thinks the NRC should be
22 doing as opposed to what NRC does.
23 MS. CHANCELLOR: I believe his answer
24 was, this is what you said NRC says it's doing.
25 JUDGE FARRAR: And I thought I heard the

1 word industry in there, or maybe I misheard. Was
2 that NRC or was that industry?
3 MR. TRAVIESO-DIAZ: We can either do it
4 again, or have the question and answer read back.
5 MR. TURK: I heard him say this is what
6 has been done by industry.
7 JUDGE FARRAR: Yeah.
8 MR. TURK: But the last question I don't
9 think got a direct answer.
10 JUDGE FARRAR: The question dealt with
11 NRC, and the answer dealt with industry. So why
12 don't you ask the question again.
13 Q. (By Mr. Travieso-Diaz) Let me try the
14 question very precisely if I can. Your views as to
15 the use of multiple time histories, does it reflect
16 your understanding of what the prevailing industry
17 practice is as opposed to the NRC regulatory
18 position?
19 DR. OSTADAN: My understanding is that
20 the industry practice has been, at least for
21 nuclear power plant, consistent with NRC's position
22 that no nonlinear analysis use multiple time
23 histories.
24 Q. So your answer is then that in cases
25 that have no nonlinear analysis, the NRC requires

1 three time histories?

2 DR. OSTADAN: It does not require a set

3 number. It requires multiple sets of time

4 histories?

5 Q. I see. And what the basis for your

6 understanding of what the NRC has required in those

7 cases?

8 DR. OSTADAN: The basis is just what I

9 read in 3.7.1, for nonlinear systems.

10 Q. But I think that we have a disconnect

11 here, if I can use the term, because you are -- I

12 thought you were referring that you knew of cases

13 that the NRC has required multiple time histories

14 when you have nonlinear systems. Do you know such

15 cases?

16 DR. OSTADAN: Yes, for example, Diablo

17 Canyon field analysis?

18 Q. And do you have instances in mind that

19 you can cite where NRC has allowed the use of a

20 single time history in a situation where you had a

21 nonlinear system?

22 DR. OSTADAN: I do not know of any.

23 Q. If I were to tell you that a table that

24 Holtec has filed in its testimony cites quite a

25 number of cases in which this has been done, would

1 that modify your answer?

2 DR. OSTADAN: As I indicated before, I

3 need to look at the information and the context

4 study that has been present, and on what basis this

5 has been agreed to. Whether it has to do with the

6 movement of the cask or seismic loading on the pad,

7 I just don't have the information here to express

8 that opinion.

9 Q. Excuse me, my question was much simpler.

10 Whether you know of any instances -- if I tell you

11 that there are instances in which the NRC --

12 MS. CHANCELLOR: Objection, Your Honor,

13 the witness has qualified whether he can agree with

14 that statement or not based on the reason that the

15 analysis was performed, and without that

16 information, Mr. Travieso-Diaz is beating a dead

17 horse?

18 MR. TRAVIESO-DIAZ: No, I'm not. With

19 all due difference, Ms. Chancellor, my question

20 amenable to a yes or no answer. So one problem is

21 that the witness didn't answer yes or no. He gave

22 his explanation, which is fine. But my question

23 was very clear and was amenable to answer yes or

24 no.

25 JUDGE FARRAR: And the new question is

1 in terms of a hypothetical when you said if I give
2 you instances? In other words, you don't want him
3 to agree that those instances are correct, but if
4 that were the situation?
5 MR. TRAVIESO-DIAZ: Exactly.
6 JUDGE FARRAR: Then on that basis, we'll
7 overrule the objection. Do you have the question
8 in mind?
9 DR. OSTADAN: Your Honor, may I ask for
10 the question again?
11 MR. TRAVIESO-DIAZ: Yes.
12 JUDGE FARRAR: Do you want to reask it
13 or do you want --
14 MR. TRAVIESO-DIAZ: Yes, you could
15 probably do better than I can.
16 JUDGE FARRAR: No, not me, but do you
17 want the reporter to read it or do you want to --
18 COURT REPORTER: Repeat it.
19 MR. TRAVIESO-DIAZ: Repeat it?
20 COURT REPORTER: Repeat it.
21 MR. TRAVIESO-DIAZ: Fine.
22 COURT REPORTER: I want lunch.
23 JUDGE FARRAR: There you go.
24 Q. (By Mr. Travieso-Diaz) My question
25 was, you said that your understanding is that in

