

1 for the excitations. To date the State has not
2 taken up my offer to give them those inputs. We've
3 offered to get those values.

4 But I should point out also that when I
5 made that offer to the State, I pointed out that
6 these would take approximately 2,250 pages. So
7 although it's seemingly simple to produce the
8 excitations, you're talking about a very detailed
9 set of numbers over minute portions of time. I
10 don't know that the record needs all of the detail.
11 But if that's the kind of information the State
12 thinks should be in the record, of course we can
13 produce it for the Staff, and I'm sure the
14 Applicant can go back and put together a large
15 document for the State for their exhibit.

16 JUDGE FARRAR: That sounds like a good
17 point. When I speak of the missing numbers, maybe
18 one of the missing numbers is, as I understand,
19 just as you described it, would be to point to a
20 specific document where you would need to go in
21 some detail to find that missing number. That's a
22 good suggestion. But my sense was the descriptions
23 the witness was giving of where the missing numbers
24 were were not as precise as what you just said.

25 So, you know, what we're looking for is

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1 if someone sitting down could say, okay, I'm going
2 to review what these people did; I need to look
3 specifically here, here, here, and here. And maybe
4 you can provide them a number or maybe you can
5 provide what Mr. Turk just said, a 2,000-page work.
6 But my sense is at this point the record is not
7 adequate for someone to review what it was
8 precisely that you did.

9 MR. TURK: May I also comment on the
10 admissibility of the exhibit? In our view the
11 proper way to handle it would be to admit the
12 exhibit and let it be subject to cross-examination.
13 The witnesses could explain or not be able to
14 explain, depending on the case, what the inputs
15 were or what value should be given to the exhibit.

16 JUDGE FARRAR: Okay, it's 10:35. Let's
17 do this. Let's take a -- can we go off the record
18 and get some information?

19 (Discussion off the record.)

20 JUDGE FARRAR: Back on the record.
21 Let's take -- how does this sound. Let's take a
22 longer than usual break, maybe 20 minutes, for the
23 purpose of counsel conferring on how we're going to
24 resolve this. I think you all understand
25 Mr. Soper's point, the Board's point. We recognize

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1 the validity of what Mr. Turk just said. Would a
2 20-minute break for you all to resolve how we move
3 forward be helpful, or do you want us just to rule
4 ourselves on this?

5 MR. SOPER: I don't know what we could
6 do except to comment on some suggested solutions as
7 far as the State's concerned. So I don't know how
8 to respond. I don't know what else to do.

9 JUDGE FARRAR: The State has a problem,
10 we need a solution. Then the Board has a problem,
11 we need a solution. Mr. Gaukler, Mr. Turk, can you
12 confer with Mr. Soper --

13 MR. TURK: Yes, sir.

14 JUDGE FARRAR: -- and the witnesses?
15 And bearing in mind there are things the witnesses
16 can point to now, there's runs they can do in an
17 hour, and there's things that would take them a
18 month to do. Work out how we're going to arrive at
19 a solution that allows for a good record and good
20 cross-examination. So let's take 20 minutes, until
21 five of.

22 (A recess was taken.)

23 JUDGE FARRAR: If the parties have had
24 time to confer on this matter, we'll resume. Or do
25 you need more time?

1 MR. GAUKLER: We've had time to confer,
2 and let me tell you where we're at, your Honor.
3 I've conferred with both counsel for the State and
4 the Staff after conferring with our witnesses. We
5 believe we can provide a table of the input files
6 for two of the cases over lunch. I propose that we
7 do that. We look at them to see if, A, is that the
8 information they want, is everybody satisfied, do
9 you want more information, do we want all that
10 stuff. We'll pick up at that point in time.

11 JUDGE FARRAR: All right. Mr. Soper, is
12 that satisfactory to you?

13 MR. SOPER: Yeah, I think it's a
14 starting place, your Honor.

15 JUDGE FARRAR: That's what I meant,
16 satisfactory as a start. Mr. Turk?

17 MR. TURK: Yes, your Honor, it seems
18 fine to us.

19 MR. GAUKLER: I do want to say one
20 thing. It will not be possible for Dr. Soler to do
21 both that and do this other summary report you
22 talked about with respect to the displacements for
23 cask 1 over lunch. And at least Mr. Soper said he
24 preferred getting the inputs first as opposed to
25 that.

1 JUDGE FARRAR: All right. Let's go off
2 the record for a moment to discuss clarifying the
3 transcript. Off the record.

4 (Discussion off the record.)

5 JUDGE FARRAR: In terms of the
6 references to the two similar sounding names, the
7 parties and the Board have agreed that the court
8 reporter should go back and wherever there's a
9 reference to Dr., it's Dr. Soler, and wherever it's
10 a reference to Mr. or the state, it's Mr. Soper.
11 And the record will reflect what everyone knew was
12 happening.

13 Thank you, Mr. Gaukler. We will then
14 defer action on the motion to introduce Exhibit O
15 pending the development of further data.

16 Are the witnesses available for
17 cross-examination?

18 MR. SOPER: I think that's Exhibit OO,
19 your Honor.

20 JUDGE FARRAR: I'm sorry, OO, yes. Did
21 you have anything else, Mr. Gaukler?

22 MR. GAUKLER: No, I don't.

23 JUDGE FARRAR: Mr. Turk, before you
24 begin, the Board has something we want to clarify.
25 Dr. Soler, were you here yesterday when Dr. Lam

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1 asked the question about, could you just look at
2 the casks?

3 DR. SOLER: Yes.

4 JUDGE FARRAR: And kind of say, gee, I
5 know that's a problem or I know that's not a
6 problem? I have a similar kind of request of you.
7 Were you here yesterday when I asked about hidden
8 faults toward the end of the day, and someone said
9 that's -- you look for those when you're doing
10 things deterministically, not when you're doing
11 them probabilistically?

12 DR. SOLER: Okay.

13 JUDGE FARRAR: And then you mentioned
14 this morning in terms of the movement of the casks
15 "rock and roll." There are people who say
16 culturally I'm stuck in the 50's, but in terms of
17 earthquakes I'm stuck in the late 70's. When I was
18 on the appeal board we dealt with some earthquake
19 hazards at Indian Point and Seabrook, and I
20 remember how we analyzed those. You looked for
21 tectonic provinces, you looked for the largest
22 earthquake in the province; if it was in the
23 province, you moved it to the site; if it was in
24 the next province, you moved it to the border. And
25 I want to make sure that I have a full, simple

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1 understanding of how you do deterministic
2 analysis -- I'm sorry, probabilistic analysis. And
3 I notice at page 5 and 6 of your testimony you say
4 you've done both, and I notice in your resume you
5 were a professor for 25 years, so assume it's day
6 one of probabilistic analysis class.

7 DR. SOLER: I'm looking for -- I'd like
8 to give you a little clarification. The exact
9 sentence I believe you're referring to is at the
10 bottom of page 5 where it said, "I performed the
11 original analysis for PSFS using a deterministic
12 earthquake and directed and reviewed the follow-on
13 efforts utilizing various probabilistic seismic
14 events."

15 JUDGE FARRAR: Correct.

16 DR. SOLER: We did not develop the
17 earthquakes, so...

18 JUDGE FARRAR: Right, but --

19 DR. SOLER: But the statement "utilizing
20 various probabilistic seismic events" was meant to
21 infer and to state that we received earthquakes
22 that were probabilistic in nature. I myself have
23 not done any probabilistic seismic analysis.

24 JUDGE FARRAR: Okay, then what we'll do
25 is I will get from you as much or as little as I

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1 can, and any other witness for the Applicant or the
2 Staff or the State can volunteer to help us. I
3 think even though this takes things out of order,
4 I'd rather have it all now, because this is going
5 to help us or at least me understand, make sure we
6 have the right understanding of the evidence rather
7 than interject questions time after time.

8 Mr. Gaukler?

9 MR. GAUKLER: Unfortunately, Dr. Youngs
10 was the person who generated the earthquakes and is
11 the one who has --

12 JUDGE FARRAR: We may not need it. Let
13 me just ask a few questions.

14 MR. GAUKLER: Dr. Soler, is your
15 microphone on?

16 DR. SOLER: Oh. Is it on now?

17 JUDGE FARRAR: Pull it closer to you.

18 All right, somebody hires you and they
19 say, we want to do this probabilistic analysis.
20 First question you ask is, what return period
21 earthquake do you want me to deal with? And these
22 are very simple questions. Don't take them too
23 high a level. They have to tell you, we're going
24 to deal with 1,000, 2,000, 10,000-year return.

25 DR. SOLER: I have to preface by saying

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1 if you want me to do this I've got to go get
2 someone who has done this, because where I start
3 with probabilistic analysis is with an earthquake.

4 JUDGE FARRAR: So --

5 DR. SOLER: So if somebody came to hire
6 me, I would hire someone else to do that part of
7 it.

8 JUDGE FARRAR: I feel better already.
9 Okay, but they are going to -- do you all want me
10 to defer this? Do counsel understand --

11 MR. TURK: Yes.

12 JUDGE FARRAR: -- what I'm looking for?

13 MR. TURK: And I think it's very
14 important that we establish soon in this proceeding
15 what are we talking about when we talk about PSHA.
16 We have Dr. John Stamatakos with us and we also
17 have Dr. Marty McCann, who I believe is just going
18 downstairs to leave for the airport. We're trying
19 to retrieve one or both of them. Perhaps they can
20 come in and explain -- without them being sworn, or
21 swear them in and have them give you an
22 explanation.

23 JUDGE FARRAR: We've tried to follow
24 this. We think, you know, I think I have an
25 understanding, and -- but I don't want to go

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1 forward with the case if I don't have exactly the
2 right understanding.

3 MR. TURK: I think it's a very good
4 idea. I also think that perhaps in structuring
5 testimony we should have perhaps started with E and
6 looked to see, what are the excitations, what's the
7 peak ground acceleration that's then just being
8 built into all the design testimony that we're
9 going to be hearing.

10 MS. CHANCELLOR: Your Honor,
11 Dr. Bartlett can do it for us.

12 JUDGE FARRAR: Could he do it right --
13 would the parties mind if he did it now, and then
14 your -- and I give you each a chance if you
15 disagree with what he said? And I'm not talking
16 about this case. I'm just talking about when
17 someone sits down to do this type of analysis, what
18 are their thought processes.

19 MR. TURK: Your Honor, because we don't
20 have Dr. Stamatakos in the room, I'd prefer to
21 defer. But if Dr. Arabasz was in the room, who is
22 the State's expert on PSHA, I think that would be
23 probably an even more appropriate witness than
24 having Dr. Bartlett testify. But if we could wait
25 for Dr. Stamatakos to come in, but if the state

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1 wants to put Dr. Bartlett on, I won't have a
2 problem.

3 MS. CHANCELLOR: I can see if
4 Dr. Arabasz is available.

5 MR. TURK: We will have Dr. Stamatakos
6 back in a few minutes.

7 JUDGE FARRAR: Okay. Then why don't we
8 go ahead, Mr. Turk, with your cross, and then we'll
9 do the tutorial at the appropriate moment.

10 MR. TURK: Thank you, your Honor. For
11 the record, your Honor, I'd like to note that
12 Dr. Vincent Luk has joined us. And I ask him
13 simply to stand and identify himself.

14 JUDGE FARRAR: Yes. Thank you.

15 MR. TURK: Dr. Luk was here this morning
16 during the showing of the movie and during the
17 introduction of the Applicant's testimony, and we
18 hope to have him deposed later this week and for
19 him to testify soon hereafter.

20 I would note also for the record that
21 Dr. Luk is employed by the Sandia National
22 Laboratories and that he is appearing here through
23 the Office of Nuclear Regulatory Research with whom
24 the NRC Staff has requested his attendance and
25 participation. And when I say "NRC Staff," I'm

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1 speaking of the spent fuel project office which is
2 responsible for the licensing or nonlicensing of
3 this facility.

4

5

CROSS-EXAMINATION

6 BY MR. TURK:

7 Q. Good morning, gentlemen. My name is
8 Sherwin Turk. I'm an attorney with the NRC Staff
9 in Washington. I'd like to ask, first of all, for
10 some information about the multipurpose canister
11 that is contained within the HI-STORM cask. Could
12 you please describe the construction of the MPC,
13 including the shell of the MPC. And when I use the
14 phrase "MPC," we understand that's multipurpose
15 canister.

16 DR. SINGH: The multipurpose canister
17 basically consists of two major components, the
18 fuel basket which is inside and the enclosure
19 vessel which surrounds the basket, the enclosure
20 vessel.

21 MR. TURK: May we stop for one moment,
22 your Honor. May we go off the record?

23 JUDGE FARRAR: Yes.

24 (Discussion off the record.)

25 JUDGE FARRAR: Dr. Stamatakos, let's get

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1 you sworn. Stand and raise your right hand, if you
2 would, please.

3 (DR. JOHN STAMATAKOS WAS SWORN
4 AS A WITNESS.)

5 MR. TURK: Your Honor, for the record,
6 let me introduce Dr. Stamatakos. Dr. Stamatakos is
7 trained in geology. He has a Ph.D. from Lehigh
8 University. He is employed by the Center for
9 Nuclear Regulatory -- Nuclear Waste Regulatory
10 Analysis in San Antonio, Texas. The Staff has
11 prefiled his testimony on Part E of the contention,
12 and attached to his testimony is a statement of his
13 professional qualifications.

14 Dr. Stamatakos in particular, as it
15 applies to the PFS facility, is the author, or I
16 should say principal author of a 1999 report in
17 which he presented the results of a probabilistic
18 seismic hazard analysis done for the PFS site. He
19 is here today along with Dr. Marty McCann, who
20 unfortunately is not in the audience at this time.
21 Dr. McCann was also an author, a co-author of that
22 report.

23 MS. CHANCELLOR: Your Honor, if I may
24 interject. I assume the questions about the
25 probabilistic and deterministic seismic hazard

1 analysis will be just in general and not specific
2 to the PFS site?

3 JUDGE FARRAR: Precisely.

4 MS. CHANCELLOR: Thank you.

5 MR. TURK: Yes, my comments are in the
6 way of introducing the witness rather than making
7 any statements about the PFS PSHA in particular.
8 That will be the subject of the testimony that
9 comes later. And Dr. Stamatakos I believe is
10 willing to assist answering any questions the Board
11 has.

12 JUDGE FARRAR: Thank you, Mr. Turk.

13 Dr. Stamatakos, as your counsel has
14 probably explained to you, we're looking for a
15 tutorial on the conceptual framework of
16 probabilistic seismic analyses just to be sure that
17 as we hear the testimony over the next two to four
18 weeks we are sure we can put all the details in the
19 right context. So as Ms. Chancellor just
20 indicated, it has nothing to do -- what we're
21 asking has nothing to do with PFS site or project,
22 just how you go about doing your work. And I
23 mentioned when you were not in the room that 25
24 years ago I was on the appeal board dealing with
25 Indian Point and Seabrook matters, and those were

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1 deterministic, and I want to make sure that for me
2 and perhaps for my colleagues that my thinking has
3 sufficiently shifted from that to how you do things
4 now that we can understand it. So these are
5 elemental level questions. And if you could try to
6 respond to them in that way, then I'll ask for more
7 if I need it.

8 JUDGE LAM: Mr. Turk, would you define
9 for the court reporter what PSHA is?

10 MR. TURK: Yes. Perhaps I'd ask the
11 witness to do that, your Honor.

12 DR. STAMATAKOS: PSHA is a probabilistic
13 seismic hazard assessment.

14 JUDGE FARRAR: Now, when you start to do
15 one of these, one of the early questions is what
16 year, what return period earthquake are we dealing
17 with?

18 DR. STAMATAKOS: Yeah, that's kind of a
19 misnomer. It's really the return period ground
20 motion. And we should -- to be precise we really
21 should be talking about return period ground
22 motions. So the ground motion you would expect at
23 the site with some probability of exceedance.

24 JUDGE FARRAR: Okay. Now, when we did
25 that -- so someone comes to you and says, okay,

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1 we've been told or we're going to use here a
2 2,000-year return period. How do you then find out
3 what that ground motion is you just described?

4 DR. STAMATAKOS: Well, in the
5 probabilistic seismic hazard assessment you
6 evaluate all the known seismic sources. So based
7 on a geologic mapping or geophysical work, you
8 identify all those faults that you think are
9 capable of producing earthquakes.

10 JUDGE FARRAR: Just like we used to do
11 deterministically?

12 DR. STAMATAKOS: Exactly. So that's one
13 component. And you assign values to those or
14 parameters to those with distributions that go into
15 usually a logic tree, some kind of a logic tree to
16 define those parameters.

17 In addition to that, you identify
18 seismic zones to account for what we would call
19 background earthquakes or those earthquakes that
20 can generate ground motion on faults that you
21 haven't identified. Usually there's an upper bound
22 magnitude limit on those based on other kinds of
23 field studies.

24 And all of that gets incorporated with
25 the ground motion component, the attenuation of the

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1 ground motion from all these sources. It all gets
2 added together with their uncertainties to produce
3 this essentially what's called a seismic hazard
4 curve. So it's a curve that defines the mean
5 ground motion you would expect at different
6 probabilities.

7 JUDGE FARRAR: Okay. Now, how does --
8 if I understand what you just said, and you won't
9 offend me by telling me I understood you
10 incorrectly, you look at many of the -- it sounds
11 like you look at many of the same things that used
12 to be looked at deterministically, but you come up
13 with a much more robust curve or set of data than
14 in the old days when out of the Cape Ann
15 earthquake, for example, near Seabrook you would
16 come up with a simple number, ground acceleration?

17 MR. STAMATAKOS: Yeah, right. You
18 incorporate all the sources. You basically have a
19 composite of the hazard. And then the next step in
20 that would be to deaggregate and see what kinds of
21 earthquakes most control that hazard.

22 JUDGE FARRAR: Okay. Now, with the
23 process you've described a moment ago, would you do
24 the same thing if the return period was 1,000
25 years, 2,000 years and 10,000 years? Would --

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1 you'd look at the same basic data, earthquake data
2 and fault data to begin with?

3 JUDGE FARRAR: Absolutely.

4 MR. STAMATAKOS: Okay. Where, then, did
5 you factor in that, a-ha, it was 2,000 as opposed
6 to 10,000? Where does that figure in?

7 DR. STAMATAKOS: Well, that's a decision
8 at what level you think the design requirements are
9 to meet safety.

10 JUDGE FARRAR: I understand how you
11 would pick that in a particular case we're going to
12 use 2,000 or in a particular case we're going to
13 use 10,000. Once you're handed that decision or
14 you make that judgment as the staff on a particular
15 case, how do you take all that earthquake and fault
16 data that you've investigated, how do you, if I can
17 use the term "manipulate" it and say, here's what
18 it means if we're looking at a 2,000-year return
19 ground motion as opposed to a 10,000?

20 DR. STAMATAKOS: Well, you have a --
21 it's essentially a single curve that defines the
22 probability of exceeding a level of ground motion
23 at all exceedance level from a hundred years to
24 hundred thousand years or more if you want. So you
25 just, whatever level of probability exceedance you

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1 choose, you can, you know, read those numbers off
2 of the hazard curve.

3 JUDGE FARRAR: Okay. Now, that hazard
4 curve, if you did that hazard curve, would someone
5 representing an applicant and someone representing
6 an opponent readily agree that that was the hazard
7 curve, or would there be debate within the
8 community on whether that was the right hazard
9 curve?

10 DR. STAMATAKOS: There certainly will be
11 debate among experts about what the final hazard
12 curve might look like, depending on interpretations
13 of the sizes of earthquakes that can occur, how
14 frequently they can occur, you know, the kinds of
15 attenuation of ground motion. So all of the
16 parameters that go into the hazard curve are still
17 open for debate.

18 JUDGE FARRAR: But then once you all
19 agreed on the right hazard curve, once you pick a
20 2,000-year return, you would just look where that
21 intersects the curve and you would all agree that
22 now we have the right input data?

23 DR. STAMATAKOS: At that time, yeah,
24 roughly, yes.

25 JUDGE FARRAR: Okay. Or would there

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1 also be debate about where 2,000 intersects the
2 curve?

3 DR. STAMATAKOS: I don't think there
4 would be debate there.

5 JUDGE FARRAR: So now you have this
6 ground motion. I assume at this point everyone
7 agrees that you've defined the curve correctly,
8 agreed on the intersection. Now you just -- how do
9 you go from there to a particular site to define
10 how the facility, not the PFS facility but whatever
11 facility is proposed for that site, how do you now
12 reach a design basis for whatever the proposed
13 facility is?

14 DR. STAMATAKOS: Well, there are a lot
15 of steps when you go from --

16 MR. TURK: Excuse me, your Honor. I'm
17 sorry to interrupt. Dr. Martin McCann has joined
18 us and he's indicated he's willing to take the
19 stand also. I think it might help your Honors.