1 situations in which the application presented for
2 NRC review involved nonlinear analysis, that NRC
3 has required the use of multiple time histories.
4 And my question to you was if, in fact, where there
5 were also cases involving nonlinear analysis in
6 which the NRC has allowed the use of one single set
7 of time histories, wouldn't that demonstrate to you
8 that, in fact, the practice is to allow either one
9 or the other regardless of whether this linear or
10 nonlinear?
11 DR. OSTADAN: Based on what my
12 experience, if that is the case, I would look at it
13 more of an exception rather than the rule, and I
14 have to look at the circumstances and the basis for
15 that, whether it's generically applicable or not.
16 Q. Is the answer yes or no?
17 MS. CHANCELLOR: Objection, Your Honor,
18 he can't force a yes or no answer.
19 JUDGE FARRAR: The answer is what it is.
20 MR. TRAVIESO-DIAZ: All right.
21 JUDGE FARRAR: We have had a ruling from
22 the court reporter that it's time for lunch and
23 that ruling has -- like some of ours, has some
24 justification. Are we close to a break point here?
25 MR. TRAVIESO-DIAZ: This is a good break

1 point here. I have a few more minutes to finish my
2 examination, but I think we can do this after
3 lunch.
4 JUDGE FARRAR: Okay, it's 12:20, let's
5 come back at 1:20.
6 (Noon Recess.)
7 JUDGE FARRAR: Let's resume with the
8 Applicant's cross-examination.
9
10 CONTINUED CROSS-EXAMINATION
11 BY MR. TRAVIESO-DIAZ:
12 Q. Good afternoon, gentlemen.
13 DR. OSTADAN: Afternoon.
14 DR. BARTLETT: Afternoon.
15 Q. If you both could turn your attention to
16 page 22 of your testimony, and to question 44.
17 DR. OSTADAN: Yes.
18 Q. I think this one is for you,
19 Dr. Ostadan. Could you tell us what your concern
20 is on the answer to question 44.
21 DR. OSTADAN: I notice a typo here, by
22 the way.
23 Q. Okay.
24 DR. OSTADAN: The third line in answer
25 to question 44, at the very end of the line it says

1 "ASCE 4098". It was intended to say 4-98.

2 Q. I think Ms. Chancellor took care of

3 that.

4 MS. CHANCELLOR: You must not have the

5 corrected copy.

6 DR. OSTADAN: Okay. What this question

7 and answer are referring to are the two

8 requirements of ASCE 4-98. One had to do with use

9 of multiple time histories for nonlinear analysis.

10 We discussed that to some extent before lunch. It

11 is stating ASCE 4-98 requires that. It also states

12 that ASCE 4-98 requires that for seismic analysis,

13 one needs to consider not only vertically

14 propagating waves but also nonvertically

15 propagating waves. And if the designer chose not

16 to do that, probably another option is to include

17 the so-called accidental torsion in the seismic

18 analysis.

19 Q. Let's talk for a second about that

20 second option because if I remember our

21 conversation during the deposition, I asked you to

22 suppose that PFS decided that for the canister

23 transfer building they were going to avail

24 themselves of that second option that the code

25 gives them. If I recall, you said that if they do

1 that, they did not have to comply with this
2 requirement or not be worried about this condition.
3 Is that right?
4 DR. OSTADAN: Well, if they chose to do
5 or include the accidental torsion, then they do not
6 need to do analysis for nonvertically propagating
7 waves. And I think that's what they did.
8 Q. Excuse me. And if they include the five
9 percent accidental torsion in their design, they
10 don't have to consider the effect of the incoming
11 waves not going vertically?
12 DR. OSTADAN: That is correct. And that
13 has been done, as I understand, for the canister
14 transfer building.
15 Q. Exactly. That's what I was going to get
16 to. There is testimony that that's what they did.
17 DR. OSTADAN: They did, yes. I don't
18 know the detail of how they did it, but it's been
19 stated that they did it.
20 Q. So we are actually focusing now on the
21 pads?
22 DR. OSTADAN: I think it is safe to say
23 that, yes.
24 Q. You also said in your deposition that
25 you expected that the departure from vertical of

1 the waves that we will be seeing at the PFS site
2 was a small departure. In other words, the angle
3 would be small.
4 DR. OSTADAN: I recall that, yes.
5 Q. And by "small", you were saying
6 something on the order of 10 degrees or so, or
7 less?
8 DR. OSTADAN: I don't recall a number,
9 frankly. You may have a better memory.
10 Q. All right. We are trying to locate a
11 document. Maybe in the meantime you can answer a
12 question based on memory and that may give us the
13 time we need to locate it.
14 Is it your understanding or do you
15 recall whether Dr. Youngs and Dr. Tseng have
16 addressed this issue in their testimony?
17 DR. OSTADAN: Yes. And if you are
18 looking for that document, you probably don't need
19 it. I recall that. We can discuss it.
20 Q. Now, let's see how well I can describe
21 what they said, since I don't have the document
22 here.
23 DR. OSTADAN: Okay.
24 Q. If I remember, they used an analysis
25 that establishes a list to their satisfaction that

1 the angle of incidence of these waves for the PFS
2 site would be less than 10 degrees? Do you
3 remember that?
4 DR. OSTADAN: Yes. I have an opinion on
5 their calculation, but I think to some extent yes,
6 that's probably what they stated.
7 Q. So that we don't have to -- let's assume
8 it is 10 degrees. I think that will be proved to
9 be right. But let's hear your opinion.
10 DR. OSTADAN: The calculation that
11 Dr. Youngs did is based on the Ray Path method,
12 which is a good method. But it applies only to SH
13 waves, which is one kind of a shear wave. And
14 basically what it does is if you start with a wave
15 coming from the side down below a certain angle, as
16 you reach to a layer interface the angle of the
17 wave propagation changes depending on the velocity
18 contrast of the soil layers. And I think he looked
19 at earthquake waves initiating fairly deep, low
20 ground. I don't remember the numbers. But
21 kilometers. Let's say a few kilometers. And then
22 he followed this Ray Path calculation all the way
23 to get to the site, and he found that his angle
24 could be pretty small.
25 So there are two observations I have

1 made with respect to that calculation. First of
2 all, it's only valid and true for SH waves. And
3 that's what he did. There are other types of waves
4 that are as destructive and damaging. One is the
5 shear wave so-called SV wave which is -- I cannot
6 think of anybody who can do Ray Path method for SV
7 wave. It is very complicated. And the main reason
8 is when the SV wave strikes a boundary of two
9 layers, it does all kinds of funny things. It
10 reflects as SV wave, it reflects as P wave, also
11 there's refraction as SV wave hits and P waves, and
12 it becomes quickly very complicated when you have
13 multi-layers. So he didn't do that. Obviously he
14 couldn't do that. So his evaluation is limited to
15 SH wave. Number one.
16 Number two, he looked at the energy
17 being initiated several kilometers down below
18 ground. I don't know the number. But the fact is
19 the fault that we have here at the site propagates
20 all the way to the surface. And even though I
21 agree with him that perhaps the main source of
22 energy release would be from deep below, but you
23 could have waves initiating from shallower depths
24 because the fault comes all the way to the surface.
25 And if we have some energy released from the

1 shallow rock rupture, then his calculations did not
2 include those scenarios.
3 So I have two concerns here: This is
4 limited to SH wave, and it's only for deep
5 ruptures. And it does not include SV and P waves.
6 Q. I hate to pick on you, Dr. Bartlett, I
7 swear I do. But since you have been here all week
8 let me try you again on this. Also going back to
9 the first day of testimony, do you recall that
10 Dr. Youngs gave a tutorial, so to speak, on the
11 different kinds of waves that you can get from an
12 earthquake?
13 DR. BARTLETT: Yes. I think he talked
14 about body and surface waves.
15 Q. I seem to vaguely remember that
16 Dr. Youngs made a point that most of the energy
17 that comes in the way of your earthquake is in the
18 form of SH waves. Do you remember him saying that?
19 DR. BARTLETT: I think that would be
20 true for close-in sources. I think he did say that
21 at more distances then there's energy in the
22 surface waves, as I recall.
23 Q. And he was talking distances on the
24 order of 50 miles or so?
25 DR. BARTLETT: I can't remember. It was

1 miles, kilometers, somewhere.

2 Q. But he did say the source from which he

3 computed contribution of the seismic waves was

4 about five miles from the site? The fault that is

5 directly underneath --

6 DR. BARTLETT: I recall it was

7 reasonably close.

8 Q. So for that kind of wave, Dr. Ostadan,

9 assuming that is the source, is it true most of the

10 energy would be in the form of shear waves?