20 JUDGE FARRAR: Glad to have him.

21 MR. TURK: Thank you. I'm sorry to
22 interrupt the last question, and after we introduce
23 him perhaps the reporter can read it back.

24 JUDGE FARRAR: My bigger fear is that
25 he's stepping into the witness box. Does he know

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1 what's about to happen to him?

2 MR. TURK: I think he'll just have to
3 handle the questions as best he can. If I can have
4 just a moment with him.

5 JUDGE FARRAR: Okay, go ahead.

6 (Discussion off the record.)

7 (DR. MARTIN McCANN WAS SWORN.)

8 MR. TURK: Your Honor, just by way of
9 introduction, let me indicate that Dr. McCann has
10 prefiled written testimony in this proceeding,
11 along with Dr. Stamatakos and Dr. Rui Chen.
12 They'll be appearing on part E. Attached to
13 Dr. McCann's prefiled testimony is a statement of
14 his professional qualifications. Let me summarize
15 simply by stating that he was trained in civil and
16 structural engineering. He has a Ph.D. in civil
17 engineering from Stanford University. He is
18 president of a company known as Jack R. Benjamin &
19 Associates in Mountain View, California, and he has
20 considerable experience in conducting probabilistic
21 seismic hazard analyses. The Staff is pleased that
22 Dr. McCann is able to join us today and available
23 for assistance.

24 JUDGE FARRAR: I think when previously
25 seen he was headed for the airport, and we

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1 appreciate him coming back.

2 MR. TURK: I may have been wrong. I had
3 been told he was on his way to the airport, but I'm
4 glad that he's still here.

5 DR. McCANN: Can I make one correction?
6 The location of our office is Menlo Park,
7 California, not Mountain View.

8 JUDGE LAM: That's a better place,
9 right?

10 DR. McCANN: It is a better place.
11 Closer to home.

12 JUDGE FARRAR: Counsel may have had a
13 chance to explain to you the Board is looking for a
14 tutorial on probabilistic seismic hazard analysis
15 just to make sure that we have no conceptual
16 misunderstandings, so that we will be able to
17 understand the evidence that's coming in over the
18 next several weeks. It's always better to stop now
19 and make sure we're all -- that we are on the page
20 the party would like us to be on rather than have
21 testimony come in and us have to write a decision
22 some months from now not having the right
23 conceptual understanding.

24 And your colleague has taken us through
25 how you prepare the curves for the ground motion

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1 you're going to deal with, and I did have a
2 question that I had stated at that point when
3 Dr. McCann returned. Could the reporter read that
4 back, please?

5 (The record was read as follows: "So now
6 you have this ground motion. I assume at this
7 point everyone agrees that you've defined the curve
8 correctly, agreed on the intersection. Now you
9 just -- how do you go from there to a particular
10 site to define how the facility, not the PFS
11 facility but whatever facility is proposed for that
12 site, how do you now reach a design basis for
13 whatever the proposed facility is?")

14 DR. McCANN: To me or to --

15 JUDGE FARRAR: Whoever can help the
16 most. And feel free, unlike the usual case, to
17 consult before you answer and decide who should
18 answer and --

19 DR. STAMATAKOS: We ended up at, you
20 know, we have a generic hazard. I explained up to
21 for a generic hazard probabilistic curve. So go
22 from there to the design.

23 DR. McCANN: Just a clarification. As I
24 understood it, this is a generic question, not PFS
25 per se?

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1 JUDGE FARRAR: It has nothing to do with
2 PFS. It's conceptually, how do you all do your
3 work?

4 DR. McCANN: As I understand the
5 question, given the probabilistic seismic hazard
6 analysis results, which is a set of hazard curves,
7 the current evolution of the use of these curves
8 both within the nuclear industry and elsewhere is
9 to look towards a level of performance that one is
10 attempting to achieve, and that performance has
11 I'll say two dimensions. One is a level of
12 physical performance. You can think of it as
13 damage.

14 DR. STAMATAKOS: Can I -- I think he
15 didn't follow the other part of the conversation.
16 We want to go from -- we're not at that point yet.
17 We've agreed on what level, whatever level of
18 probability the judge has asked from us, it's
19 agreed upon. And the question is simply, once you
20 have a hazard curve, what steps come next to get
21 you to the design ground motions that would be
22 input into a design analysis.

23 DR. McCANN: Given the probability
24 levels then already selected?

25 JUDGE FARRAR: If someone tells you,

1 from a regulatory standpoint we're going to design
2 against a 2,000 year --

3 DR. McCANN: I see.

4 JUDGE FARRAR: We've agreed what part of
5 the curve we're going to use. How do you now take
6 that and draw design requirements from it?

7 JUDGE LAM: And before you gentlemen go
8 further, would you describe for this licensing
9 board the set of hazard curves, the parameters?

10 DR. McCANN: I didn't catch the last
11 word you said.

12 JUDGE FARRAR: Parameters.

13 JUDGE LAM: The parameters.

14 JUDGE FARRAR: What does the design
15 curve have in it?

16 JUDGE LAM: The hazard curve.

17 JUDGE FARRAR: I'm sorry, the hazard
18 curve.

19 DR. McCANN: The hazard -- the results
20 of a probabilistic seismic hazard analysis are
21 typically multifaceted in terms of the parameters
22 that are presented. The most familiar is a set of
23 curves that define the probability of exceedance
24 per year of levels of ground motion. The one we've
25 heard about here most often is peak ground

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1 acceleration. That typically is one of many for
2 which the seismic hazard calculations are
3 performed. Others would be spectral acceleration
4 at various frequencies of response for structures,
5 and there might be four or five or six of those.
6 So in essence, you have a set of hazard curves for
7 six or seven measures of ground motion.

8 Now, a set --

9 JUDGE FARRAR: Let me interrupt there.
10 Where we used to do deterministic, all I ever
11 remember we argued about was peak ground
12 acceleration.

13 DR. McCANN: Typically, yes. In a
14 deterministic world of design previously we would
15 argue over the peak ground acceleration. We would
16 then use that peak ground acceleration to scale a
17 response spectrum. And so those other frequencies
18 are being brought in, but the point of argument and
19 focus of analysis, if you will, tended to be the
20 peak ground acceleration, that's correct.

21 The probabilistic seismic hazard
22 results, and I don't know if you went over this, as
23 we've said, there are a set of curves. These
24 curves are a quantification of the uncertainties
25 that are in the various elements of the

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1 probabilistic seismic hazard analysis, often
2 represented by fractiles or, in statistical
3 parlance, competence intervals on the result. And
4 one would have decided before selecting the design
5 basis which one of those curves one would use to
6 enter, say, at a 2,000-year return period to
7 ultimately select the design basis ground motion.

8 MR. TURK: May I ask a favor, your
9 Honor? Dr. Stamatakos testified while Dr. McCann
10 was out of the room as to how you go about doing
11 the PSHA. Could we ask the same question of
12 Dr. McCann? I know he hasn't heard
13 Dr. Stamatakos's answer, but perhaps he has a
14 different way of describing it that may be useful.

15 JUDGE FARRAR: Okay. Before we do that,
16 let me ask, once you -- no, let's do what Mr. Turk
17 asked. I'll get to my other question later.

18 So the question there was, how do you
19 begin in a given geo -- you know, they said that
20 we're going to have a site in a given geographical
21 area; how do you begin to put these curves
22 together?

23 DR. McCANN: There are a number of
24 elements to a probabilistic seismic hazard
25 analysis. The -- I'll call it the first major

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1 element is the characterization of seismic sources
2 in the vicinity of the site. Usually one looks
3 within, say, two to three hundred kilometers of
4 that site, and they will gather relevant geologic,
5 seismologic, geophysical information and, if
6 necessary, site-specific geotechnical information,
7 the site soils.

8 JUDGE FARRAR: When you say two or three
9 hundred kilometers, does the old concept of
10 tectonic province come into play here in how far
11 you look?

12 DR. McCANN: It does, yes. It's part of
13 the determination of how far you actually need to
14 look. Different parts of the country may force you
15 to look further, and in other parts of the country
16 you may not need to look that far.

17 JUDGE FARRAR: I recall being very
18 critical of the Staff in 1978 for not having a map
19 of the tectonic provinces. Is there such a map
20 now?

21 DR. McCANN: There are maps of tectonic
22 provinces, yes. And in the east we tend to look
23 further away from a site than we do in the west.
24 In fact, it's quite substantial in terms of the
25 difference.

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1 The purpose of the seismic source
2 characterization part of the analysis is to model
3 those tectonic features, faults, and other geologic
4 structures that are capable of generating
5 earthquakes in the vicinity of the site. We
6 develop a model in which we are trying to describe
7 the spatial as well as the temporal rate of
8 earthquake occurrences relative to that site. In
9 other words, we want to know the likelihood that
10 they will occur at certain distances from the site,
11 how often they will occur, and then ultimately how
12 large they will be.

13 That analysis will incorporate also a
14 measure of, a quantification of the uncertainties
15 in the source characterization process -- the
16 earthquake occurrence intervals, for example. The
17 boundaries of the seismic sources, the
18 interpretation of faults and their ability to
19 generate large earthquakes, et cetera. So one
20 gets, if you will, a best estimate of how likely
21 earthquakes are to occur as well as an explicit
22 measure of the uncertainty in that assessment.

23 The next major part of the analysis is
24 the attenuation of ground motion in which we need
25 to model the magnitude and likelihood of ground

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1 motions, peak ground acceleration, for example,
2 that would occur at the site as a function
3 typically of earthquake magnitude and distance.

4 That modeling is probabilistic also in
5 two elements. There is a natural randomness to
6 ground motions that could occur even if you knew
7 the magnitude and location of an earthquake
8 deterministically. If you were decreed a certain
9 earthquake, there would be a randomness to the
10 ground motions that actually occur given that
11 magnitude and given that distance from the site.
12 So we typically refer to that as randomness, and
13 there is a probabilistic model that models that
14 part of the natural variability.

15 In addition, because we -- although we
16 have a considerable amount of data from slow motion
17 recordings, invariably, even in California where we
18 have the most data, there is indeed uncertainty,
19 meaning we don't really know exactly what the best
20 model is that should be used to predict those
21 ground motions, and therefore we have to account
22 for this modeling uncertainty, if you will.
23 Typically that is done by accounting for the
24 regional geology and propagation paths, east versus
25 west, in a very gross sense; and looking at the

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1 merits of the various models that are available in
2 the published literature, in some extreme cases one
3 might actually develop a model for the region of
4 interest.

5 If one uses the -- or follows the
6 typical practice of using published models,
7 probabilistic weights are assigned to the various
8 models based on their individual scientific merits
9 such that a diversity of professional opinion is
10 incorporated explicitly in the analysis.

11 Setting aside for the moment site
12 response, which may or may not be an issue on a
13 given site, one then combines probabilistically the
14 seismic source characterization and all of its
15 uncertainties with the ground motion modeling
16 characterization and its uncertainties. Typically
17 this will produce easily many thousands, very often
18 tens to hundreds of thousands of individual hazard
19 curves which individually have a degree of
20 credibility associated with them, and that
21 credibility propagates back to the individual
22 weights assigned to attenuation models or the
23 various source characterization parameters that
24 were used in the analysis.

25 These potentially hundreds of thousands

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1 of curves are then organized and presented in the
2 format of these fractiles that we referred to a
3 moment ago, and, for example, one could from that
4 distribution calculate the mean hazard curve from
5 the distribution. And that becomes the primary
6 product of the probabilistic seismic hazard
7 analysis.

8 MR. TURK: Could we ask for one
9 explanation? Dr. McCann used the term "fractile."
10 Could you explain what that is?

11 DR. McCANN: At each ground motion level
12 for which one is calculating the probability of
13 exceedance, there will be a set of calculated
14 points, if you will. Those points are the
15 probability of exceedance of the ground motion of
16 interest. And each point has a weight, a
17 probabilistic weight associated with it that is
18 derived from the uncertainties in the source
19 characterization and the ground motion part of the
20 analysis. Those points, that collection of points,
21 which at each ground motion may be on the order of
22 hundreds of thousands, define a probability
23 distribution on the probability of exceedance.

24 Using those points to construct that
25 distribution, one can then pose the question, what

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1 is the 90 percent probability level that the
2 probability of exceedance will not exceed that
3 level; i.e., again, in statistical jargon, it would
4 be a statistical competence interval. I use that
5 only as a notion that people would be familiar
6 with, but it doesn't strictly apply here.

7 So that 90 percent competence interval
8 would be determined at each ground motion level,
9 and the collection of points over the multitude of
10 ground motions for which the hazard was calculated
11 would define the 90th fractile hazard curve.
12 Obviously that process could be repeated as many
13 times as one would like, depending upon which
14 fractiles one was interested in.

15 JUDGE FARRAR: And why do you use
16 "fractile" instead of "percentile"?

17 DR. McCANN: Just part of the jargon
18 that I guess we've adopted over the years.

19 JUDGE FARRAR: Okay. All right, and
20 thank you very much for that explanation.

21 All right, then moving from that to the
22 return period that someone decides on, depending on
23 regulatory standards or legal requirements, we were
24 at the point of applying that or deciding on how
25 well or how to design a proposed facility to

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1 withstand -- how to design a proposed facility.
2 Take us from the curves and the return period into
3 the design of the facility.

4 DR. McCANN: Okay.

5 MR. TURK: And your Honor, part of that
6 may or may not be what Dr. McCann had deferred. It
7 was the site response he had put aside. I don't
8 know if those two are related or not, but I hope
9 you could address both of those points. You had
10 said, "putting aside the site response."

11 JUDGE FARRAR: You've done all that for
12 a region of the country. No, the curve you defined
13 is for a specific site.

14 DR. McCANN: That's correct.

15 MR. TURK: I'm sorry. So that includes
16 site response.

17 JUDGE FARRAR: The curve is for that
18 site. But does that curve -- is site response now
19 something different?

20 DR. McCANN: If there is a site response
21 issue, it would have to be incorporated. And
22 there's a variety of ways to do that.

23 JUDGE FARRAR: "Site response" meaning
24 it's on bedrock or it's on soil or whatever?

25 DR. McCANN: Or soil, right. And I

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1 elected but could certainly discuss for purposes of
2 tutorial and hazard curves. The details of that I
3 didn't think were necessary.

4 JUDGE FARRAR: We don't need the details
5 so much as the concept. In other words, so now you
6 have this curve, now you look at the site, and so
7 you make some adjustment for what's underlying the
8 site.

9 DR. McCANN: And ultimately the effect
10 of the site soils, the near-surface geology, if you
11 will, would be incorporated such that the final set
12 of hazard curves would have all of those effects
13 included. And that's what we would be working with
14 to go to this next step.

15 JUDGE FARRAR: Now, I think your
16 colleague indicated that at virtually each one of
17 these steps there can be arguments among experts,
18 arguments among people who are proponents or
19 opponents of a particular proposal. Once you have
20 created what you've just described, including the
21 site response, would everyone in the world -- and
22 we knew what the proposed facility was -- a bridge,
23 a highway, a nuclear power plant, whatever -- would
24 everyone in the world agree how to design that
25 facility, or is that another issue?

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1 DR. McCANN: Well, if --

2 JUDGE FARRAR: Is that automatic?

3 DR. McCANN: I'm not sure I really know
4 what your question is.

5 JUDGE FARRAR: My question is, if
6 everyone agreed to the point you just took us to.

7 DR. McCANN: Yes.

8 JUDGE FARRAR: And now we say, okay, now
9 we've got to sit down and design this facility.
10 Would that design be automatic, everyone would know
11 what to do, or would we now have another --

12 DR. STAMATAKOS: Do you mean the design,
13 or do you mean the inputs that would go into the
14 design?

15 JUDGE FARRAR: The inputs that would go
16 into the design, or both. The inputs that would go
17 into the design, and then how -- if I'm the
18 designer, would this be a routine task, now you
19 give me all these inputs, or would we have another
20 debate about what -- about the design outputs?

21 DR. McCANN: Well, you're getting --
22 your question has considerable breadth to it in the
23 sense that on the one hand you're actually getting
24 into the design process. I'm not a designer and I
25 don't practice engineering design. But to say

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1 everybody agrees on everything, that's a bit of a
2 stretch. But I will say, even if we know the type
3 of facility, an engineer could say, all I need for
4 purposes of my design, even though it's a critical
5 facility, and obviously if the regulation permits
6 it, I'm going to do just a static analysis,
7 therefore I only need a response spectrum as one
8 might derive it from your set of seismic hazard
9 purposes. And if that were the case, that
10 particular product could be generated for that
11 designer.

12 On the other hand, an engineer might
13 elect for purposes of thoroughness a level of
14 detail, say, I also want a time history that
15 satisfies the following criteria, regulatory or
16 otherwise, that is consistent with that response
17 spectra, but I want it to be earthquake-like as
18 opposed to totally artificial and needing some
19 broad, nonrealistic criteria.

20 JUDGE FARRAR: And when you say "time
21 history," you mean a time history of the event --
22 the hypothetical event I'm designing against?

23 DR. McCANN: Yes. As input, such as we
24 saw this morning, that would be input to that
25 analysis. And he would then be doing presumably a

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1 time history response analysis and would use that
2 as a basis for determining the forces on members
3 ultimately in his structure, etc.

4 JUDGE FARRAR: And where would he get
5 that time history analysis?

6 DR. McCANN: Typically he would go to
7 the seismic hazard analysts, provide the criteria
8 that he is interested in, whether he's crafted it
9 himself or refers to a regulation, and says, I
10 would like a time history or a set of time
11 histories that are consistent with, say, a
12 2,000-year response spectrum that are magnitude
13 distance dependent, etc.

14 JUDGE FARRAR: And those would be given
15 to him by going back to the curves you originally
16 described?

17 DR. McCANN: That would be one of the
18 starting points. Those curves would be one of the
19 starting points. Other information that is
20 available from a hazard analysis would also be of
21 interest. For example, an obvious criterion would
22 be to have a time history that is consistent with
23 the fault that dominates the ground motion at the
24 site. So it has a particular location, it has a
25 particular set of faulting characteristics, things

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1 of that nature.

2 JUDGE LAM: Dr. McCann, are the hazard
3 curves time dependent?

4 DR. McCANN: No, they are not. In
5 the -- let me clarify. The estimate of the
6 parameters, in particular the seismic source
7 characterization parameters, which are the only
8 parameters that have an element of time in them in
9 which we estimate the rate of occurrence of
10 earthquakes associated with a particular fault is a
11 rate per year of earthquake occurrences. If there
12 were processes in place, physical processes in the
13 earth in place that would suggest, for example, a
14 strained buildup on a fault, and therefore as we
15 move in time the likelihood of a large earthquake
16 is now increasing. Typically that time variability
17 of the rate of earthquake occurrences is not
18 explicitly modeled, and there's reasons for that,
19 even though physically that may be in existence,
20 you know, on the fault.

21 So the hazard curves represent an
22 estimate in time today of the probability of
23 exceedance per year of the ground motions of
24 interest that are specified.

25 JUDGE LAM: Now, in both of the source

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1 characterization and ground motion modeling, there
2 are a great deal of uncertainties everywhere. How
3 is that issue handled in your final result?

4 DR. McCANN: In a probabilistic seismic
5 hazard analysis, there is -- if the analysis is
6 done appropriately and well, there is an explicit
7 effort made to identify, recognize, and incorporate
8 probabilistically the range of interpretations,
9 say, source boundaries, or parameter estimates,
10 such as maximum magnitude, the range of parameter
11 values that are credible within the context of the
12 state of information that's available. So the
13 point is that there is an effort made to seek out
14 what those credible interpretations are and
15 represent them fully from the very unlikely and
16 only slightly credible to the most likely and most
17 credible. And again, at both ends, meaning
18 something could be incredible at the high end of
19 the range of possibilities as well as at the low
20 end.

21 So the point is that there is an
22 explicit effort to search out the range and the
23 credibility of the various parameters that are
24 necessary for the analysis.

25 JUDGE LAM: So a great deal of reliance

1 is placed on the skill and the experience of the
2 analysts?

3 DR. McCANN: That's correct. And
4 typically, typically in both parts of the analysis,
5 the major parts that I referred to, source
6 characterization and ground motion, there's
7 typically more than one analyst involved to some
8 degree or another. And also there is -- as part of
9 the effort to seek out alternative interpretations
10 and parameter estimates, there is an effort to
11 utilize what's been published in the literature.
12 For example, if somebody has done work studying the
13 geology or seismology of a particular region and
14 published in a refereed journal estimates of, say,
15 maximum magnitude for particular seismic sources,
16 that implicitly, at least implicitly has a
17 credibility associated with it.

18 And so there's an effort beyond the
19 immediate experience of the analysts doing the work
20 to find within the profession the understandings
21 and estimates of parameters that are necessary for
22 the analysis. Ground motion attenuation is the
23 easiest example, because quite explicitly models
24 developed by others are brought into the analysis.