11 DR. OSTADAN: I agree with the notion

12 that most of the energy would be initiated from

13 deeper depth and that mainly has to do with the

14 fact that the rock is more competent and when it

15 ruptures it releases more energy. And what I'm

16 trying to say that there is waves and some energy

17 that is going to be released from rupture at

18 shallower depth. And therefore, there is -- and I

19 mean that Dr. Youngs has agreed to that, that we

20 are not saying there is absolutely no possibility

21 of having inclined waves or any other kind of

22 waves; that there are other waves and inclined

23 waves but they may not be as dominant as the shear

24 waves coming from down below.

25 Q. Okay. I think that you are mostly now

1 talking about the second concern of yours which is
2 that there may be another source of waves due to
3 sort of reflection from the upper levels of the
4 soil as opposed from deep beneath? Is that what
5 you are saying?
6 DR. OSTADAN: Even with SH waves, there
7 are some waves that will come at an angle. They
8 may not have much energy, I don't know how much.
9 But he didn't calculate that or show that. And
10 then he did not do any calculations for using the
11 Ray Path method for SV wave and P wave if they come
12 in at an angle.
13 Q. That was the reason I was trying to
14 refresh myself with the aid of Dr. Bartlett. I
15 found that Dr. Youngs testified that even though
16 those waves also made a contribution, he felt that
17 that could be neglected because the main source was
18 the shear waves. Assuming he said that, would you
19 agree with that?
20 DR. OSTADAN: I don't want to speak for
21 Dr. Youngs. I have a great deal of respect for
22 him. I work with him. I don't know whether he
23 knows if -- his background is, of course,
24 developing time motion time histories for
25 conventional nuclear buildings. I'm not sure he is

1 aware of the fact that analysis of a cask on a pad
2 is a nonlinear and sensitive analysis and how much
3 that would impact cask response.
4 Q. Staying with the waves themselves for a
5 second, I want to clarify something that I asked
6 you before. In fact, there are two types of shear
7 waves, I'm reminded. One is an SH wave, another
8 one which is an SV wave, and that or those two
9 definitions correspond to the way in which the
10 vibration propagates? Is that correct?
11 DR. OSTADAN: The nature of the wave,
12 yes.
13 Q. And I thought that Dr. Youngs testified
14 that his analysis includes both SH and SV waves
15 although he may not -- in fact, he does not include
16 P waves. Is that your understanding?
17 DR. OSTADAN: No, no. His Ray Path
18 calculations - that's the calculation that goes
19 from layer by layer and changes the angle - is only
20 done for SH waves. He couldn't do that, and nobody
21 else can do that, for SV wave and P wave because,
22 as I say, it is very complicated. So instead, what
23 he did is he referred to a paper by Luco and I
24 believe Wong, if I'm not mistaken, in which they
25 have solved the response of the mat to incline SV

1 wave and P wave and tried to show how the motion
2 changes when these waves change. And he has used
3 that as a basis of his argument for SV wave and P
4 wave.
5 Q. You have a greater understanding of what
6 he did than I do, but what you are saying is he
7 used two methods; he used ray tracing for the SH
8 waves and he did something else for the SV waves?
9 DR. OSTADAN: He referred to the paper
10 published for SV waves.
11 Q. Thank you for clarifying that for me.
12 Now, you were talking about the second area of
13 concern for you was the fact that you could have a
14 source of waves other than the original source
15 below the surface? What is that? What are you
16 saying?
17 DR. OSTADAN: We are going back to SH
18 wave now. As I said, he starts down below some
19 kilometers and he releases the waves and he traces
20 that that comes to the pad and carries out the
21 calculation. I have no comment on that
22 calculation. What I'm saying is the fault is
23 inclined under the side and when it ruptures, true
24 that it ruptures a few kilometers down below but
25 the rupture propagation comes all the way to the

1 surface. So you have some energy being released
2 from points close to the ground surface. And if we
3 trace those waves, then the angle could be quite a
4 bit, even though I admit that the energy would be
5 less. But the wave would come at an angle.
6 Q. So what you are saying is this may be,
7 if I can use the term, a secondary source to waves
8 that may be inclined?
9 DR. OSTADAN: Secondary with respect to
10 the waves, correct. But I'm not sure secondary
11 when it comes to the response of the cask.
12 Q. But it would be also secondary with
13 respect to the energy that they impart on the cask?
14 DR. OSTADAN: I agree with that, yes.
15 Q. One more thing; you just said that
16 Dr. Youngs used a paper to compute the SV waves?
17 DR. OSTADAN: Right.
18 Q. Was that the Wong and Luco paper that we
19 talked about earlier?
20 DR. OSTADAN: I believe that is the one.
21 Q. So it is a respected paper?
22 DR. OSTADAN: It is a respected paper.
23 Q. All right. Are you aware, maybe you are
24 and maybe you are not, that there was also
25 testimony from the NRC staff on this issue?