25 JUDGE FARRAR: Dr. Stamatakos, did you

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1 want to add anything? And feel free to jump in at
2 any point.

3 DR. STAMATAKOS: No, I think that's a
4 pretty good explanation.

5 JUDGE FARRAR: Is there anything else,
6 then, that we need to know to flesh out our
7 conceptual framework here?

8 DR. McCANN: We haven't answered your
9 question yet, I don't think, as to given a
10 probability and a set of hazard curves, where do we
11 go from here. Do you want to pursue that?

12 JUDGE FARRAR: Well, I thought you said
13 you weren't -- I thought you'd gone as far as you
14 could in terms of not being a designer. I mean,
15 you started to get into that, but I sensed we've
16 gotten as much as we could, or feel free to --

17 DR. McCANN: We can go a little bit
18 further. What I didn't want to do was go into an
19 area that we don't have expertise or I don't have
20 expertise, which is the design side.

21 JUDGE FARRAR: I don't need you
22 necessarily to be able to do the design as to tell
23 me what the designers do. So if you could speak to
24 that.

25 DR. McCANN: Okay.

1 JUDGE FARRAR: Okay, now how do they
2 approach their job given their interaction with
3 you?

4 DR. McCANN: The handoff, if you will,
5 from the hazard analysis would be, given the
6 probability that has already been selected and the
7 hazard curve that's been selected, the mean, the
8 median, one would enter for each one of the ground
9 motion measures that one has done the analysis for,
10 the five or six or whatever the number is, at that
11 probability of exceedance and find the ground
12 motion that corresponds to that probability level.
13 Those points, the five or six ground motion
14 measures, would define what's referred to as a
15 uniform hazard response spectrum. Uniform hazard
16 is meant to mean that each one of those points has
17 the same probability of being exceeded in a given
18 year.

19 DR. STAMATAKOS: And those ground motion
20 measures he's referring to are the different
21 frequencies of the ground motion from peak
22 acceleration to the whole spectral portion of the
23 ground motion.

24 DR. McCANN: In a very simple,
25 structural analysis, that response spectrum is used

1 as the basis to define the loads that would be
2 applied to the structure. And it would be at that
3 point that the handoff is complete, if you will.
4 If there's a time history, that would be generated
5 and that would be part of the handoff.

6 JUDGE LAM: How was the time history
7 generated, given the set of hazard curve that has
8 been selected?

9 DR. McCANN: The -- given a response
10 spectrum which I just described, for example, the
11 uniform hazard response spectrum, which might be
12 used as the basis for a time history, there are a
13 number of techniques available. I believe the
14 standard review plan has explicit description. I'm
15 not familiar with the details of those as to what
16 they find acceptable on the criteria. But one
17 approach to derive the time history would be the
18 following.

19 From the hazard analysis one would find
20 out what size earthquake is likely to have
21 generated a response spectrum of that magnitude, I
22 mean, that level of shaking. The approach then
23 would be to go to the available database of strong
24 motion recordings, actual recordings in the field
25 from earthquakes of that size, presumably at

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1 approximately the same distance from the earthquake
2 and same soil conditions, approximately, and use
3 that as a starting point.

4 And then numerical techniques would be
5 used to in effect fit the response spectrum from
6 that realtime history to the response spectrum
7 derived from the probabilistic seismic hazard
8 analysis. And there's -- it's literally an
9 iterative scheme in which one adjusts the, quote,
10 realtime history to match the response spectrum of
11 the uniform hazard response spectrum that was
12 derived from the hazard analysis. And one
13 continues to iterate until whatever acceptance
14 criteria has been satisfied. For example, no point
15 on the response spectrum from the time history can
16 deviate by more than 10 percent, plus or minus,
17 from the uniform hazard spectrum, which is your
18 target. And you would continue the iteration until
19 that acceptance criteria has been met.

20 So that would be one example. That is
21 often preferable, at least in my view, because
22 you're starting with something real that has been
23 recorded, and the realtime history brings other
24 attributes to the table that a totally artificial
25 or stochastically generated time history does not,

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1 and yet still has the same level ultimately of
2 shaking that you're looking for as defined by the
3 uniform hazard response spectrum.

4 JUDGE LAM: Thank you.

5 JUDGE FARRAR: Okay, I think that's -- I
6 think that fills out the conceptual framework we
7 wanted, I think. Is there any -- Mr. Turk?

8 MR. TURK: I have one request for a
9 clarification. Dr. McCann, you mentioned that you
10 believe there's explicit guidance in the standard
11 review plan. Are you referring to section 3.7.1 of
12 NUREG 800? Do you know?

13 DR. McCANN: I don't know.

14 JUDGE FARRAR: This has been extremely
15 helpful personally. I mentioned doing things in
16 1978 in a case, and if you wonder how come I didn't
17 keep up with my learning, I was on a -- beginning
18 in 1980 I was on a work release program from the
19 Commission. I guess last summer I must have
20 violated my probation or something, so I came back
21 and that's why I needed this update. So I
22 appreciate that.

23 The danger now, of course, is that we
24 have a tutorial from people who, while they seem
25 like decent people who are associated with one of

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1 the parties, Mr. Gaukler and Ms. Chancellor, rather
2 than have you question these gentlemen about what
3 they said, would it be a better practice if one of
4 your witnesses wants to add something? I think
5 that would be better than putting them to cross --
6 you know, this was a tutorial, not evidence. How
7 do you want to proceed?

8 MS. CHANCELLOR: I'll make this quick
9 statement. We certainly understand your plight.
10 As lawyers we don't know the questions to ask,
11 either, and being a tutorial, I don't think we
12 would need to put on somebody or ask any questions.

13 JUDGE FARRAR: And if at any point as we
14 get into the testimony you want to, you know,
15 challenge this kind of assumption or the sort of
16 framework being applied, you're welcome to. But if
17 your witness doesn't take great issue with, you
18 know, what was said, then that's good.

19 Mr. Gaukler?

20 MR. GAUKLER: Again, I don't have any
21 need to question these witnesses. I just would say
22 a lot of the subject matter that we discussed
23 concerned topics that were at issue in A and B that
24 are really no longer being litigated here. And we
25 pick up at some point, I don't know exactly what

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1 point we pick up, but we pick up at some point
2 pretty far into that process that they've
3 described.

4 JUDGE FARRAR: Right. And so had we
5 litigated A and B we might have found this out, but
6 not litigating it, we needed, maybe let's call this
7 catchup so that we could get to where you were
8 having resolved A and B.

9 MR. GAUKLER: We spent many months
10 working on those issues, your Honor.

11 JUDGE FARRAR: And this puts us in a far
12 better position to understand C and D and the --

13 MR. TURK: Maybe it's good to note on
14 the record that A and B that we've been talking
15 about now, those parts of the contention about the
16 faulting hazard and the ground motion, those are,
17 as the witnesses explained, some of the key
18 components that go into the PSHA analysis. As you
19 mentioned, we have not closed those issues.

20 JUDGE FARRAR: We've spent about an hour
21 on this. I think it's certainly worthwhile in
22 terms of the efficiency of the future of the
23 hearing, and I know next August and September it
24 will save more than one hour in terms of our
25 preparing a decision. So I thank the parties for

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1 their forbearance and the witnesses for providing
2 us exactly what we needed.

3 Mr. Gaukler, I hope your people have
4 taken this opportunity to work on their assignment.

5 MR. GAUKLER: I don't know. Probably
6 not.

7 JUDGE FARRAR: They have not? I hope
8 they didn't need this tutorial. We're delighted if
9 they had the benefit of it.

10 Given all the events of this morning,
11 then, is it better that we take a lunch recess now,
12 come back, and then we'd be in a better position to
13 start the State's cross-examination?

14 MR. TURK: The Staff's. I think that's
15 a good idea, your Honor. Unless the State wants to
16 go ahead of me, which I've argued for and would be
17 willing to --

18 MS. CHANCELLOR: No, the State just
19 doesn't want to get confused with the Staff.

20 JUDGE FARRAR: Then Mr. Turk, unless you
21 want to -- is it better that we have the lunch
22 break before your cross?

23 MR. TURK: I think, given the need for
24 the witnesses to do the work they're planning to
25 do, it's a good time to break.

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1 JUDGE FARRAR: They do need to do the
2 work and they need to eat. Do we want to take -- I
3 hate to do it, but take an hour and a half? I
4 mean, they're going to be on the stand. They're
5 going to be on the stand all afternoon. I hate to
6 have them -- or can they do the work and you bring
7 them a sandwich?

8 MR. GAUKLER: We're having sandwiches,
9 presumably. I think an hour and a half would
10 probably be appropriate.

11 JUDGE FARRAR: Okay, we'll give them a
12 little less than that. It's 12:08. Let's come
13 back at 1:30.

14 (A recess was taken.)

15 MR. FARRAR: On the record for just a
16 moment. We're back after the lunch break, but we
17 understand the company witness needs a little more
18 time to finish his calculation. So we'll wait for
19 that.

20 Meanwhile, I wanted to put on the record
21 a suggestion. In leaving the room this noon I had
22 a brief and inconsequential discussion with both a
23 representative of the State and a representative of
24 the Company about the tutorial and it led -- leads
25 me to suggest for counsel and the witnesses, if at

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1 any point during the course of the testimony you
2 think a further tutorial is necessary to build on
3 what we said you can build that into your direct
4 examination.

5 In other words, when you present your
6 witness and would like him or her to give a little
7 more explanation than you might have had in your
8 direct testimony, we would welcome that so that
9 every party has the same opportunity the staff did
10 to provide a little tutorial. So do not think you
11 will insult us by offering something elemental.
12 You will not, and even if you did, I would rather
13 be insulted now than struggling in August and
14 September. So go ahead, Mr. Gaukler.

15 MR. GAUKLER: I understand we can have
16 marked for identification the report that goes
17 along with the simulations, which would be PFS
18 Exhibit 86.

19 MR. FARRAR: Let's do that.

20 (APPLICANT EXHIBIT-86 MARKED.)

21 MR. GAUKLER: Your Honor, it's been
22 noted that Dr. Singh has been moved to proprietary
23 status so the report can be introduced into the
24 record.

25 MR. FARRAR: Okay. We and everyone

1 appreciate that.

2 MR. GAUKLER: I would move for its
3 admission as an Exhibit.

4 MR. FARRAR: Just so the record is
5 clear, Mr. Gaukler, if you would, in about 15
6 seconds tell us what the controversy was this
7 morning and how this responds to it.

8 MR. GAUKLER: Well, this will have --
9 well, first of all, this has the backup information
10 with respect to simulations in terms of the
11 methodology and certainly the input data is in this
12 document. It was put together by Dr. Soler and
13 will show two cases at least where the serial data
14 appears in this document.

15 MR. FARRAR: And this was the document
16 to which he referred during his testimony --

17 MR. GAUKLER: Yes, it is.

18 MR. FARRAR: -- under Mr. Soper's
19 questions?

20 MR. GAUKLER: Yes. It's also the
21 document he referred to when he was talking about
22 the displacement of cask 1, he mentioned certain
23 figures. It's that document as well.

24 MR. FARRAR: And it's entitled PFSF
25 Beyond Design Basis Scoping Analyses by Holtec

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1 International. Mr. Soper.

2 MR. SOPER: Well, based on that
3 representation that this contains the input data I
4 would object. In fact, I asked Dr. Singh to look
5 at this and tell me what the input data was and he
6 admitted he could not. So I'm not sure that that
7 representation --

8 MR. FARRAR: Well, I think the
9 representation was this is the document to which he
10 first referred when you asked him to go beyond the
11 illustrations, the video illustrations, he referred
12 to this. I think you later indicated even this was
13 not enough, and therefore he was -- that's why he's
14 spending the lunch hour doing some more, but this
15 was at least, I thought, a first step. But I take
16 it that's all the representation is, that this is
17 the report he had handy which is the first thing he
18 refers to. And beyond this report he has other
19 information available to him and we haven't gotten
20 to that point yet. This is just a question of do
21 we admit this as the first document that he keeps
22 handy to support his work. And that would be the
23 basis on which it would be admitted.

24 MR. SOPER: I'm not trying to be
25 difficult, your Honor. If I might address this.

1 Table 2, which was referred to in connection with
2 the animation that we watched this morning --

3 MR. GAUKLER: Table 2, where are you
4 referring to?

5 MR. SOPER: Excuse me, 17, page 17.

6 MR. GAUKLER: Of the testimony?

7 MR. FARRAR: No. Table 2 in the.

8 MR. SOPER: What you just handed out.

9 MR. FARRAR: The proposed Exhibit, page
10 17.

11 MR. GAUKLER: I got it.

12 MR. SOPER: Purports to be a summary of
13 the VisualNastran Analysis for each circumstance
14 that was shown in the animation. I think that it's
15 no more informative, reliable or with foundation
16 than the video itself without the underpinning
17 data. So that's the problem I have. There is a
18 bunch of conclusions drawn from assumptions and
19 facts that do not appear. And so based on
20 foundation I don't know how I can not object to
21 this on the same basis as the cartoon.

22 MR. GAUKLER: I object to that
23 characterization of what was put together by a
24 computer simulation program.

25 MR. FARRAR: As I understand, Mr. Soper,

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1 we're trying -- the parties or the Company is
2 trying to put together a case that's responsive to
3 your concern about the lack of availability of the
4 underlying data for the animation, which is a point
5 which is on the table and which, you know, is
6 nowhere near being resolved at this point. As I
7 understood it, this offer is the first step in
8 building that foundation.

9 You're correct that you still need more
10 before that foundation is completed, but we have to
11 start somewhere. My inclination would be to let it
12 in subject to the same objections and concerns and
13 cross-examination that you're going to raise, but I
14 can be convinced otherwise.

15 In other words, we may be arguing --
16 this may be a theoretical argument. The Board
17 understands your concern that here's been an
18 animation and you don't know what went into it and
19 until you know what went into it you can't
20 challenge it, and that's what the witness has been
21 spending his lunch hour doing.

22 MR. GAUKLER: Your Honor, the witness
23 has put together two cases, case 8 and case 11, and
24 in those two cases he's showing exactly where the
25 integrate in terms of spring constants and dampers

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1 appear. They appear in the various figures in the
2 appendices that are attached to the report.

3 MR. FARRAR: Let's do this. Let's keep
4 the motion to admit this under advisement pending
5 the -- in other words, on the table. We won't act
6 on it now pending the providing of further
7 information and a cross-examination and then we'll
8 see where we are. Let us know as soon as the
9 witness returns with his calculations.

10 MR. GAUKLER: I don't know if you want
11 to keep this on the record or off the record
12 regarding our schedule. Right now Dr. Singh has a
13 plane out tomorrow afternoon about four o'clock. I
14 had a vision that we would be substantially through
15 cross by this time, or at least a portion of it.
16 I'm just trying to get an idea what's realistic or
17 not and, you know, whether it might be possible to
18 go a little bit later tonight, if we have a chance
19 or not, in terms of his meeting his plane for a
20 meeting he has Thursday morning.

21 MR. FARRAR: Assuming we start, now a
22 quarter to 2:00, how much cross does the State
23 have? And recognizing that the time so far has
24 been spent on direct, on the animation, on the
25 Board's tutorial and certainly, even though we're

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1 starting the State later than we expected, it's
2 certainly no fault of theirs. How long do you
3 think you need?

4 MR. SOPER: There's a potential for the
5 cross to only take two hours. I don't know how
6 else to say that, your Honor. I think you well
7 know what I'm saying.

8 MR. GAUKLER: That's what you may call
9 the lower bound. What's the upper bound?

10 MR. FARRAR: And if the question, the
11 preliminary questions thus far today are any
12 indication, the upper bound could be quite large.
13 And the plane is when?

14 DR. SINGH: Tomorrow at 4:40 p.m.

15 (The Board conferred off the record.)

16 MR. FARRAR: What we'll do is at five
17 o'clock tonight see where we are. And if we have
18 -- this might be one of those circumstances where
19 if we have to go late for the convenience of the
20 witnesses we will. Who is doing the cross?

21 MR. SOPER: Ms. Nakahara and I are each
22 doing some. I might suggest, your Honor, if it
23 would help things, Dr. Soler is out doing
24 calculations so we can't start cross. It seems to
25 me that when he finishes those, all we'll have is a

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1 bunch of numbers that our experts are going to look
2 at before we can say anything because I won't
3 recognize this as anything meaningful, that perhaps
4 we ought to start the cross-examination, have Dr.
5 Soler do this after we have recessed for the day
6 rather than hold up cross-examination now.

7 MR. FARRAR: Okay. If you exclude that
8 part of cross-examination can you profitably cross
9 the two witnesses on other subjects other than
10 that?

11 MR. SOPER: Yeah. I think that that
12 information just went to admissibility of the
13 Exhibit. You know, it's foundation for the
14 Exhibit. I have some questions that relate to
15 that, but he can answer those without having the
16 actual data.

17 MR. TURK: Your Honor, I have some
18 questions I can ask Dr. Singh without Dr. Soler
19 having to be part of the panel. I'm not sure if
20 you prefer to go with the State's cross before mine
21 or not.

22 JUDGE FARRAR: Well, no.

23 MR. GAUKLER: Keep trying.

24 MR. TURK: I'm only trying to
25 accommodate.

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1 MR. FARRAR: We know that. If no one
2 minds we can ask this witness --

3 MR. GAUKLER: I have no problem.

4 MR. FARRAR: If the State doesn't mind,
5 we'll start the Staff's cross-examination of this
6 witness. Go ahead, Mr. Turk.

7 MR. TURK: Thank you, your Honor

8

9 CROSS-EXAMINATION

10 BY MR. TURK:

11 Q. Hello, again, Dr. Singh.

12 DR. SINGH: I'm already under oath.

13 Q. Everybody is reminding me of things
14 these days.

15 I would like to get some information
16 about the MPC, and this was something we had begun
17 discussing before we broke. You had indicated that
18 essentially there are two components, there's the
19 outer shell and the basket within the shell?

20 DR. SINGH: Right.

21 Q. Could you describe the outer shell of
22 the MPC.

23 DR. SINGH: The outer boundary of the
24 MPC is called the enclosure vessel. It is
25 essentially an all-welded stainless steel

1 enclosure.

2 Q. How thick is it?

3 DR. SINGH: Can you hear me?

4 JUDGE FARRAR: Fine.

5 DR. SINGH: The shell itself is half an
6 inch thick, the bottom plate is 2.5 inches thick
7 and the top plate varies between 9.5 to 10 inches
8 thick. It is all austenitic stainless steel, which
9 means from structural standpoint, that means that
10 the material would have to be strained to the
11 extent of approximately 40 percent before it will
12 fail. Which means that if you take a 10-inch bar
13 and you pull on it, it will have to be
14 approximately 40 percent longer, which will be 14
15 inches long before the ball will break. It's a
16 highly ductile material and that's why we selected
17 it for the enclosure boundary of the MPC.

18 Q. In the Applicant's previous set of
19 testimony they indicated that the MPC was filled
20 with helium before it was sealed. What is the
21 sealing process, how is that done?

22 DR. SINGH: The sealing process is done
23 by first -- actually, let me go back a second.
24 There are two lids. The top lid actually consists
25 of two lids, a real thick lid which is

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1 approximately 9.5 to 10 inches thick, and then
2 there's another closure lid. The thick lid is
3 welded to the shell after the fuel is installed in
4 the canister. The water from the lid -- from the
5 canister is evacuated, is replaced with helium.
6 And we use a special device to remove water and put
7 in helium without exposing the fuel to any air.
8 And then the closure ring is installed, closure
9 plate is installed. So essentially the field
10 welding, the welding at the nuclear plant of the
11 closure welding consists of two independent welds
12 that close the -- that make the final closure.

13 Q. And this is a weld that would seal the
14 entire circumference of the MPC shell?

15 DR. SINGH: Yes. And also it -- we
16 close the penetrations that we use to fill with
17 helium and evacuate water, they are also closed.

18 Q. With the same method of welding?

19 DR. SINGH: Yes. We use tungsten inert
20 gas welding technique which gives it a very high
21 quality weld.

22 Q. We're heard testimony that the design
23 limit of the HI-STORM 100 cask is for a
24 deceleration of 45 g's. Is that the same
25 deceleration limit for the MPC?

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1 DR. SINGH: Well, it actually is not the
2 limit at all. The 45 g's, we set that as the value
3 that the cask, the HI-STORM cask should meet. And
4 therefore, one designs the pad to that reference
5 limit. The cask itself is capable of taking much
6 greater g loads. Specifically, the canister, we
7 have done numerical evaluations of the strength of
8 the canister under g loads. We have determined
9 that it can take actual g loads in excess of 300
10 g's and still maintain its confinement capability,
11 which is its capability to maintain radioactive
12 material confined.

13 Q. In the same manner that the design
14 criterion for the cask has been set at 45 g's, is
15 there a design criterion set for the MPC?

16 MR. SOPER: Can I just object? I don't
17 see any of this in the direct examination. If it
18 is, could you direct me to it so I can follow
19 along? If not, it seems to me to be outside the
20 scope of cross.

21 MR. TURK: Yes, I would be glad to.
22 Answer 22 on page 11 describes the MPC and its
23 design margins, but does not specifically indicate
24 the deceleration design criterion. I'm exploring
25 that.

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1 The same issue arises in answer 44 and
2 46 of the testimony. The answer to 44 discusses
3 the cask itself, but not the MPC, and there it
4 talks about the 45 g. I'm now exploring the way in
5 which the MPC may have a different design criterion
6 than the cask itself. And similarly answer 46
7 talks about the 45 g limit for the cask. I'm now
8 exploring the g limit for the MPC within the cask.

9 MR. FARRAR: Under the ground rules we
10 adopted yesterday and given the references Mr. Turk
11 has given this is legitimate. So we'll overrule
12 the objection.

13 MR. TURK: Thank you, your Honor.

14 DR. SINGH: I can proceed? The MPC
15 lateral acceleration/deceleration limit is also set
16 at 45 g's in the HI-STORM overpack. In HI-STAR,
17 which is the dual purpose transport -- dual
18 transport overpack with transport capability, the
19 same MPC had a 60 g lateral deceleration.

20 Q. So the same MPC with a 60 g deceleration
21 limit is being moved into the HI-STORM cask?

22 DR. SINGH: Yes. And we set a lower
23 limit in the HI-STORM cask.

24 Q. Is there any reason to believe that the
25 60 g limit would not apply as well to the MPC?

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1 DR. SINGH: It could have. We simply in
2 our regulatory applications, we set the g load at
3 45 g applicable to the MPC and the overpack.

4 Q. Has the MPC been transformed, changed,
5 modified in any way from the time it leaves the
6 HI-STAR transportation cask and enters the HI-STORM
7 storage cask?

8 DR. SINGH: No, it does not.

9 Q. The MPC is set within the HI-STORM cask,
10 correct?

11 DR. SINGH: Yes.

12 Q. And there is an annulus between the MPC
13 and the inner shell of the cask, correct?

14 DR. SINGH: Yes.

15 Q. Can you describe the width of that
16 annulus between the MPC and the cask?

17 DR. SINGH: The -- it's not a -- the
18 inside surface of the overpack, HI-STORM overpack,
19 is not a cylinder. Therefore, there is no one
20 unique annular distance. The inside surface is
21 equipped with channels. They serve -- the channels
22 are longitudinal to the shell. They serve to
23 provide airflow, but at the same time under the
24 non-mechanistic tip-over condition that the NRC
25 requires us to evaluate the cask for, for that

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1 condition it serves to cushion the force on the
2 MPC. It's strictly a protective measure. So the
3 annular gap can vary anywhere from 2.5 inches to 4
4 inches, to the best of my memory.

5 Q. And the lower amount, the 2.5 inch
6 approximate distance, would that be between the
7 edge of the channel to the MPC?

8 DR. SINGH: Right. That would be the
9 diametrical distance, not radial. The gap is
10 diametrical. You take half of that for the radial
11 dimension.

12 Q. I see. So that on any particular side
13 of the cask it would be half of the 2.5 inches
14 between the channel and the MPC?

15 DR. SINGH: Right. I'm giving you an
16 approximate number. I don't have the drawings in
17 front of me.

18 Q. In your testimony, answers 26 and 30 --

19 JUDGE FARRAR: Mr. Turk, is this a new
20 subject?

21 MR. TURK: Moving to number 2 on the
22 cross-examination.

23 JUDGE FARRAR: Let me just ask. So when
24 the completed package is sitting on the pad, the
25 MPC is in contact only with the bottom of the --

1 only the bottom of the MPC and the bottom of the
2 overpack are in contact with each other?

3 DR. SINGH: Yes. The bottom of the
4 overpack has a pedestal. That pedestal consists of
5 a shell filled with concrete and the MPC sits on
6 it.

7 JUDGE FARRAR: But not immediately
8 laterally constrained?

9 DR. SINGH: They are not in physical --
10 physically -- MPC is not physically constrained by
11 the body of the overpack, if that's your question.

12 JUDGE FARRAR: And Mr. Turk asked you a
13 few minutes ago if the MPC was changed in going
14 from the transportation cask to the overpack. The
15 MPC is planned never to be changed from the time it
16 leaves the nuclear power plant, right?

17 DR. SINGH: That's correct.

18 JUDGE FARRAR: In other words, it's
19 prepared there and that's the last it changes
20 physically.

21 DR. SINGH: It's a permanent waste
22 package, we like to call it.

23 JUDGE FARRAR: Go ahead, Mr. Turk.

24 Q. (By Mr. Turk) Following up on Judge
25 Farrar's question, what prevents the MPC from

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1 moving around within the transport cask if it's not
2 held in place by the channels? I'm sorry --

3 DR. SINGH: Are you thinking in terms of
4 seismic events or are you thinking in terms of --

5 Q. Well, no, in any kind of --

6 DR. SINGH: Well, the MPC, realize,
7 weighs about 45 tons.

8 Q. Let me be fair. I may have said
9 transport cask. I'm seeking to understand why the
10 MPC remains centered within the storage cask. Is
11 there some mechanism that holds it in place?

12 DR. SINGH: No. Deliberately so. The
13 mechanism is gravity and friction. Just like the
14 cask is situated on the pad, the mechanism is
15 gravity and friction.

16 Q. So that it's loaded vertically down into
17 the storage cask and is expected to stay in this
18 position from the time it's loaded until the time
19 it reaches its place on the storage pad?

20 DR. SINGH: Well, I'm not sure I'll say
21 yes to that statement. I'm not sure I'll say yes
22 to that statement. The MPC is, the typical plant,
23 the MPC is brought in from the pool to the ISFSI
24 pad using a transfer cask. Do you want to take a
25 minute?

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1 Q. No, go ahead.

2 DR. SINGH: Okay. The transfer cask is
3 used to transfer the MPC from the transfer cask to
4 the storage overpack, okay? But at no time in the
5 storage of the MPC on the transport pad -- on the
6 storage pad is the MPC physically connected to the
7 overpack. That is not the intent of the design.

8 JUDGE FARRAR: But in the canister
9 transfer building, when you put it in the overpack,
10 presumably you center it and then some fairly large
11 vehicle carries it out to the pad. In that
12 transportation process, the local PFS site
13 transportation process, how do you assure that
14 there's no giggling that leaves it off center or do
15 you not care or is it not significant if it's off
16 center?

17 DR. SINGH: Well, if it were off center
18 it's not significant. That's the first answer.
19 The second answer is the actual experience with
20 moving these loaded overpacks show that the MPC is
21 not willing to move. It stays exactly where we
22 place it. We have so far moved at three nuclear
23 plants some 20 HI-STORM overpacks. So the
24 practical experience suggested that it does not
25 move. And if it were to move it doesn't matter.

1 JUDGE FARRAR: So if it were to shift,
2 remain upright and just kind of shift over inside
3 the overpack so that it contacted one of these
4 channels on one side and had four inches on the
5 other side, you wouldn't be concerned?

6 DR. SINGH: No. It has -- engineers
7 call it a second order effect on the performance.

8 Q. (By Mr. Turk) I would like to ask you a
9 little bit about the DYNAMO code. This is in your
10 answers 26 and 30.

11 DR. SINGH: Okay.

12 Q. I don't know if you need Dr. Soler to be
13 here with you for this or not.

14 DR. SINGH: No. I should be able to
15 answer. He's a professor. You get a longer answer
16 if you ask him.

17 Q. But as students, I'm sure we would all
18 like to hear it.

19 MR. GAUKLER: Your Honor, Dr. Soler just
20 walked in.

21 MR. TURK: Should we continue, your
22 Honor, while we wait for Dr. Soler to come forward,
23 or should we start?

24 JUDGE FARRAR: Mr. Gaukler, do you need
25 time to consult with him or should he turn over the

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1 information now --

2 MR. GAUKLER: I think I would turn over
3 the information now since given the representation
4 of State's counsel that he can act on it right away
5 and have his experts look at it.

6 JUDGE FARRAR: Well, why don't you take
7 a moment to talk to your witness and we'll have him
8 resume the stand. Let's go off the record and take
9 a two-minute break in place for a minute.

10 (A recess was taken.)

11 MR. GAUKLER: Do you want us to mark
12 what I handed out?

13 (Discussion Off the record.)

14 MR. FARRAR: Back on the record. The
15 witness. Dr. Soler, is back on the witness stand.
16 Mr. Gaukler?

17 MR. GAUKLER: I'm just going to mark
18 what we handed out as PFS Exhibit 87 for further
19 questions. That's the table that we talked about
20 before where Dr. Soler has put down inputs from
21 cases 8 and 11 from the testimony accompanying
22 answer 118.

23 JUDGE FARRAR: And the plan is to have
24 the State give this to its witness and defer that
25 portion of its cross-examination for another time.

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1 We'll stop and have the court reporter mark that.

2 (APPLICANT EXHIBIT-87 MARKED.)

3 MR. GAUKLER: And just for your
4 information for purposes of the table, K refers to
5 spring value or spring constant value and C refers
6 to a damping value.

7 JUDGE FARRAR: Does the State's witness
8 have this yet?

9 MR. SOPER: Yes.

10 JUDGE FARRAR: So as to save time, can
11 we just have a quick answer from him on whether
12 this is comprehensible and the kind of thing he was
13 looking for?

14 MR. SOPER: I don't think so, your
15 Honor. I think this is going to take some --

16 MR. FARRAR: I mean just a quick look at
17 it, is this what he was expecting to get?

18 MR. SOPER: Well, I can tell you from
19 having discussed with him that what we're more
20 wanting to get was the actual input runs that
21 showed what was actually coded in so that we could
22 check and see that numbers claimed to be used were
23 actually coded into the code without coding errors.

24 JUDGE FARRAR: Let me make sure I
25 understand. So what we have here are input values,

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1 which I take it is the representation from Dr.
2 Soler that these are the values he started with.
3 Is that correct, sir?

4 DR. SOLER: Yes.

5 JUDGE FARRAR: So that's my first --
6 let's take this a step at a time. Is this the
7 type, initially the type of information the
8 witness, your witness was looking for, the State's
9 witness?

10 MR. SOPER: I don't know that yet. May
11 I have a minute to consult?

12 JUDGE FARRAR: Yes.

13 (Discussion off the record.)

14 MR. SOPER: Your Honor, could we ask
15 what the reference to Figure 6 is on here?

16 DR. SOLER: That is in the report.

17 MR. GAUKLER: Reference to Figure 6 is
18 on page 30, if I'm correct.

19 JUDGE FARRAR: The report, Mr. Gaukler,
20 that you just marked as --

21 MR. GAUKLER: Marked as PFS Exhibit 86.

22 JUDGE FARRAR: Right. We've, unless
23 complicated issues, have been able to get by with
24 references that everyone understands. I think now
25 we've got so many orders of reports, if I can use

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1 that term, that we better be sure whenever we refer
2 to something as the report, either use its name or
3 its number just so we are all sure because we've
4 got levels of reports here.

5 MR. GAUKLER: I would note that the
6 report number is identified in the right-hand
7 column, the note references the report 2022854,
8 which is the report number for PFS Exhibit 86.

9 DR. SOLER: On table --

10 MR. GAUKLER: Did you circle that?

11 DR. SOLER: The number should be a
12 point, it should be a dot. On the table, the first
13 table, Kxx, the number should be 1 --

14 MR. SOPER: Wait, wait. I don't know
15 what you're reading from.

16 DR. SOLER: PFS Exhibit 87.

17 MR. FARRAR: Yes.

18 DR. SOLER: The one, two, three, four,
19 five, six, seventh line from the bottom the number
20 should be 1.385 not 1,385 for Kxx.

21 JUDGE FARRAR: Okay. Off the record.

22 (Discussion off the record.)

23 JUDGE FARRAR: Back on the record.

24 MR. GAUKLER: Off the record.

25 (Discussion off the record.)

1 JUDGE FARRAR: Back on the record. Mr.
2 Soper?

3 MR. SOPER: I have sort of an answer.
4 This is a -- we would say that this is a good
5 start, but we need a little more time to actually
6 review it and look at the references and try to see
7 --

8 JUDGE FARRAR: Yeah. My first question
9 was just is this, as a start, is this the kind of
10 thing you were expecting? I'm not pinning you
11 down, but I don't want to find out five hours from
12 now that this is not what we're thinking of at all.
13 We're off to a good start, we're fine there, but
14 you need time to check it out and maybe ask for
15 some more.

16 MR. SOPER: Yes, we're off to a start.

17 JUDGE FARRAR: That's fine. All right.
18 Let's get back to where we were then in the Staff's
19 cross-examination.

20 MR. TURK: Thank you, your Honor. If
21 you don't mind, I would like to ask one follow-up
22 question to the discussion of the MPC and the
23 channels that we had talked about previously.

24 Q. (By Mr. Turk) As I understand it, and
25 tell me if this is incorrect, the channels are not

1 there to provide seismic restraint, but instead are
2 to ensure an adequate annulus for heat removal
3 purposes; is that correct?

4 DR. SINGH: Well, the absence of the
5 channels will not detract from heat removal, let's
6 put it that way. The channels are not there for
7 the seismic criteria. They are there for the
8 non-mechanistic, which is what I like to call
9 counterfactual, assumed for the cask to tip over
10 when no analysis showed it to tip over. For that
11 hypothetical condition we installed channels in the
12 cask to serve as a cushion to the MPC, if you will.
13 If the cask were to tip over the MPC will
14 experience low decelerations.

15 Q. Is that because the channels themselves
16 will absorb some of the force?

17 DR. SINGH: Yes. The channels are
18 thin-walled so they will absorb more energy under
19 the back load. That's the basic concept on impact
20 limit or design. We make structures that will
21 deform and absorb energy.

22 Q. I would like to come back now to the
23 DYNAMO computer code. This is discussed in your
24 answers 26 and 30. Can you give us an explanation
25 of the history in which that code has been accepted

1 at NRC?

2 DR. SINGH: DYNAMO was originally
3 developed in 1977-78 time frame by my esteemed
4 colleague here and another gentleman, Dr. Burton
5 Ball.

6 Q. And Dr. Soler?

7 DR. SINGH: And Dr. Soler, right. And
8 the two of them, with some ancillary support from
9 people like ourselves, developed this program in
10 the late '70s. We used it for the first time in
11 1980 to license high-density storage racks for
12 Enrico Fermi Unit 2. That's a VW out in Michigan.
13 That was the first time the NRC had requested a
14 three-dimensional time history analysis of the
15 high-density storage rack. This code was
16 appropriate for it, we used it, and to make a long
17 story short, since then we have used it in over 60
18 docket.

19 Q. How many?

20 DR. SINGH: Over 60 dockets here in the
21 United States and in four other countries overseas.
22 The program has been validated with every
23 conceivable form of problem and has been
24 continuously used since 1980 in laboratory-related
25 work.

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1 Q. In your testimony in answer 27 there's a
2 reference that I don't understand, and it's
3 probably based on my lack of knowledge rather than
4 the fault of the witnesses, there's a reference to
5 the Columbia Generating Station. Is that a nuclear
6 power plant or some other kind of plant?

7 DR. SINGH: Yes, it is. It used to be
8 Washington Nuclear Unit 2. They didn't want the
9 word "nuclear" in their name anymore.

10 Q. Also in that answer, number 27, there's
11 a discussion of the fact that Holtec performed
12 site-specific seismic analyses using DYNAMO for the
13 HI-STORM system at various facilities. Do those
14 facilities utilize the HI-STORM cask?

15 DR. SINGH: In practically every
16 instance they utilize our cask, yes. Although we
17 have used the program to support other, for
18 example, the decommissioning of Shoreham that took
19 place in the early '90s, we qualified the IF-300
20 cask using this program for use at that site to
21 remove fuel from the plant.

22 Q. Looking at each of the specific power
23 plants that you mention in answer 27, let's start
24 with Diablo Canyon, do you know whether that
25 facility uses or proposes to use the HI-STORM cask

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1 under a general license or a specific license?

2 DR. SINGH: Diablo Canyon proposes to
3 use HI-STORM under a site-specific license.

4 Incidentally, two senior representatives from PG&E
5 are here in the audience.

6 Q. And when we use the phrase site-specific
7 versus a general license, can you explain your
8 understanding of that difference?

9 DR. SINGH: Mr. Turk, you would know it
10 better than I would, but I will give you my limited
11 understanding.

12 Q. I'm not allowed to testify. As much as
13 I try to get around that sometimes.

14 DR. SINGH: Under general certificate a
15 licensee can -- a nuclear plant owner can utilize
16 the cask without making a site-specific application
17 to the NRC. That's what it boils down to.

18 Q. In other words, if a facility meets the
19 criteria established for the general license they
20 don't need to apply separately to get a
21 site-specific license to use the cask?

22 DR. SINGH: That is correct.

23 Q. Now, for Diablo Canyon, for instance,
24 you had mentioned that they would be using a
25 site-specific license. Is that because they exceed

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1 the criteria in the general license in terms of
2 either their seismic design basis or some other
3 factor?

4 DR. SINGH: Well, to my knowledge,
5 Diablo Canyon perhaps could use the general
6 certificate and deploy the casks, but they have
7 chosen to use the site-specific process. And I'm
8 not the authority on this matter, but my
9 understanding is that they want to give the local
10 community maximum participation in their program to
11 deploy dry storage in the area near the plant.

12 Q. For the Columbia station, could you
13 answer the same question?

14 DR. SINGH: Columbia Generating Station
15 is deploying HI-STORMs under the general
16 certificate.

17 Q. Under the general license?

18 DR. SINGH: Yes.

19 Q. The general CoC, I should say?

20 DR. SINGH: Yes.

21 Q. And could you give me the same type of
22 answer with respect to Fitzpatrick and Sequoyah
23 which are mentioned in answer 27?

24 DR. SINGH: The same answer applies to
25 Fitzpatrick and Sequoyah and perhaps 20 other

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1 plants that have purchased our system that are not
2 listed here.

3 Q. All under the general Certificate of
4 Compliance?

5 DR. SINGH: That is correct. Except for
6 Trojan, which is using our canister under
7 site-specific certificate in Diablo Canyon.

8 JUDGE FARRAR: Mr. Turk, I think we get
9 the idea here.

10 MR. TURK: I'm moving on here.

11 Q. (By Mr. Turk) Dr. Soler, in answer 21
12 you indicate the use of a 5 percent damping factor,
13 if I'm not mistaken?

14 DR. SOLER: Is it 21?

15 Q. Am I wrong? Is it 31?

16 DR. SOLER: 32, I believe.

17 Q. I apologize.

18 DR. SOLER: Yes, we used 5 percent
19 damping.

20 Q. Now, is that a damping for the soil or
21 for the cask pad interaction?

22 DR. SOLER: Well, the damping was
23 supplied to us for the earthquake. Now, where we
24 used 5 percent was to simulate -- in the interface
25 between the cask and the pad to simulate the energy

1 lost during an impact. That's the only place where
2 we use the 5 percent. Since the cask is rigid and
3 the pad is rigid there's no inference here that we
4 had 5 percent structural damping. There was no
5 structural damping. This was simply a 5 percent
6 damper to simulate the behavior that you're likely
7 to get when you drop an object on the ground and it
8 bounces up so many times before coming to rest.

9 Q. Did you use any damping factor for the
10 soils?

11 DR. SOLER: We used damping for the
12 soil, but the damping was calculated strictly from
13 ASCE 486. We did not ascribe a percentage of
14 damping to that.

15 Q. Is it possible to describe the damping
16 you used in a percentage term or something similar?

17 DR. SOLER: Well, generally speaking,
18 when you talk about percent of critical damping,
19 since critical damping is defined as two times the
20 square root of the stiffness times the mass, it's a
21 little difficult here because you can't get your
22 arms around what you should use for the cask --
23 pardon me, for the mass in that calculation of
24 critical damping. So that is why we -- the ASCE
25 code simply provides the appropriate formula, but

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1 they do not make any reference to a certain
2 percentage of critical damping.

3 DR. SINGH: The damping as a percentage,
4 it derives from the concept of a simple harmonic
5 oscillator where you have a spring and a mass and
6 the damper is parallel to the spring. You can
7 neatly define what a percent damping is, but when
8 you get into complex structures then it is -- the
9 mass becomes indeterminate, the stiffness
10 indeterminate. You cannot neatly come up with a
11 percent damping. You can, but you have to define
12 it first and then the definition doesn't carry over
13 in a good way.