1 DR. OSTADAN: I'm not aware of that.

2 Q. While this testimony is being passed

3 around, we don't need again to mark it as an

4 exhibit because it is already in the record.

5 The witness has a copy of what is on the

6 record as the NRC testimony of Daniel J. Pomerening

7 and Goodluck I. Ofoegbu concerning Unified

8 Contention Utah L/QQ, Part V (Seismic Design and

9 Foundation Stability).

10 If you would turn to Answer 13 in the

11 testimony, which is fairly lengthy. And maybe the

12 way to help us locate ourselves -- I believe that a

13 good bit of the answer, if not all of it, relates

14 to this issue. I would like you to read it so you

15 are familiar with what they say.

16 MR. TURK: May I note, this looks to be

17 an e-mail version of the testimony. The actual

18 Answer 13 appears at numbered page 15 of the

19 prefiled testimony that is in the record.

20 MR. TRAVIESO-DIAZ: That is correct.

21 And that's why I was unable to give a page number.

22 But I think it is the same document.

23 MR. TURK: And there was a typo. May I

24 point out to the witness that there is a

25 typographical error at the bottom of the first full

1 paragraph of Answer 13, that appears at the top of
2 the page following where the answer begins. It
3 should say nonvertically propagating in-phase
4 waves.
5 MR. TRAVIESO-DIAZ: To clarify, it is
6 just before the line that starts with, "Applicant's
7 calculation"?
8 MR. TURK: No. Just before the
9 paragraph -- yes, before that line. Just before
10 the paragraph, "The Applicant recently provided."
11 MR. TRAVIESO-DIAZ: So that instead of
12 "vertically" it should be "nonvertically".
13 MR. TURK: Correct. And that's a change
14 that was made when the witnesses appeared.
15 MR. TRAVIESO-DIAZ: Correct.
16 DR. OSTADAN: I prefer the way it was.
17 Yes, I think I get an idea. Go ahead
18 with your question.
19 Q. (By Mr. Travieso-Diaz) You can find the
20 place that the Staff pointed out to you the
21 typographical correction?
22 DR. OSTADAN: Yes.
23 Q. The next paragraph, it essentially says
24 that they have reviewed what PFS did and they agree
25 with it; right?

1 DR. OSTADAN: That's right.

2 Q. I don't want you to focus on that

3 because, as I understand it, their testimony goes

4 on to come up with their own reasons or their own

5 reasoning, starting with, "The following

6 considerations . . ." Do you see that?

7 DR. OSTADAN: Where are you now?

8 Q. In the paragraph immediately after the

9 paragraph that says --

10 DR. OSTADAN: Okay.

11 Q. My understanding of what follows the

12 paragraph I asked you to skip is a more detailed

13 explanation or the reasons why they agree with the

14 PFS calculations. Right?

15 DR. OSTADAN: That's right.

16 Q. Focusing on those two paragraphs, do you

17 see anything in that discussion that either

18 supports or provides additional light on the views

19 that you expressed with respect to the PFS

20 analysis, or is it essentially the same thing?

21 DR. OSTADAN: I think it's the same

22 thing. They have looked at it from the same angle,

23 more or less, and arrived at the same conclusion.

24 Q. So your comments with respect to the PFS

25 analysis would also be applicable to this portion

1 of the answer?

2 DR. OSTADAN: I think I really agree

3 with them, as I indicated a few moments ago. I

4 think as far as the wave is coming, this is a

5 secondary effect as far as the seismic wave is

6 concerned. I make it clear. But I'm not sure what

7 it means in terms of the cask response.

8 Q. But that was what I was getting to,

9 exactly. If you read on, in the paragraph that

10 starts, "Additional supporting basis . . ." It's

11 about the third page of the answer. I'm sorry,

12 it's a long answer. Do you find where I was

13 talking about?

14 DR. OSTADAN: Yes. Now ask your

15 question.

16 Q. I just wanted to make sure you were on

17 the same page I was.

18 Here, in fact, the Staff has gone on its

19 own with respect to computing what you were

20 thinking about, which is the effect of those

21 incoming waves on the pad. And as I understand it,

22 they use an analysis based on the pad geometry and

23 the anticipated displacements of the pad based on

24 the wavelength of the incoming waves. Is that what

25 you understand it to be?