14 Q. When you're describing the mass here
15 you're not describing the pad or the cask but
16 you're talking about the soils underlying it?

17 DR. SOLER: That's the problem. You
18 could certainly, for the sake of defining a number,
19 choose the entire mass of the system and tie it to
20 the soil spring and in that way define two times
21 the square root of Km, but whether it has any
22 meaning as a critical damping is open to question.

23 DR. SINGH: It doesn't.

24 DR. SOLER: So there's nothing you can
25 compare it to. You have a number for damping and

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1 you don't have anything to divide into it to come
2 up with a percentage.

3 Q. Let me move on to your answer number 44.
4 Oh, before I do that, Dr. Singh, do you recall for
5 the general CoC, for the HI-STORM 100 storage cask
6 system, what is the seismic limit?

7 DR. SINGH: The earthquake is specified
8 on the pad as an inequality. And I'm going to try
9 to state it, I'm going to try to verbalize it and
10 see if it's --

11 JUDGE FARRAR: What was the word again?

12 DR. SOLER: Inequality.

13 DR. SINGH: Right. I thought I said it
14 with perfect accent.

15 DR. SOLER: Not quite.

16 DR. SINGH: The relationship is $A_{sub H}$
17 plus μ times $A_{sub V}$ is less than or equal to μ
18 times -- it's μ , right? It's based on equal to
19 μ . So μ being the Greek symbol μ , coefficient
20 of friction. $A_{sub H}$ is the horizontal --

21 DR. SOLER: The net horizontal.

22 DR. SINGH: In two directions, and $A_{sub V}$
23 V , the vertical acceleration. That is the
24 criterion in the CoC, the HI-STORM.

25 MR. TURK: May I have just a moment,

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1 your Honor?

2 JUDGE FARRAR: Yes.

3 MR. LAM: While Mr. Turk is working on
4 something, may I ask you, Dr. Singh, for that
5 particular criterion can you relate that to a
6 return interval?

7 DR. SINGH: I'm sorry, I didn't get the
8 question.

9 MR. LAM: For the Certificate of
10 Compliance, I guess is set for certain seismic
11 event. Am I correct?

12 DR. SINGH: It's the design basis
13 earthquake event.

14 MR. LAM: Right. How would that relate
15 to a return interval of 1,000 years?

16 DR. SINGH: Return interval? Well, this
17 is a general certificate so it can be used anyplace
18 in the country, anyplace in the world. It simply
19 gives the acceleration limits. It does not deal
20 with the hazards, you know, how many years of
21 return duration for which it is -- it will be
22 different.

23 In other words, let me phrase it this
24 way. For most facilities to the east of
25 Mississippi, the earthquakes even with large

1 durations are lower and the certificate, the cask
2 can be used without any further evaluations. It
3 does not tie to a specific site.

4 MR. LAM: Right. That I understand. My
5 question is, is this integral relationship between
6 that limit that has been set for the Certificate of
7 Compliance relative to a return interval? Would it
8 relate to 10,000 year, 20,000 or 2,000 year?

9 DR. SINGH: For which place? It will
10 depend on the facility. See, the earthquake
11 intensity return period will be specific to a
12 facility or to a location.

13 MR. LAM: Right.

14 DR. SINGH: This is a general limit on
15 the cask's deployment without doing any further
16 evaluation, earthquake evaluation under the
17 general certificate.

18 MR. LAM: Okay. Well, then let me
19 reframe the question. For all the domestic nuclear
20 sites, would a Certificate of Compliance, would it
21 fit for any and all nuclear sites?

22 DR. SINGH: Typically it won't. It will
23 fit a great majority of them, but not all of them.
24 The general certificate, and I don't wish to speak
25 for the NRC, but I believe their approach is to put

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1 conservative limits on the certificate for general
2 uses. For site-specific situations they will
3 evaluate them on the materiality for that
4 particular site, information for that site.
5 Generally the sites, the general certificate values
6 are extremely conservative. The values cited, the
7 limits cited in the general certificate are
8 extremely conservative. That's my personal opinion
9 having worked with the NRC for a fairly long time.

10 MR. TURK: Your Honor, just so we put on
11 the record what I believe are correct limits in the
12 CoC, I would like to approach the witness and show
13 him a copy of the stats SER for the HI-STORM 100
14 cask System.

15 JUDGE FARRAR: Let me follow-up on Judge
16 Lam's question first. Let me ask it a different
17 way. The Certificate of Compliance has a limit.
18 Someone with a storage facility will have a ground
19 motion they're guarding against depending on
20 whether it's a 1,000, 2,000 or 10,000. So the
21 certificate might show that the cask is sufficient
22 if you pick a 2,000-year return motion at a
23 particular site. If someone comes along and says,
24 Now we're going to use a 10,000, it may not meet
25 that.

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1 DR. SINGH: That is correct.

2 JUDGE FARRAR: In other words, so all
3 you do is match the certificate against what we
4 call the number from the facility.

5 DR. SINGH: Right.

6 JUDGE FARRAR: However that number is
7 derived. It either meets it or it doesn't?

8 DR. SOLER: Correct.

9 JUDGE FARRAR: If it doesn't they've got
10 to buy from your competitor or do something
11 additional?

12 DR. SINGH: Yeah. Let me further add
13 some thoughts to it. A typical deployment at a
14 nuclear plant, of course at a nuclear plant at the
15 present time, and at the plant the design basis
16 earthquake the free-field acceleration is already
17 known, it's already specified. So that information
18 is available. All one does is to calculate what
19 would happen because of soil structure interaction
20 on top of the pad. So it's a fairly
21 straightforward evaluation and then the
22 determination is made whether they should buy our
23 cask or a competitor's.

24 JUDGE FARRAR: Go ahead, Mr. Turk.

25 Q. (By Mr. Turk) With your permission I

1 would like to approach the witness. And what I'm
2 going to show him are the NRC Staff's SER for the
3 HI-STORM 100 Cask System. Unfortunately, I only
4 have the one copy in my possession at this time,
5 and I'm looking at page 3-7 and I'm going to ask
6 Dr. Singh to read the limit so we at least put them
7 in the record. And I'll show counsel.

8 Dr. Singh, I'm showing you page 3-7 of
9 the NRC Staff's SER for the HI-STORM 100 Cask
10 System. And I would ask you to take a look at the
11 table at the bottom of that page and ask if this
12 may refresh your recollection in terms of the
13 specific seismic design criteria accepted by the
14 Staff for the CoC?

15 DR. SINGH: Yes. And what I said is
16 consistent with this. It's simply this table shows
17 the horizontal g-Vector and the vertical vector
18 corresponding to a coefficient of .53, friction
19 coefficient Mu of .53. The numbers are derived
20 from it, that inequality.

21 Q. I agree, it's not consistent with your
22 testimony at all. It provides specifics, it has
23 three columns. Is it correct the first column
24 lists the horizontal g-level in each of two
25 orthogonal directions?

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1 MR. SOPER: If this is a question, may I
2 object to it? If we're trying to read a document
3 into the record, why don't we just admit the
4 document and the page.

5 MR. TURK: Your Honor, I'll make an
6 Exhibit out of the page along with the title. It's
7 a document of approximately 75 to 100 pages in
8 length which is not necessary in this proceeding.

9 MR. SOPER: Well, why don't we just
10 admit the page you want to have him read.

11 JUDGE FARRAR: There's a limit to how
12 much we'll read. While we'll read sentences and
13 short paragraphs, I don't want people reading pages
14 into the record. One, they read it wrong. Two,
15 even with their sparkling performance, the court
16 recorder might get it wrong and it just wastes time
17 and doesn't yield as good as having the Exhibit
18 itself in.

19 MR. TURK: What's your pleasure, then,
20 your Honor? Should I proceed to have the witness
21 read it or should I make an Exhibit out of the
22 page?

23 JUDGE FARRAR: Make an Exhibit out of
24 the page.

25 Q. (By Mr. Turk) Okay. Then let me just

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1 ask you, Dr. Singh, is this table, to your
2 knowledge, a correct description of the design
3 limits stated in the CoC?

4 DR. SINGH: I believe so.

5 Q. Thank you. Answer 44 in your testimony,
6 Dr. Soler.

7 DR. SOLER: Yes.

8 Q. You indicate that the -- and I'm going
9 to quote here. This appears about five lines into
10 your answer. You state, "The concrete in the cask
11 and in the pad was modeled using a nonlinear
12 concrete material model that has been accepted by
13 the NRC," and that's closed quote. Could you
14 describe what that model is?

15 DR. SOLER: That model, which was
16 developed by a contractor to NRC, Anatec
17 Corporation.

18 DR. SINGH: Lawrence Livermore.

19 DR. SOLER: That's right, Lawrence
20 Livermore, I got my companies confused. Lawrence
21 Livermore uses the code called LS Dyna, which was a
22 code that has a long history at Lawrence Livermore
23 Lab and was originally developed to study
24 short-time events taking into account very highly
25 nonlinear materials. In that code was a generic

1 model of concrete, a generic damage model, which
2 required that you input things like the crush
3 strength of the concrete and a number of
4 parameters.

5 What Lawrence Livermore did over the
6 course of a certain period of time under contract
7 to the NRC was to calibrate that concrete model
8 against a series of tests of dropping billets and I
9 believe a half-scale cylinder representing a cask.
10 And they correlated their model with this test
11 data, put out a report, and basically that has been
12 adopted by the Staff as the guideline for doing
13 these drop analyses. It allows for a crush of the
14 concrete and I guess failure of the concrete as
15 failure is defined within that code.

16 Q. All right. Thank you. Dr. Soler, I
17 would also like to ask you a question about answer
18 69 in your testimony. At the beginning of your
19 answer you indicate your belief that the pad will
20 not undergo sliding under the 2,000-year design
21 basis earthquake. Do you know whether the staff
22 has fully accepted that position?

23 DR. SOLER: No, I do not.

24 Q. In answer 71, again, Dr. Soler, I
25 believe this is your answer, you use a phrase that

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1 I would like to see if you can explain a little bit
2 more. The second sentence of your answer states
3 that, "this," referring back to the first sentence
4 of your answer --

5 DR. SOLER: What was that question
6 number again?

7 Q. Answer 71.

8 DR. SOLER: Okay. I'm looking for the
9 word "this" and I can't find it.

10 Q. The second sentence begins with the word
11 "Indeed, this."

12 DR. SOLER: Not in my copy it doesn't.

13 DR. SINGH: Look at mine.

14 DR. SOLER: Now, what was the word you
15 were asking me to look for here?

16 Q. What I'm going to ask you to do, and
17 maybe you can do this from memory.

18 DR. SOLER: Okay.

19 Q. You state that, "this is the theory
20 behind base isolation design of structures or
21 buildings to protect them from earthquake damage."
22 And I want to ask you to explain that. What do you
23 mean by the base isolation design of structures?

24 DR. SOLER: Well, let me try to explain
25 that with a simple case. Let's assume that we have

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1 a ground which is subject to some earthquake
2 excitation in the horizontal direction. So during
3 the earthquake the ground is moving laterally by
4 some amount. Now, if I put a structure on the
5 ground and tie that structure completely down to
6 the ground so that it moves with the ground, then
7 the base of that structure is going to move with
8 the earthquake. And depending on the structure, if
9 there are flexible parts above it, there may be
10 amplification of that motion at higher levels.

11 To preclude this and basically separate
12 the building from the ground, one would first, say,
13 put in a base isolation system which essentially
14 acts so the building is not attached to the ground,
15 is separate from the ground, and doesn't feel any
16 of the energy associated with the earthquake.

17 To put it in really simple terms, if I
18 was able to lay a permanent sheet of ice over the
19 ground, and this ice had a presumably very low
20 coefficient of friction and then I had the
21 earthquake, what will happen is that the ground
22 will move laterally and in inertial space the
23 building won't move at all, if in the absolute
24 lower limit you assume that ice had a zero
25 coefficient of friction, the building would stay

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1 absolutely still during the earthquake and the
2 ground would simply be moving under it.

3 So you've essentially isolated the
4 earthquake from the building. The building would
5 see no stresses, no deformation, and the only way
6 people in the building would know that they were
7 being subjected to an earthquake is because if they
8 looked out the windows they would see the ground
9 moving.

10 Q. I'm going to get in trouble for this
11 one, but it reminds me of the magic actor where
12 somebody takes the tablecloth and pulls it hard and
13 everything on the table remains standing in place.
14 Is that applicable or am I in trouble?

15 DR. SINGH: I wouldn't go there.

16 DR. SOLER: I'm not willing to confirm
17 or deny that.

18 MR. TURK: That's fine. That was not a
19 scientific question.

20 Q. (By Mr. Turk) In answer 78, Dr. Soler,
21 the second sentence of your answer states that "use
22 of this procedure," and you're referring back to
23 the use of the upper bound and lower bound
24 coefficient of friction, "has been accepted by the
25 regulating body as appropriate in the many license

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1 submittals for Holtec's spent wet storage fuel
2 racks." Do you recall -- when you speak about the
3 regulating body, are you speaking about the Nuclear
4 Regulatory Commission or other body?

5 DR. SOLER: Yes.

6 DR. SINGH: And other bodies also, the
7 regulatory body overseas.

8 DR. SOLER: Mainly every rack
9 installation that's been licensed in the United
10 States, that upper and lower bound has been used in
11 doing the simulations.

12 Q. In answer 88, Dr. Soler, again this is
13 your answer, I believe, you discuss the concept of
14 cold bonding. The question asks you, "Will cold
15 bonding develop over time between the casks and the
16 pad as alleged by Dr. Ostadan," and your answer is
17 no. Can you identify whether there are any studies
18 that establish at what pressures cold bonding is
19 likely to occur?

20 DR. SOLER: My colleague is anxious to
21 answer that. I will simply answer it, I cannot
22 personally identify any studies.

23 Q. But do you have an opinion based on any
24 of your experience or knowledge?

25 DR. SOLER: My experience, which is

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1 secondhand in that it deals with analysis rather
2 than fabrication, when two pieces of metal plate
3 are clad together it's because one material is,
4 let's say, very expensive or very exotic and the
5 base material is very common and you need the
6 exotic material as a surface layer. One of the
7 ways to construct such a composite plate is by
8 bonding the two materials together under very high
9 pressures. I do not know myself the magnitudes of
10 those pressures, but they are certainly greater
11 than the pressures that are experienced in this
12 application.

13 Q. When you say this application --

14 DR. SOLER: At PFS.

15 Q. In other words, the cask pressure on the
16 pad?

17 DR. SOLER: The cask pressure on the
18 pad.

19 Q. Dr. Singh, did you want to add something
20 to that?

21 DR. SINGH: I'm not particularly
22 anxious, but I would if you asked.

23 Q. Only if you have something which you
24 want to contribute.

25 DR. SINGH: Well, yes. Cold bonding is

1 not a scientific term, it is not a literature term
2 that I have been able to find anywhere. The
3 materials do bind, however, if they have a high
4 level of internal cohesion. For example,
5 austenitic stainless steel will bind to austenitic
6 stainless steel under pressure, under pressures
7 which would typically be in the order of 10 to
8 20,000 psi. I realize the pressure under HI-STORM
9 is in the order of 20 to 30 psi. Some materials
10 don't like to bond to each other at all and there
11 you need very, very high pressures.

12 Again, if you want to bind titanium to
13 steel it requires pressures in excess of double the
14 yield strength of the material, which is about 50
15 to 60,000 psi, pounds per square inch, that is. So
16 cold bonding is possible in certain situations, but
17 usually it happens only when you have a poor choice
18 of materials or you have excessively high pressure.

19 Q. And if I'm not mistaken, you're
20 describing roughly three orders of magnitude
21 difference between the HI-STORM cask sitting on the
22 pad at the PFS site versus the austenitic steel
23 example you gave?

24 DR. SINGH: That's correct.

25 Q. There is a table in answer 102 of your

1 testimony, and I just want to clarify. The third
2 column -- I'm sorry, the fourth column which is
3 entitled "# of Time Histories". Do you see that?

4 DR. SOLER: Uh-huh (affirmative).

5 Q. You say single time history references,
6 three different spectra. Are those the two
7 horizontal and one vertical spectra?

8 DR. SOLER: No. At Diablo Canyon were
9 the LTSP, the Hosgri and the DE spectra.

10 Q. So those were three different fault
11 spectra?

12 DR. SOLER: Three different response
13 spectra from which each one gave three time
14 histories.

15 Q. And when you say different response
16 spectra you're identifying now three different
17 fault systems?

18 DR. SINGH: Yeah. Hosgri was a
19 different fault system, that's correct. Now,
20 long-term seismic plan, I believe is LTSP, is a
21 composite. I'm not sure.

22 MR. TURK: Your Honors, I'm skipping
23 item 13 because I think that's been gone over with
24 the description of the fuel pad and I think Mr.
25 Soper will have more with that.

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1 Q. (By Mr. Turk) Have either of you had an
2 occasion now to review Dr. Luk's report concerning
3 his expected performance of casks at the PFS
4 facility under 2,000 year or 10,000 earthquake
5 conditions?

6 DR. SOLER: I have read the report I
7 believe twice.

8 Q. Do you have an opinion of it?

9 DR. SOLER: It, of course, studies a
10 different problem than we have simulated either
11 with DYNAMO or with VisualNastran. Is also models
12 certain features of the problem in a different
13 manner than we have modeled. It treats one cask
14 that includes flexibility of the pad and it models
15 the soil by using a finite element representation
16 of the soil. As far as the 2,000-year earthquake
17 is concerned, the results in terms of magnitude of
18 excursions expected to the cask appear to be in the
19 same order as has been predicted by both DYNAMO and
20 by VisualNastran.

21 As far as the 10,000-year earthquake is
22 concerned, my recollection is that for the case of
23 .2 the numbers are in the same order, but for the
24 cases of coefficients of friction .8, there was a
25 difference between the results in the analysis but

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1 not in the conclusion. The general conclusion from
2 both analyses was that the casks remain upright.
3 However, the maximum excursion under a high
4 coefficient of friction there was a difference in
5 the results. I can't comment on why there was such
6 a difference.

7 DR. SINGH: I can.

8 Q. Dr. Luk's report comes up with a smaller
9 prediction of the excursion under the 10,000-year
10 earthquake, doesn't it?

11 DR. SOLER: That is correct.

12 DR. SINGH: Let me supplement that. I
13 think it's a fine piece of work. The model is
14 quite comprehensive. It uses appropriate methods
15 and techniques to the extent as described in the
16 report, I agree with them. The document, of
17 course, as Dr. Soler said, the details of the model
18 are different. When you model a complex problem
19 and you take a different modeling path you're going
20 to have some differences in the final results. But
21 the solutions in the end are essentially in
22 agreement with ours.

23 Q. Thank you. I would like to ask you a
24 question about your answer 136. I believe this
25 answer is ascribed to both of you but whichever of

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1 you feel more comfortable answering it will be
2 fine. There's some terminology that I don't
3 understand. In the middle of the paragraph on page
4 78 you talk about a cask moving towards the pad.
5 Do you see that sentence?

6 DR. SOLER: Yes.

7 Q. Could you explain what you mean by that
8 phrase?

9 DR. SOLER: Kris, would you?

10 DR. SINGH: Go ahead.

11 JUDGE FARRAR: And let me suggest to the
12 witnesses, in our ground rules yesterday urged that
13 we give -- that we not give overly extensive
14 answers if not necessary. Is there a one word
15 answer to this? It's going downward?

16 DR. SOLER: Rephrase the question and
17 I'll see.

18 Q. (By Mr. Turk) Let me state it in
19 traditional cross-examination form. As I read the
20 statement that the cask would move towards the pad,
21 I understand that to mean the cask is pressing
22 downwards. Is that a correct understanding?

23 DR. SOLER: Yes.

24 Q. In answers 138 and 139 you refer to the
25 ANSYS, A-N-S-Y-S, guidance values for values for

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1 contact stiffness. Could you be more specific in
2 terms of what values should be used under that
3 guidance?

4 DR. SOLER: ANSYS does not say a
5 specific value should be used. They present to you
6 ways for any given problem of choosing a value on
7 an iterative basis. In a nutshell, ANSYS tells you
8 that the contact stiffness must not be so large as
9 to cause you a problem with convergence of your
10 solution in that you never get convergence.

11 On the other hand, it must not be so
12 small that by just putting the object down on the
13 ground you would observe a visible penetration
14 under gravitation -- under simple gravitational
15 load. Beyond that they suggest by example. There
16 is a complete ANSYS, I'll call it a workbook, in
17 which people who are taking a course from the
18 originators of ANSYS learn how to use the program.
19 This book describes -- this workbook describes
20 contact problems in the course of about 100 pages
21 and suggests with sample problems and with textual
22 material how one should go about choosing contact
23 stiffness. They do not, however, suggest a
24 specific value for all problems.

25 Q. Dr. Soler, have you had occasion to use

1 the ANSYS guidance in the past?

2 DR. SOLER: I have.

3 Q. And do you recall on what applications
4 have you done that?

5 DR. SOLER: I believe we used it
6 certainly in some of our work with impact limiters
7 for our transportation submittal. I have used it
8 in a number of occasions to verify the results from
9 another code that also predicted impact. And I
10 have used it in the course of the validation of
11 DYNAMO, we ran some simple cases with ANSYS. I'm
12 sure I've used it elsewhere over some 40 years, but
13 I couldn't be more specific than that.

14 Q. All right. In answer 160, and this may
15 be repetitive already, again you use the phrase a 5
16 percent Beta damping value. I believe in the past
17 you used a 5 percent damping value. Can you
18 explain what the 5 percent Beta damping value is?

19 DR. SOLER: Here I guess I'm guilty of
20 using the terminology that the people who deal with
21 structural damping tend to use. In the choice of a
22 damping constant, given a problem, you can either
23 choose it to be proportional in a complex problem
24 which is modeled by finite element methodology.
25 You can choose your damping based either to be a

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1 certain proportion of the mass matrix or a certain
2 proportion of the stiffness matrix, or a certain
3 proportion of both.

4 The multiplier to get the damping matrix
5 as a proportion of the mass matrix is usually
6 called Alpha damping. When it's a proportion of
7 the stiffness matrix it's usually called Beta
8 damping. Here we're using -- we're ascribing a
9 certain percentage of damping to our interface in
10 terms of the contact stiffness. So I tended to
11 lapse into the terminology of considering it as a
12 Beta damping because it's a multiplier on the
13 stiffness matrix, but in reality it's not the
14 structural damping term, it is simply a damper that
15 is introduced to simulate a real physical
16 phenomena.

17 Q. Is this the same 5 percent damping value
18 that we've talked about previously?

19 DR. SOLER: Yes.

20 Q. Also with respect to damping, in your
21 answer 164, and this is at the top of page 93,
22 you're describing the use of a 5 percent damping
23 for energy dissipating dampers in parallel with
24 contact stiffness elements. And you then state,
25 "The same methodology has been reviewed and

1 accepted by the NRC in the web storage licensing
2 submittals." Can you explain what you mean by that
3 sentence?

4 DR. SOLER: Well, in the DYNAMO
5 simulation of storage racks we generally have a
6 square or rectangular object which is sitting on
7 four legs. Occasionally -- or four pedestals,
8 occasionally more than four pedestals. These four
9 pedestals are in contact with the spent fuel pool
10 liner. So simulate that contact we introduce a
11 vertical compression-only spring and two horizontal
12 friction springs, if you will, for lack of a better
13 term, so that the triad of springs simulates the
14 behavior when you would get a contact and possible
15 lift-off and contact coupled with sliding.

16 Now, in a pure contact problem, if you
17 imagine the spent fuel rack somehow being elevated
18 above the floor and then dropping back down, and if
19 it were allowed to bounce in a free vibration
20 problem, you would observe that if it's dropped
21 from one height it bounces back to a lesser height
22 and keeps on bouncing and eventually comes to a
23 stop. The only mechanism to simulate this kind of
24 physical observable behavior is with a damper
25 that's in parallel with that compression-only

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1 spring. Of course, it only works while it's in
2 compression.

3 Q. Finally, I would like to ask you a
4 question about your answer 169. In a sense this is
5 a wrap-up paragraph. You're asked to summarize the
6 results of the various cask stability analyses that
7 Holtec has performed for the PFSF facility. And in
8 the middle of this paragraph you state, I'm going
9 to quote here, "Even under unrealistic worst-case
10 assumptions as to damping and other factors, the
11 casks do not tip-over in a 10,000-year earthquake."
12 Can you be a little more specific about what are
13 the worst-case assumptions that you're referring to
14 here?

15 DR. SOLER: Well, as I alluded this
16 morning, what I mean here by worst-case assumptions
17 is the choice of soil parameters not on the basis
18 of what soil testing and geotechnical work would
19 say they should be, but rather a choice of soil
20 parameters to force a resonance under a certain
21 kind of vibration. The words that I usually use
22 are I'm tuning the spring to get the most
23 amplification of the mass.

24 MR. TURK: I thank you very much, your
25 Honor. That concludes my cross.

1 MR. FARRAR: It's five after 3:00 and
2 this would be a good time to take a break, change
3 court reporters, and then we'll be ready to start
4 the State's cross unless there's anything anyone
5 needs to deal with right now. Then let's take a
6 10-minute break and be back at 3:15. Actually, a
7 9-minute break.

8 MR. FARRAR: Off the record.

9 (A recess was taken.)

10 JUDGE FARRAR: All right, we're back on
11 the record, ready to start the State's
12 cross-examination, much later in the day than we
13 would have expected, but we've had some unusual and
14 useful developments, so we are where we are.

15 Mr. Soper, you're going to start?

16 MR. SOPER: Yes, Your Honor. May I
17 proceed?

18 JUDGE FARRAR: Yes.

19 MR. SOPER: Thank you.

20

21 CROSS EXAMINATION

22 BY MR. SOPER:

23 Q. Good afternoon, gentlemen, my name is
24 Jim Soper. I am one of the lawyers for the State
25 in this matter.

1 Dr. Singh, you are the president and CEO
2 of Holtec International; is that correct?

3 DR. SINGH: That's correct.

4 Q. And that's a New Jersey corporation, I
5 understand?

6 DR. SINGH: That is correct.

7 Q. And it employs about 50 people,
8 something like that?

9 DR. SINGH: Between 50 to a hundred.
10 Between 50 to a hundred, somewhere in there.

11 Q. The reason I'm not responding is you're
12 the president, I'm a little surprised you don't
13 have a little closer count on that.

14 DR. SINGH: Well, we have some people
15 who directly work for us, some are contractors. I
16 look at the total work force?

17 Q. I see. Well, I was asking about
18 employees, but I think your answer is sufficient.

19 And you've been employed at Holtec since
20 1986; is that correct?

21 DR. SINGH: That is correct.

22 Q. In the same capacity, as president and
23 CEO?

24 DR. SINGH: That is correct.

25 Q. And Dr. Soler has also been employed

1 with Holtec since 1986; is that right?

2 DR. SOLER: On a full-time basis.

3 Q. Well, actually, I'm still asking
4 Dr. Singh.

5 DR. SINGH: Initially, he was part time
6 and then he became full time, I think in 1990, '91,
7 is that right?

8 DR. SOLER: (Nodding affirmatively.)

9 Q. And he is the executive vice president;
10 is that true?

11 DR. SINGH: That is true.

12 Q. Is he the only executive vice president?

13 DR. SINGH: That is correct.

14 Q. So you and Dr. Soler are the two top
15 executives at Holtec; would that be fair?

16 DR. SINGH: That's a fair statement.

17 Q. And you're both mechanical engineers, I
18 take it?

19 DR. SINGH: Yes.

20 DR. SOLER: Yes.

21 Q. Actually, I'm just asking Dr. Singh
22 questions right now, Dr. Soler. Even though they
23 may pertain to you, I assume he could answer with
24 respect to your employment, since he's, I would
25 guess, your boss so to speak.

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1 DR. SINGH: Doesn't seem that way in
2 day-to-day work.

3 Q. Well, maybe I ought to ask Dr. Soler
4 these questions.

5 Neither of you have degrees in nuclear
6 physics; is that right?

7 DR. SINGH: That is correct.

8 Q. Or nuclear engineering?

9 DR. SINGH: That is correct.

10 Q. And I take it, that neither you nor
11 Dr. Soler are being paid a fee for assisting PFS in
12 this matter? Would that be right?

13 DR. SINGH: We have a contract with PFS.
14 I presume that there are commercial arrangements
15 between Holtec International and PFS, but we don't
16 personally get fees, that is true.

17 Q. Well, is Holtec being paid a fee for
18 your assistance in connection with this application
19 proceeding?

20 DR. SINGH: Holtec has a contract with
21 PFS, and the work we do for PFS is compensated in
22 one form or another.

23 Q. And I notice that in your deposition,
24 you said you had an agreement with PFS but not a
25 contract. What did you mean by that?

1 DR. SINGH: Well, agreement is, I guess
2 lawyers are more qualified to speak to that. We
3 have an MOU, I guess a memorandum of understanding,
4 which will later solidify into a contract. But at
5 the present time, it's in the form of an MOU.

6 Q. I see. And that's memorandum of
7 understanding?

8 DR. SINGH: That is correct.

9 Q. And what is Holtec required to do under
10 that memorandum of understanding?

11 DR. SINGH: At the present time, simply
12 to be cooperative and provide technical information
13 as requested. That's the extent of our
14 understanding at this point.

15 Q. I see. And that providing technical
16 assistance would be -- include for this proceeding?
17 Would that be right?

18 DR. SINGH: This proceeding is just a
19 part of it, yes.

20 Q. Uh-huh. And the PFS application calls
21 for 4,000 Holtec HI-STORM casks systems to be used
22 at the proposed site; is that right?

23 DR. SINGH: I believe that to be true.

24 Q. Was there some question in your mind?

25 DR. SINGH: Well, I know that PFS

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1 originally had filed for two separate systems,
2 either one of them could be used. I understand it
3 was later modified to include only HI-STORMs.

4 Q. And I take it, there will be some other
5 Holtec products, as well, like the HI-TRAC canister
6 transfer?

7 DR. SINGH: HI-TRAC canister cask, is
8 that what you mean?

9 Q. Yes.

10 DR. SINGH: I presume, yes, uh-huh.

11 Q. Let me ask you just a couple of
12 questions about the HI-STORM 100. I think Mr. Turk
13 asked you if that cask was going to be used at
14 Diablo Canyon, and I think you answered in the
15 affirmative, that it was; is that right?

16 DR. SINGH: Yes, we have a contract with
17 PG&E, which is the owner of Diablo Canyon, to
18 provide them HI-STORM overpacks and MPC 32
19 multipurpose canisters.

20 Q. Would that be the HI-STORM 100 S or SA?

21 DR. SINGH: It will be HI-STORM 100 SA.

22 Q. And I understand from your web site,
23 that the HI-STORM 100 S is a hugely improved
24 version of the HI-STORM 100; is that correct?

25 DR. SINGH: Well, yes. Yes, everything

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1 we do is an improvement. Everything we do today is
2 an improvement over yesterday. 100 S is
3 essentially HI-STORM 100. In the regulatory space,
4 if there is even a comma and italic, a letter
5 different from the Certificate of Compliance
6 originally given by the NRC, then we need to
7 resubmit it and get another CoC, Certificate of
8 Compliance. 100 S for all anatomical aspects is
9 identical to 100.

10 Q. Well, your web site says it's a hugely
11 improved version of the HI-STORM 100. Are you
12 telling me that's not right?

13 DR. SINGH: Well, I didn't say it was
14 not right. I simply said that the 100 S is
15 anatomically similar to 100. We have made
16 improvements with respect to handling of the cask
17 to reduce those to personnel who unload the cask
18 and so on. But the cask basically is the same
19 cask.

20 Q. Isn't the 100 S an anchored version?

21 DR. SINGH: No, 100 SA is the anchored
22 version.

23 Q. At Diablo Canyon, in fact, it's the 100
24 SA; is that right?

25 DR. SINGH: I've answered that question

1 before affirmatively.

2 Q. And I think you said that at Columbia,
3 it was a HI-STORM 100; is that right?

4 DR. SINGH: 100 S. Wait. You know, I'm
5 not quite sure right this minute.

6 Q. Let me refresh your recollection --

7 DR. SINGH: It's 100 S.

8 Q. Yes, and I think you told Mr. Turk it
9 was the 100. And what about Sequoyah?

10 MR. TURK: I would object to that, Your
11 Honor. My question may have been parse in terms of
12 it being a HI-STORM 100 without differentiating
13 between casks. I think it's unfair to ascribe to
14 the witness an error on my part.

15 JUDGE FARRAR: I don't know that you
16 have standing to make that objection. We're doing
17 just fine here right now. Thank you.

18 DR. SINGH: In answering Mr. Turk's
19 questions, I was focused on answering -- our system
20 as opposed to somebody else's system. That was the
21 context of his questions. Frankly, in my mind, on
22 a day-to-day basis, I do not make a large
23 distinction between 100 S and 100. I consider them
24 twins.

25 Q. (By Mr. Soper) Even though your web

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1 site says the S is hugely improved?

2 DR. SINGH: And that is a correct
3 statement. It does say so, and I explained to you
4 earlier, our focus in designing overpacks, first,
5 of course, is to maximize public health and safety.
6 We also attempt to maximize occupational safety
7 that goes to personnel who load the casks. Our 100
8 S was motivated to reduce dose to personnel who
9 load the cask as opposed to its behavior on the pad
10 long-term. That's why I say they are twins. But
11 from the standpoint of operations, loading of the
12 cask, 100 S indeed gives benefits to the nuclear
13 plant operators.

14 Q. Well, your web site goes on to say that
15 "This huge improvement goes to the ability to
16 deploy our system in high seismic regions."

17 That doesn't have anything to do with
18 the employee doses, does it?

19 DR. SINGH: No. You're reading it --
20 perhaps you do not understand the context in which
21 it is stated. 100 S is a later variation of 100.
22 When we went to the NRC to get an anchored
23 variation from the HI-STORM overpack, we decided it
24 would be more appropriate to have the anchored only
25 with 100 S. It was a choice made. The 100 SA is

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1 the anchored variation of 100 S. We could have
2 also applied for HI-STORM 100 A, but we chose not
3 to. A would have been anchored variation of it.

4 Q. And with respect to Sequoyah, that was
5 also -- you meant to say 100 S, I believe; is that
6 correct?

7 DR. SINGH: Sequoyah very recently has
8 decided to go to 100 S.

9 Q. I see. Has there been any indication
10 for the PFS site to deploy 100 S rather than the
11 100?

12 DR. SINGH: I would think that they
13 would use 100 S or 100. In their case, it does not
14 make any difference because first, the casks are
15 not anchored, therefore, they don't need the A
16 feature, which is the anchoring lugs, and second,
17 they are not doing the MPC loading. The MPC
18 loading will occur at the plant and the
19 occupational dose considerations that motivated us
20 to go to 100 S do not exist for PFS.

21 Q. I also understand that Holtec has been
22 in the dry cask storage business for approximately
23 six years; would that be right?

24 DR. SINGH: Well, we have been in the
25 business of developing the technology since 1991.

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1 We made our first successful sale in 1995, which
2 would be seven years ago.

3 Q. I see.

4 Now, this PFS license application was
5 filed in June of '97 about five years ago, so the
6 PFS facility would be one of your first efforts, I
7 take it, to sell this technology?

8 DR. SINGH: Well, I wouldn't put it that
9 way. We have sold -- we have sold systems to D.C.
10 Cook, which is American Electric Power, in 1995.
11 We have sold to Dresden, which is Campbell & Curtis
12 and now they're called Exelon in 1995. And I think
13 we had negotiations ongoing with Plant Hatch in
14 '97.

15 Q. Okay. So soon after your first sales,
16 you probably began looking into the PFS facility
17 since its license application was filed in '97, I
18 guess that would be more accurate statement?

19 DR. SINGH: Well, I don't know if we
20 were in 1997, at the time the application was
21 filed, we had an agreement with PFS. I'm not sure.

22 Q. I see. Dr. Singh, you are actually the
23 founder of Holtec International; isn't that
24 correct?

25 DR. SINGH: Yes, that's true.

1 Q. And you founded the company in 1986?

2 DR. SINGH: That's correct.

3 Q. And were there cofounders who started
4 the company with you?

5 DR. SINGH: Well, Dr. Soler has been
6 with me from the very beginning.

7 Q. Is he a cofounder, would you say?

8 DR. SINGH: Yes. He's a cofounder.

9 Q. Any other cofounders?

10 DR. SINGH: Dr. Paul has also been with
11 us from the beginning.

12 Q. I see. Holtec is a privately owned
13 company, I understand?

14 DR. SINGH: That's correct.

15 Q. And the three of you you just mentioned
16 are the owners?

17 DR. SINGH: That's correct.

18 Q. Dr. Singh, tell me what facilities
19 currently have -- well, let's start with this,
20 excuse me.

21 What facility currently has the most
22 HI-STAR 100 casks actually in use storing spent
23 nuclear fuel?

24 DR. SINGH: You said HI-STAR. You meant

25 --

1 Q. Excuse me, HI-STORM.

2 DR. SINGH: We have, I believe, 12
3 HI-STORMs loaded. They're all HI-STORM 100s, being
4 that you like the distinction between the two.
5 They're not 100 S. They're loaded at Dresden.
6 That's in -- about 50, 60 miles from Chicago,
7 Illinois. We have, I believe it will be within
8 four to seven, I don't know the number exactly, at
9 Plant Hatch in Georgia, Baxley, Georgia owned by
10 Southern Nuclear Company.

11 I believe in the past two weeks, they
12 have loaded a HI-STORM 100 S at J.A. Fitzpatrick on
13 the shores of Lake Ontario in New York. And there
14 are loadings planned this year at Columbia
15 Generating Station in Richland, Washington, and a
16 second campaign at Plant Hatch, and also a second
17 campaign at Dresden. We expect three to four
18 loading campaigns each year at different plants
19 around the country on an ongoing basis.

20 Q. And how many did you say at Fitzpatrick?

21 DR. SINGH: Fitzpatrick plans to load
22 three. They have loaded one, they may have loaded
23 the second one this week. I'm just not in the loop
24 this week.

25 Q. And Columbia, how many did you say?

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1 DR. SINGH: Columbia will load a minimum
2 of five this year. They are going through their
3 preparations to begin loading.

4 Q. That's a count, 27 casks in use?

5 DR. SINGH: I wouldn't call them in use.
6 They are not all loaded.

7 Q. They're not all in use, but they may be
8 present on the site or not even shipped yet?

9 DR. SINGH: The bulk of them have been
10 shipped. Maybe a couple not shipped to each site.
11 We typically ship six months before loading, so I
12 suppose most of the hardware should be at these
13 sites by now.

14 Q. In view of the fact that you have
15 somewhere in the neighborhood of 27 casks either in
16 use or about to be in use or planned, and the fact
17 that this facility calls for 4,000, this will be, I
18 guess to say the least, the largest contract for
19 dry storage casks, what, in history, as far as you
20 know?

21 DR. SINGH: I don't know, but I'll tell
22 you this: The 4,000 casks would not be procured
23 first in one day. It's a long-term. It could be a
24 long-term procurement. And second, if you're going
25 towards the capacity and manufacturing, our plan is

1 to manufacture the HI-STORM overpacks locally here
2 in Utah.

3 Q. I see. I think even the crudest
4 estimate would show that the sales that you're
5 contemplating here would be in the, what, hundreds
6 of millions of dollars for these casks?

7 DR. SINGH: I would think so, yes.

8 Q. And you and Dr. Soler, as the principal
9 owners in Holtec, will no doubt receive substantial
10 economic benefits as a result? No question about
11 that, is there?

12 DR. SINGH: Well, there are always
13 questions. I see the dry storage company that have
14 preceded us, practically everyone has gone out of
15 business. You know, whether we successfully
16 produce and make money is very different from
17 selling a contract. But it's not always a
18 guaranteed income. Believe me, I'm in the
19 trenches, I know it.

20 Q. Any of your competitors ever placed a
21 sale for 4,000 casks, that you're aware of?

22 DR. SINGH: Well, some of our
23 competitors have gone out of business trying to
24 sell a smaller number of casks.

25 Q. Let me ask you a question or two, sir,

1 about the DYNAMO program. For the 2,000-year
2 return seismic event, you performed a cask
3 stability analysis using a DYNAMO, isn't that
4 right?

5 DR. SINGH: That's correct.

6 Q. And among other things, the analysis was
7 conducted to determine if the HI-STORM 100 casks
8 would tip over? That would be one of the purposes
9 of that study?

10 DR. SINGH: Yes.

11 Q. And I understand that DYNAMO is a code
12 that you originally copied out of a textbook that
13 was published in 1976 and then you made some
14 modifications?

15 DR. SINGH: Well, that will be
16 belittling the work we did. But yes, the
17 technology called "Component Element Method" is
18 extremely well described in the book written by two
19 gentlemen, and we thought that that particular
20 approach, that particular method is ideally suited
21 for solving the response of freestanding mechanical
22 components under earthquakes.

23 Q. And you adapted that program with
24 modifications for use in the wet storage arena; is
25 that right?

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1 DR. SINGH: We modified the program to
2 give it capabilities and features so we could
3 analyze freestanding structures with special
4 emphasis on wet storage equipment.

5 Q. Well, at the time you modified it, you
6 were not in the business of dry storage, were you?

7 DR. SINGH: Well, realize that dry
8 storage is not the only business when one does
9 dynamic analysis. We use the program for a variety
10 of consulting projects that we did for utilities.
11 It is true, however, that the great bulk of the
12 application of DYNAMO was in fuel fix.

13 Q. Well, I'm not trying to be clever with
14 you, doctor. Dr. Soler testified, "I took that
15 code over the years and adapted it first for use in
16 wet storage seismic analysis and later on used it
17 for dry storage seismic analysis."

18 Now, is that true or not?

19 DR. SINGH: I'm further illuminating his
20 testimony, that we have used it in freestanding
21 structures outside of racks, also.

22 Q. But my question is, do you agree with
23 this statement?

24 DR. SINGH: The statement is correct.

25 Q. And you claim this code now as its

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1 modified to be proprietary information of Holtec;
2 is that right?

3 DR. SINGH: Oh, it's been that way for a
4 long time, yes, sir.

5 Q. I see. So no one has this code except
6 Holtec?

7 DR. SINGH: No, actually, we leased that
8 code to Taiwan Power Company in 1988 when they
9 were -- they wanted to develop the capability to do
10 such work in Taiwan themselves.

11 Q. You haven't provided it to the NRC?

12 DR. SINGH: We have not given the actual
13 code to the NRC, but we have given NRC validation
14 of the code to authenticate its voracity many
15 times.

16 Q. And you haven't given it to anyone
17 outside of Holtec other than the company in Taiwan?
18 Would that be right?

19 DR. SINGH: Nobody else has bought it
20 from us, would be a more appropriate answer.

21 Q. So, then, other than the company in
22 Taiwan, no one else can run simulations on the code
23 that you have named DYNAMO, as far as you know?

24 DR. SINGH: Well, you know, all our
25 products are available for sale. You can acquire

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1 it tomorrow, start running it.

2 Q. No kidding?

3 DR. SINGH: No kidding.

4 Q. And how much does it cost?

5 DR. SINGH: I'll have to ask our CFO.

6 But it is available for sale if you so wish.

7 Q. And I take it that no one knows exactly
8 what modifications that you have made from the
9 textbook version?

10 DR. SINGH: We will give your people a
11 complete training if you were to purchase the two
12 codes.

13 Q. Other than that, except for those who
14 have purchased it, I take it, no one else is aware
15 of what the modifications are?

16 DR. SINGH: I wouldn't go that far,
17 because in numerous presentations to the NRC, we
18 have been subjected to penetrating questions about
19 the characteristics of the code, its attributes,
20 its limitations, and we have had similar in-depth
21 reviews by several utilities over the years. So I
22 wouldn't say that other people are completely in
23 the dark about the code. But they certainly don't
24 have the code itself to run it unless they were to
25 buy it from us.

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1 Q. Okay. DYNAMO, I understand, does not
2 calculate equilibrium step-by-step; is that right?

3 DR. SINGH: I wouldn't say that.

4 Q. Well, actually, I'm quoting Dr. Soler.

5 DR. SINGH: Well, it doesn't seem like a
6 complete quote if you're quoting him.

7 Q. In a nutshell, the DYNAMO code does not
8 alter the equilibrium equations step-by-step?

9 DR. SINGH: Does not alter, did you say
10 I'm sorry.

11 Q. Does not alter the equilibrium equations
12 step-by-step. In other words, at each instant in
13 time, the equilibrium equations are not
14 recalculated to assume the deformed angle --

15 DR. SINGH: Deformed geometries.

16 Q. Yes.

17 DR. SINGH: It's a -- that is correct.
18 The program does not take geometric nonlinearity
19 into account, that is true, the variation in the
20 geometry of the structure with the passage of time
21 during the earthquake.

22 Q. For example, if at some instant during
23 the time of the event, the event being the earth
24 movement, the cask becomes tipped or deformed or
25 rotated, DYNAMO does not alter the equilibrium

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1 equation to account for the fact that the cask is
2 now tipped, it would simply use the original
3 equilibrium equation throughout the entire run?

4 DR. SINGH: That is correct. It assumes
5 small deformations, small motions.

6 Q. Small rotations?

7 DR. SINGH: Small motions meaning
8 rotations, linear as well as rotation.

9 Q. In fact, sir, the DYNAMO code is not
10 capable of results that would indicate the cask
11 has, in fact, tipped over; isn't that right?

12 DR. SINGH: Well, that's a direct
13 corollary of what you said.

14 Q. And I understand further that you do not
15 know what the limitations of DYNAMO are? In other
16 words, what sort of rotation is beyond the
17 capability of the DYNAMO code?

18 DR. SINGH: Well, the capability would
19 be for a specific problem. Realize that for each
20 problem, the extent of geometric variation in the
21 geometry during the earthquake may have a different
22 effect. I'll give you an example to illustrate the
23 point. The fuel assembly inside the storage
24 location is not, of course, fixed, and therefore,
25 during an earthquake, the fuel assembly moves

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1 inside the storage location. The consequence of
2 that movement, even though the movement is within
3 the storage cell, could be to the extent of, oh, a
4 quarter inch on each side. The program, we have
5 done studies and determined that the program, the
6 linear solution that DYNAMO uses provides
7 conservative answers. We have done in that
8 particular case. In the case of casks, where we
9 can, we have a -- actually a quite powerful
10 nonlinear geometry code available to us to
11 determine if we have large rotations, large meaning
12 engineers understand large. They understand, for
13 example, an angle data from the vertical and sign
14 data, when they begin to depart from each other
15 substantially, you no longer have a linear
16 situations. In those cases, then we prudently move
17 over to a nonlinear code.

18 Q. There are, are there not, several
19 commonly used codes that do compute equilibrium
20 equations for each instant in time? They're just
21 available commercially?

22 DR. SINGH: There are some, yes.

23 Q. I see. For example, the VisualNastran?

24 DR. SINGH: Yes.

25 Q. And would Abacus be another?

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1 DR. SINGH: Yes.

2 Q. And ANSYS?

3 DR. SINGH: ANSYS has some nonlinear
4 capabilities, yes.

5 Q. And those programs would be capable of
6 accommodating a cask turnover, that large of
7 rotation, would they not?

8 DR. SINGH: Yes.

9 Q. And Holtec, of course, could have used
10 one of these codes for its seismic analysis in the
11 2,000-year event, could it not?

12 DR. SINGH: Theoretically, yes.

13 Q. But instead, Holtec chose to DYNAMO with
14 its limitations and which is kept secret by Holtec;
15 isn't that right?

16 DR. SINGH: Well, instead, we chose to
17 use DYNAMO for reasons which are compelling. If
18 you ask me, I'll tell you what they are.

19 Q. In fact, Holtec did not use DYNAMO for
20 the 10,000-year seismic event, but instead used one
21 of the commercially available codes VisualNastran;
22 isn't that right?

23 DR. SINGH: That's correct.

24 Q. And you did that because you believed
25 DYNAMO was not capable of that analysis; isn't that

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1 true?

2 DR. SINGH: Being true to science, we
3 use the appropriate code for the appropriate
4 application.

5 Q. What was the peak ground acceleration
6 for the 10,000-year return period, Dr. Singh? Do
7 you recall?

8 DR. SINGH: Well, it's in our testimony.
9 I would rather not give you a number. It's in
10 excess of 1g.

11 JUDGE FARRAR: Is that on page 27?

12 DR. SINGH: Our answer 39 has the
13 values.

14 Q. (By Mr. Soper) That would be 1.33gs and
15 1.25gs -- oh, excuse me, 1.33gs vertical PGA,
16 horizontal PGA is at 1.25 and 1.23. Am I reading
17 that correctly, sir?

18 DR. SINGH: It seems that way.

19 Q. And for the 2,000-year seismic event, I
20 have .71gs horizontal and .695gs vertical. Does
21 that sound correct?

22 DR. SINGH: Yes, that's correct.

23 Q. Now, it's my understanding that Holtec
24 has submitted only one seismic analysis for dry
25 storage casks to the NRC where the PGAs were as

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1 high as those as we are encountering in the
2 2,000-year earthquake for the PFS facility? Is
3 that -- do you understand my question, sir?

4 DR. SINGH: I think I do, yes. The
5 answer is yes.

6 Q. And that would be at Diablo Canyon?

7 DR. SINGH: That's correct.

8 Q. And I think you told me at Diablo
9 Canyon, that's the HI-STORM 100 SA, which is
10 shorter than the HI-STORM 100; is that right?

11 DR. SINGH: No. HI-STORM 100 S can be a
12 variable length. It doesn't have to be shorter.

13 Q. The Diablo Canyon ISFSI, safety analysis
14 report I'm reading from says the HI-STORM 100 SA is
15 the short anchored version of the HI-STORM 100 S
16 system. Is that correct or --

17 DR. SINGH: Well, I cannot tell you the
18 exact dimensions. The answer I gave you is 100 S
19 can be procured in variable length by the client.
20 And actually, the 100 S that we are providing to
21 Columbia Generating Station, I know for a fact is
22 approximately the same length as 100.

23 Q. For Columbia Generating Station. What
24 about for Diablo Canyon?

25 DR. SINGH: I don't have the data in

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1 front of me. It may be a few inches shorter, I
2 don't know.

3 Q. Holtec did the seismic analysis at
4 Diablo Canyon, did it not?

5 DR. SINGH: Yes.

6 Q. But you're telling me right now, you
7 don't know how high the casks were?

8 DR. SINGH: Believe me, I do not
9 memorize all input data.

10 Q. Dr. Soler, do you know, sir?

11 DR. SOLER: The analysis to be
12 conservative was actually done using a cask of the
13 height equivalent to the hundred.

14 Q. Is the cask that's deployed there
15 shorter than the HI-STORM 100 or not?

16 DR. SOLER: Well, there are no casks
17 deployed there yet.

18 Q. Do you know what is --

19 DR. SOLER: It's my understanding that
20 it will be shorter, but the analysis was done for
21 the same height unit as for PFS.

22 Q. Well, my question is, what will be used
23 there, not about the analysis for right now. So
24 there will be shorter casks at Diablo Canyon?

25 MR. GAUKLER: Objection, his question

1 was to the analysis initially.

2 DR. SINGH: It may be shorter because
3 the qualification is done, but the complete height
4 as Dr. Soler told you, it can be made longer. It
5 does not have to be shorter.

6 Q. (By Mr. Soper) Okay. And then the peak
7 ground accelerations at Diablo Canyon would be --
8 do you remember, Dr. Soler, what they are?

9 DR. SOLER: They are -- there have been
10 a number of them over the time we've worked. I
11 believe the maximum one for one set of earthquakes
12 is slight -- around .9.

13 Q. Do you remember what time period that
14 was for?

15 DR. SOLER: Do you mean duration?

16 Q. No, I mean how many year event that
17 would be? Or didn't they use that?

18 DR. SOLER: Oh, that was not part of my
19 knowledge.

20 Q. Okay. So you believe it would be .9
21 g's?

22 DR. SOLER: In that area.

23 Q. Okay. And the casks at Diablo Canyon
24 will be anchored with 16 bolts around the
25 circumference; isn't that correct?

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1 DR. SOLER: That is correct.

2 Q. And the pad will be seven and a half
3 feet thick?

4 DR. SOLER: I have been told that that's
5 an appropriate number.

6 Q. And the pad's actually some hundred feet
7 square or something, isn't it, huge?

8 DR. SINGH: No, I don't think so.

9 DR. SOLER: That sounds too large.

10 Q. Do you remember what the configuration
11 number of casks on a pad is there?

12 DR. SOLER: You must remember, we were
13 not responsible for the pad, so that's why it's not
14 intimately familiar to me.

15 Q. I'm looking at the pad here. It looks
16 to me to be about five-by-four arrangement, 68 feet
17 by 105 feet. Does that ring a bell?

18 MR. GAUKLER: We would ask him to show
19 the document to the witness.

20 DR. SINGH: We don't have information on
21 that here to quote from memory to you.

22 Q. (By Mr. Soper) I'm just wondering if
23 that refreshed your memory. That doesn't help you
24 at all?

25 DR. SINGH: No, it does not. See, we

1 did not design the pad.

2 Q. I see.

3 JUDGE FARRAR: I don't want to interrupt
4 you, Mr. Soler -- Mr. Soper, but wouldn't it be
5 fair to show the witness that?

6 MR. SOPER: Sure.

7 DR. SINGH: It appears to be authentic.
8 The information should be right.

9 MR. SOPER: Would Your Honor like to see
10 this?

11 JUDGE FARRAR: No.

12 Q. (By Mr. Soper) My question, Dr. Singh,
13 is that at Diablo Canyon -- you did do the seismic
14 analysis there, did you not?

15 DR. SINGH: We did the seismic analysis
16 of the casks.

17 Q. With a certain .5 thick pad and casks
18 that are bolted to that pad, and the pad being 68
19 feet by 105 feet, you would not expect that the
20 casks would tip over at Diablo canyon, would you?

21 DR. SINGH: We designed them to not tip
22 over at any site.

23 Q. Would you expect much of a rotation at
24 all from the vertical?

25 DR. SINGH: In that particular design,

1 where it's a fixed anchored cask design, the
2 constraint on the cask will keep it from rotating.
3 However, it will develop much higher stresses at
4 the anchorage locations.

5 Q. And even so, Holtec did not use the
6 DYNAMO code for its analysis at Diablo Canyon;
7 isn't that right?

8 DR. SOLER: Are you asking me?

9 Q. Dr. Singh.

10 DR. SINGH: I believe in our solutions,
11 we used VisualNastran; isn't that right, Alan?

12 DR. SOLER: May I elaborate?

13 Q. Well, my question is this: On anything
14 you submitted to the NRC for a seismic analysis at
15 Diablo Canyon, was it done with DYNAMO?

16 DR. SOLER: It was done with
17 VisualNastran.

18 Q. Thank you, sir.

19 Has the NRC accepted any seismic
20 analysis using Holtec's DYNAMO code for licensing a
21 dry cask storage where the PGA were as high as they
22 are at the PFS site?

23 DR. SINGH: The answer is that yes, we
24 have used DYNAMO for the 100 SA certification, and
25 NRC issued an SER on it.

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1 Q. That's not for a site specific
2 application, is it, this is for the CoC?

3 DR. SINGH: We do not make site specific
4 applications. Holtec only make general
5 applications.

6 Q. Hold it. Excuse me, do you need to
7 talk? Well, I would just like to have your
8 recollection here without consulting, actually.

9 I think the answer to my question is for
10 a site specific analysis such as Diablo Canyon,
11 Holtec has not used the Diablo -- or excuse me, the
12 DYNAMO code for a dry cask storage analysis with
13 the PGA forces at .7gs like they are at PFS? Would
14 that be correct?

15 DR. SINGH: Your statement is correct.
16 But PGAs have nothing to do with it, I should add.
17 PGAs have nothing to do with the decision made in
18 using a particular code. Other than the fact if
19 the code cannot do a particular geometry, then you
20 would use another code.

21 Q. I see. But nevertheless, Holtec has not
22 used DYNAMO for a dry cask storage system with
23 ground forces as high as the PFS facility? That is
24 true; right?

25 DR. SINGH: No, I just got done telling

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1 you that our submittal to the NRC for the general
2 certification of HI-STORM 100 SA utilizes DYNAMO as
3 an anchored system and the applicable g loads are
4 greater than those at PFS.

5 Q. Now, that's for the 100 SA?

6 DR. SINGH: That's right.

7 Q. But that's not for a particular site
8 analysis?

9 DR. SINGH: That is correct.

10 Q. Now, in the document that's been
11 marked -- it's the Beyond Design Basis Scoping
12 Analysis, and I believe it's been marked as an
13 exhibit. As 86.

14 DR. SOLER: 87. No, no, 86.

15 JUDGE FARRAR: It's Applicant 86.

16 Q. (By Mr. Soper) You attempted to
17 validate the DYNAMO 2,000-year results by
18 suggesting you ran the same input on the VN code?
19 And I'm referring to page 20 of that document.

20 DR. SINGH: Well, strictly speaking, we
21 weren't validating the program. We were validating
22 the results from the program.

23 Q. All righty. And by validating the
24 results, you're talking about the results that you
25 obtained in the 2,000-year multi cask response at

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1 PFS ISFSI, this document here? I don't believe
2 it's been marked or submitted.

3 DR. SINGH: We should see it before we
4 answer you.

5 MR. SOPER: Your Honors, I don't know
6 that I have another -- I wasn't planning to
7 introduce it.

8 JUDGE FARRAR: Just --

9 MR. SOPER: It's the multi cask response
10 at PFS ISFSI from 2,000-year seismic event, rev.2.

11 JUDGE FARRAR: Who produced it?

12 MR. SOPER: This is Holtec's 2,000-year
13 seismic event analysis.

14 MR. TURK: What's the date of the
15 document? Do you have that?

16 MR. SOPER: The date I have is -- it
17 looks like August 20, 01. But this says revision
18 2.

19 Q. (By Mr. Soper) Maybe you can explain to
20 me, Dr. Singh, the front cover of this document
21 says revision 2 in the title, rev.2, do you see
22 that, sir?

23 DR. SINGH: Yes.

24 Q. And then on the back side of the front
25 page, it has the revision number and the date

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1 approved and it has revision 0 and revision 1.

2 DR. SINGH: Well, I guess it's an
3 unfortunate choice of words in the title. It's
4 rev.2 of the 2000-year seismic event. The report
5 itself, the report has been revised once. It's
6 rev.1. The rev.2 in the title refers to the
7 division two of the 2,000-year earthquake. Is that
8 right, Alan?

9 DR. SOLER: That's correct.

10 JUDGE FARRAR: And, Mr. Soper, just so
11 the record is clear, we have not seen this from any
12 of the parties so far; is that correct?

13 MR. SOPER: I would like to mark this,
14 then, and make it an exhibit, because this is
15 central to much of what's going to happen here.

16 JUDGE FARRAR: All right, then. And you
17 only have the one copy at this point?

18 MR. SOPER: I'm sorry to say, yes.

19 JUDGE FARRAR: That's quite all right.
20 That would be what exhibit? State Exhibit --

21 MR. GAUKLER: Right now, I would say the
22 document is Holtec proprietary. Whether Dr. Singh
23 would waive that or whether we want to keep it
24 confidential, I need to talk to Dr. Singh about
25 that. So I would ask that be kept confidential at

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1 least at this point in time.

2 JUDGE FARRAR: Okay. First, let's find
3 out what the exhibit number would be.

4 MR. SOPER: I believe it's 173. Can you
5 help me out on that?

6 JUDGE FARRAR: 173 is right.

7 MR. SOPER: Is that right?

8 JUDGE FARRAR: Let's take up
9 Mr. Gaukler's problem about the proprietary nature
10 of it. Well, I haven't seen it. Does it say
11 proprietary on it?

12 MR. GAUKLER: Yes, it does.

13 MR. SOPER: Yes. It has a company
14 private box at the bottom.

15 JUDGE FARRAR: And you got it through
16 discovery?

17 MR. SOPER: Yes.

18 JUDGE FARRAR: Okay.

19 MR. GAUKLER: We have no problem making
20 copies of those for Your Honors certainly to look
21 at. They have been available for the NRC Staff
22 under the typical NRC confidentiality rule, 2.790.

23 JUDGE FARRAR: So the Staff has seen it,
24 it's part of its -- Mr. Turk, is that correct, the
25 Staff has seen this document?

1 MR. TURK: We're looking now, Your
2 Honor? I can't answer your question. I don't know
3 yet. It's possible, but as I sit here, I can't
4 say. I'm informed by one of our Staff members and
5 consultants that yes, we have looked at it.

6 JUDGE FARRAR: So you get it as part of
7 your regulatory -- your routine regulatory process
8 and you sign confidentiality agreements?

9 MR. TURK: Your Honor, we would treat it
10 as proprietary if it was -- if a request for
11 proprietary treatment was made when it was
12 submitted to us. I don't have a record of how they
13 submitted it. Typically, we would treat it
14 proprietary, unless there was some reason to
15 disclose, if it came under a request for
16 proprietary treatment.

17 MR. GAUKLER: And just to give more
18 background, Your Honor. These are licensing
19 submittals of PFS which have been submitted to the
20 NRC Staff. Pursuant to the agreement with the
21 State we had during the January 1998 hearing
22 conference, we've provided copies to the State
23 whenever we file documents like this with the NRC
24 Staff. And the State has its own confidentiality
25 agreement, under which Holtec provides the document

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1 as we file them with the NRC Staff.

2 JUDGE FARRAR: All right. What
3 suggestions do I have as to how we handle this in
4 this proceeding? Because exhibits and discussions
5 on the record of exhibits are public unless we
6 handle them otherwise.

7 MR. TURK: I have a suggestion, Your
8 Honor. I don't know what use the State wants to
9 make of it, but if it's possible for them to
10 identify which pages they want to use, perhaps a
11 limited exhibit could be admitted and the witnesses
12 can state whether that's a problem with it being a
13 public document, those limited portions.

14 MR. SOPER: You know, we need the whole
15 thing. Actually, I'm just noticing that Beyond
16 Design Basis Scoping Analysis, which I think we've
17 already marked, admitted, have we not? Or it's the
18 subject to an offer to admit, has notes that refer
19 to table 9.8 of this very report. So -- and this
20 is a document that the Applicant is trying to
21 admit. So these things are intertwined with the
22 testimony to the extent that this has to go in.

23 MR. GAUKLER: Your Honor, it's not an
24 objection of it going in. It's a matter of
25 confidentiality.

1 JUDGE FARRAR: The question is, Mr.
2 Soper, how do we protect -- no question raised at
3 this point about your ability to use it. The
4 question is only how do we deal with the
5 confidentiality part of it in terms of how our
6 record is created?

7 MR. GAUKLER: I would suggest, Your
8 Honor, that one possibility would be to have the
9 document itself maintained as confidential, similar
10 to what we've agreed to with respect to the
11 financial qualifications contention. I believe
12 that as a general matter, discussion can be held on
13 the document without having the discussion itself
14 confidential and proprietary. That's based on my
15 understanding from previous conversations with
16 Dr. Singh and Dr. Soler.

17 So one possibility would be just to
18 treat this document as confidential in terms of it
19 being an exhibit, allow discussion. If for some
20 chance we get into something where Dr. Singh and
21 Dr. Soler believe they may be approaching something
22 that's confidential, they can tell us that.

23 JUDGE FARRAR: Is that a -- my concern
24 about that is a question comes in and is answered
25 and there goes the proprietary nature of it. In

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1 other words, let me ask the witnesses. I've never
2 seen this document. I don't know whether the whole
3 thing is proprietary or whether, you know, 90
4 percent of it is not proprietary, but there's woven
5 in there things that are. Can you help us on that?

6 DR. SINGH: Yeah, releasing these
7 documents does hurt our commercial interests,
8 because it informs our competitors on how we do
9 things. But understanding the need here and
10 understanding the need to facilitate your
11 proceedings, we discussed here, we conferred here
12 and we voted to make it nonproprietary, so you have
13 complete access.

14 JUDGE FARRAR: Let's go off the record
15 for a moment to discuss this. Could we see counsel
16 at the bench here, please.

17 (Bench discussion with counsel.)

18 JUDGE FARRAR: Back on the record.
19 We've had a discussion at the bench first with
20 counsel and then with the witnesses about the
21 willingness of the witnesses to waive the
22 confidential or proprietary nature of the document.
23 The Board did not want to accept that waiver
24 without making sure they had a full appreciation of
25 what that meant, that that meant the document would

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1 not only be available in this room today, but would
2 be part of the fully publicly available NRC files
3 available to their competitors.

4 So after going over with counsel the
5 different ways this could be handled, the witnesses
6 and their counsel are going to confer on how
7 proprietary this is versus the Board's processes.
8 The fact being to treat something as proprietary
9 leads down the road to duplicate filings by the
10 parties, duplicate decisions by the Board. Not
11 duplicate but proprietary and nonproprietary
12 versions. So they're going to caucus and report
13 back to us how we can proceed. So everyone else
14 can have a ten-minute break.

15 (A recess was taken.)

16 JUDGE FARRAR: We're back on the record
17 after having given the witnesses and their counsel
18 a chance to confer to make sure that waiver of
19 proprietary rights in this document was made
20 knowing of the full consequences of that action,
21 and Mr. Gaukler, what have you all decided?

22 MR. GAUKLER: Yes, Your Honor. After
23 talking with Dr. Singh and Dr. Soler, we would go
24 for the option as suggested by the State, which is
25 treat the document as confidential, but I'll open

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1 discussion of it on the record. So the document
2 itself would be maintained proprietary. There
3 would be no need to close the hearing with respect
4 to the questions and answers concerning the
5 document.

6 Having discussed this fully with them in
7 the context of this document, they would like to
8 treat the other document that we just identified
9 earlier, I believe it's PFS Exhibit 86, they'd like
10 to treat that one the same way. Having the
11 document maintained as confidential, but allow
12 discussions on the open record. And so we would
13 resubmit that, if that's okay with Your Honors.

14 JUDGE FARRAR: Why don't you collect,
15 then, from everyone at this moment, the copies of
16 86 that you distributed with the marking the
17 question on it, so that those are all --

18 MR. TURK: May I make a practical
19 comment, Your Honor? I have no opposition to the
20 witnesses' willingness to do this, but they did
21 submit the document to us under a claim of
22 confidentiality, as I understand it. Some question
23 may come up later as to whether there was a waiver
24 on the record of that claim of confidentiality, and
25 what does that do to the Commission's

1 responsibility to decide whether to retain the
2 document itself as a proprietary document?

3 JUDGE FARRAR: Waiver as to 86?

4 MR. TURK: Yes, as to 86 and 87, as I
5 understand it.

6 JUDGE FARRAR: 87, we didn't accept
7 their waiver -- I'm sorry, the document Mr. Soper
8 has been talking about, where they offered to waive
9 confidentiality, we were concerned that they --
10 that was not a knowing waiver, and we refused to
11 accept it, so that -- there's no problem.

12 On 86, where no one caught this, there
13 was, what I would describe as, at most, a temporary
14 non-knowing, non-understanding waiver, and as far
15 as I'm concerned, although, I would not have the
16 ultimate decision if somebody every comes to the
17 Staff looking for it, our record should reflect
18 that that was a waiver made without -- made lacking
19 full knowledge of the extent of the waiver. And as
20 far as I'm concerned, it's -- what's the word I'm
21 looking for?

22 MR. TURK: It's was retracted, it's of
23 no effect, as far as we're concerned. But my
24 concern goes now to developing the record. Once
25 they go on the record with testimony that discusses

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1 the proprietary document, would that constitute a
2 waiver of confidentiality for material contained in
3 the document? I think that's going to put us into
4 a quandary.

5 JUDGE FARRAR: I think Mr. Gaukler and
6 his co-counsel have discussed that with their
7 clients, and that's something they will have to
8 deal with at the appropriate time.

9 MR. TURK: All right.

10 JUDGE FARRAR: So if everyone who got a
11 copy of 86 will return it, for our purposes, that
12 waiver is null and void. No further force and
13 effect, or whatever other words we can think of.

14 MR. GAUKLER: Thank you, Your Honor. We
15 will resubmit PFS 86 as a proprietary document in
16 accordance with as you just stated.

17 JUDGE FARRAR: All right. Got that
18 straightened out. Go ahead, Mr. Soper.

19 MR. SOPER: Thank you, Your Honor. I
20 understand we're attempting to make exhibits of
21 what we've marked as 173.

22 JUDGE FARRAR: That's all right, just
23 keep going.

24 MR. SOPER: Okay, keep going.

25 Q. (By Mr. Soper) Dr. Singh, do you have a

1 copy of the exhibit that we've proposed to mark or
2 have marked as Exhibit 173? And I'll represent
3 it's the Multi Cask Response of PFS ISFSI of
4 2,000-year Seismic Event Revision 2.

5 DR. SINGH: No, I don't have it in front
6 of me.

7 MR. SOPER: I guess it's out being --
8 the original is out being copied. We've come up
9 with one.

10 JUDGE FARRAR: Off the record.

11 (Discussion off the record.)

12 JUDGE FARRAR: Back on the record. Are
13 we ready to proceed?

14 Q. (By Mr. Soper) Dr. Singh, do you now
15 have that document that has been marked Exhibit
16 173?

17 DR. SINGH: Yes, we do.

18 Q. And that is the Multi Cask Response of
19 PFS ISFSI -- for the reporter, that's I-S-F-S-I,
20 it's an acronym. From 2,000-year Seismic Event
21 Revision 2. And this is a document prepared by
22 Holtec International, sir; is that correct?

23 DR. SINGH: That is correct.

24 Q. And in this document, Holtec gives the
25 results of an analysis it performed for the PFS

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1 site from the 2,000-year seismic event; is that
2 correct?

3 DR. SINGH: That is correct.

4 Q. I'm sorry, sir, could you pull your
5 microphone up just a little bit more.

6 DR. SINGH: That is correct.

7 Q. Thank you. If I could direct your
8 attention, sir, to Page 13. It appears to have on
9 Page 13, the beginning of various results computed
10 by the DYNAMO code for various scenarios that were
11 run in this analysis. Would that be correct?

12 DR. SINGH: Yes, that appears to be
13 correct.

14 Q. On Page 13, specifically under the
15 heading Table 9.1, it says, "Displacement Summary
16 Two Casks Best Estimate, COF", which I understand
17 to be coefficient of friction, equals .8. And then
18 I see a number results for a two-cask scenario.
19 And in that scenario, are the results for cask one
20 stated separately and the results for cask two
21 following that. Would that be correct, sir?

22 DR. SINGH: That seems to be correct.

23 Q. And this is for the best estimate, which
24 is a description of the particular soil property
25 that was used for this run?

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1 DR. SINGH: That's right.

2 Q. If you'll turn the page. Table 9.2
3 shows again a two-cask analysis, meaning that this
4 is an analysis with a pad of the type to be used at
5 the PFS facility located with only two -- or excuse
6 me, loaded with only two tasks; is that right?

7 DR. SINGH: That's right.

8 Q. And again, there are the results,
9 meaning the displacement for cask one, and then
10 following that, the displacement results for cask
11 two. And this particular run was for the lower
12 bound of the soil properties; is that correct, sir?

13 DR. SINGH: Yes.

14 Q. And then if you turn to Page 15, Table
15 9.3, again, there is a two-cask scenario using the
16 upper bound soil properties and the displacement
17 results for cask one followed by the replacement
18 results for cask two; is that correct?

19 DR. SINGH: Yes.

20 Q. So far we have six separate cases. We
21 have cask one at all three soil properties and cask
22 two at all three soil properties; is that right?

23 DR. SINGH: You have three cases. You
24 have results for two casks in each case.

25 Q. Okay. So that would be a total of six

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1 separate results, would that be right?

2 DR. SINGH: Well, I wouldn't put it that
3 way.

4 Q. Well, the results for cask one are not
5 necessarily the same for cask two, are they?

6 DR. SINGH: No, no. The case is the
7 assumption made in the input. The case being best
8 estimate, lower bound or upper bound. Those are
9 three cases and the results for each case for
10 individual casks.

11 Q. I see. So for each of the three cases,
12 you have results for cask one and cask two?

13 DR. SINGH: That's correct.

14 Q. All right. And then if you turn the
15 page, the next Table 9.4, you have -- these are all
16 results from the DYNAMO code, are they not, sir?

17 DR. SINGH: Yes. You have asked that
18 question before.

19 Q. And 9.4 would show a four-cask scenario
20 where the cask of the type used at the PFS facility
21 would be loaded with four casks only; is that
22 correct?

23 DR. SINGH: That's correct.

24 Q. And 9.4 is a -- Table 9.4 shows the
25 results using the best estimate soil conditions; is

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1 that right?

2 DR. SINGH: That's right.

3 Q. And it shows results for cask No. 1, the
4 results for cask No. 2, the results for cask No. 3
5 and the results for cask No. 4; is that correct?

6 DR. SINGH: That's correct.

7 Q. And when I say results, it would be the
8 various displacements for each of the casks -- each
9 of the four casks; correct?

10 DR. SINGH: Yes, sir.

11 Q. The next table would be table 9.5, and
12 I'll speed this up a little bit. This again shows
13 the results for each of four casks on a four-cask
14 scenario using the lower bound soil conditions; is
15 that correct?

16 DR. SINGH: Yes. I will correct you if
17 I hear an error.

18 Q. All righty. Table 9.6, again a
19 four-cask scenario using the upper bound soil
20 conditions and the results for each of the four
21 casks listed separately; is that correct?

22 DR. SINGH: Yes.

23 Q. Table 9.7 would be an eight-cask
24 scenario, and this is using the best estimate soil
25 conditions, and you give the results for each cask

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1 one through eight for this run; is that true?

2 DR. SINGH: That's true.

3 Q. And 9.8 again is an eight-cask scenario
4 using the lower bound soil conditions, and the
5 results are run again for each cask separately, and
6 those are shown -- the results are shown on Table
7 9.8; is that true, sir?

8 DR. SINGH: All the casks were run
9 together in one simulation.

10 Q. In one simulation, but each cask has a
11 different result, does it not?

12 DR. SINGH: Of course.

13 Q. And finally, an eight-cask scenario
14 using the upper bound soil conditions and the
15 results given for each cask one through eight, and
16 that's shown in Table 9.9; is that right, sir?

17 DR. SINGH: Yes.

18 Q. Now, the way I would look at this is 42
19 different cases, when you consider the results for
20 each cask under each soil scenario and under each
21 of the three cask loading situations. In other
22 words, two cask, four cask or eight cask. Now, you
23 say in --

24 MR. GAUKLER: I object to that
25 introductory. That's not what the witness said.

1 JUDGE FARRAR: Consider that a question.
2 Is it 42 cases?

3 DR. SINGH: It's not 42 cases. I'm on
4 the record explaining before. Each simulation has
5 the number of casks in that particular simulation.
6 All results are calculated for that case. Case
7 being the input variables, the soil stiffness, soil
8 damping, you know, best estimate, upper bound,
9 lower bound and so on. The case means a
10 simulation. The results for the casks, for each
11 case, if you have eight casks, you have a solution
12 for eight casks in that simulation.

13 JUDGE FARRAR: So you'd say there's nine
14 cases?

15 DR. SINGH: There's nine cases, that's
16 correct.

17 Q. (By Mr. Soper) Let me ask you this
18 then, sir: For each separate cask that is looked
19 at -- and results are given with respect to each
20 separate cask, are they not, in each run?

21 DR. SINGH: Yes, the dynamic behavior of
22 each cask is characterized for each case in
23 simulation.

24 Q. I see. There are 42 sets of results,
25 are there not, on a cask-by-cask scenario? In

1 other words, if you were to look at each cask,
2 since the results come out for each cask
3 separately, there would be 42 different sets of
4 results contained in these tables?

5 DR. SINGH: If you choose to call them
6 sets, I'm not going to argue with you.

7 Q. All right, thank you.

8 Now, if you would look, sir, at what's
9 been marked as Exhibit 73, State Exhibit 73.

10 JUDGE LAM: 173.

11 MR. SOPER: Excuse me, 173.

12 MR. GAUKLER: If you looking at Beyond
13 Design Basis Scoping Analysis, I believe it's PFS
14 Exhibit 86.

15 MR. SOPER: That's the one I wanted.

16 Q. (By Mr. Soper) PFS Exhibit 86. Do you
17 have that there, sir?

18 DR. SOLER: No, we don't.

19 JUDGE FARRAR: That's the one we just
20 gave back. But that's all right, we don't --

21 MR. SOPER: I'm going to ask him a
22 question about it.

23 JUDGE FARRAR: You can ask him questions
24 about it, even though we don't have copies.

25 Q. (By Mr. Soper) I direct your attention

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1 to Page 20 of -- Paul, help me, this is 76?

2 MS. NAKAHARA: 86.

3 MR. SOPER: 86.

4 Q. (By Mr. Soper) Directing your attention
5 to Page 20 of what's been marked as Exhibit 86, and
6 at the top of that page appears the heading 9.0
7 Results of Analyses. Are you with me, sir?

8 DR. SINGH: Yes, I'm with you.

9 Q. Referring you to the second paragraph on
10 that page, has "One of the simulations reexamine
11 the design basis event, (two-case seismic input
12 motion) for eight casks on the pad with lower bound
13 soil springs, a comparison of the results obtained
14 from the two programs DYNAMO and VisualNastran is
15 merited."

16 I take it by that, sir, that it means
17 that running one of the scenarios that we've just
18 reviewed on VisualNastran is merited as a way to
19 compare the codes DYNAMO and VisualNastran; is that
20 right?

21 DR. SINGH: Yes, it's a standard
22 practice if we use two programs to at least
23 establish some commonality between their
24 performance.

25 Q. I see. Now, according to this table

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1 that appears on Page 20, you have run VisualNastran
2 and determined a net displacement of 3.70 and a
3 maximum angle of rotation of .916 degrees.
4 Referring to note two -- excuse me, I didn't want
5 to refer to note two. The calculation from
6 VisualNastran, the result that I just read, 3.7 for
7 displacement and .916 for degrees of rotation, that
8 is for a scenario where there are eight casks
9 loaded on a pad; is that true, sir?

10 DR. SINGH: That is indeed true, yes.

11 Q. And for the lower bound soil properties?

12 DR. SINGH: Yes.

13 Q. And for cask No. 1 only; is that right?

14 DR. SINGH: Well, the information here
15 does not tell me that. I'll have to check with the
16 author sitting next to me whether that statement is
17 correct.

18 DR. SOLER: That's correct.

19 DR. SINGH: He says that's correct.

20 Q. You did not show information for casks
21 two, three, four, five, six or seven. That's true,
22 is it not?

23 DR. SINGH: That's true. It's not in
24 this report, yes.

25 Q. You did not show information for the

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1 best estimate soil properties for any of the casks,
2 one through eight, did you?

3 DR. SINGH: That is a matter of fact,
4 yes.

5 Q. And you did not show results for the
6 calculation of upper bound soil properties for any
7 of the casks one through eight; isn't that true?

8 DR. SINGH: That is true. We did not
9 intend to run every case and compile it here. That
10 was not our intent.

11 Q. I see. And you did not run any
12 scenarios with a pad loaded with only four casks,
13 did you?

14 DR. SINGH: We didn't, but we can.

15 Q. And you didn't do that for any of the
16 three soil conditions; upper, lower or best
17 estimate; isn't that right?

18 DR. SINGH: Yeah, that's --

19 DR. SOLER: For which earthquake?

20 DR. SINGH: 2,000, I think.

21 Q. I'm sorry.

22 DR. SOLER: For which earthquake are you
23 talking about?

24 Q. I'm talking about the 2-K design basis
25 seismic event comparison table.

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1 DR. SOLER: Thank you. That is correct.

2 Q. And you made no calculations on
3 VisualNastran using a pad loaded with only two
4 casks, did you?

5 DR. SINGH: In this report, we don't
6 have that run. I don't know if we never made one.

7 Q. My point is this, sir: Of what I call
8 the 42 different sets of results for each of the
9 casks and all the scenarios you've picked one cask,
10 one soil property and one pad loaded scenario of
11 eight casks, and that's the extent of your
12 comparison on this table; is that right?

13 DR. SINGH: In this table, that is
14 correct. And I would clarify right here, there was
15 no predesigned intent to compare just one case. We
16 took one case and compared it and satisfied
17 ourselves that VisualNastran is in reasonable
18 agreement with DYNAMO. Then we proceeded to make
19 other runs on VisualNastran. That's the standard
20 engineering practice, by the way.

21 Q. I see. And on Page 21, following the
22 table there, in the first full paragraph, you say
23 "It is clear from the table above, that both
24 simulation codes predict the same general level of
25 response." That's your conclusion from this

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1 comparison?

2 DR. SINGH: Yes.

3 Q. Sir, if I could now direct your
4 attention to -- maybe Dr. Soler might be a better
5 one to ask. Dr. Soler, looking at what's been
6 marked as PFS Exhibit 87.

7 DR. SOLER: That's the rev.2, the one
8 with the title?

9 Q. Actually, it's the sheet of information
10 that you prepared over the lunch hour.

11 DR. SOLER: Okay, I don't have it.
12 Okay.

13 Q. Can you tell us what that Exhibit 87 is,
14 sir?

15 DR. SOLER: That is a summary table in
16 response to your request to provide the input
17 information for some of the runs that we did as
18 part of this Beyond Design Basis Report. In
19 particular, the first table provides the input data
20 for case eight, in our summary table in our
21 testimony, and the second table provides the
22 results for case 11.

23 Q. How did you happen to --

24 MR. GAUKLER: Excuse me, you mean to say
25 the input data; right?

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1 DR. SOLER: The input data. Pardon me,
2 the input data.

3 Q. (By Mr. Soper) How did you select cases
4 8 and 11 to be used?

5 DR. SOLER: To be used to respond to
6 your question, is that your question? If that is
7 your question, the answer is that was the data I
8 was able to provide in the immediate and timely
9 answer to your question.

10 Q. And what's the source of this data?
11 What did you do to get these numbers?

12 DR. SOLER: Well, the values for case
13 eight, I was able to get completely from the
14 report. Actually -- yes, all sets of values that
15 are presented here are found in the report entitled
16 PFSF Beyond Design Basis Scoping Analysis. HI
17 20222854 -- 2022854.

18 Q. Now, what is your understanding of what
19 these figures represent?

20 DR. SOLER: By figures, you mean the
21 table -- oh, the numbers?

22 Q. Yes, the numbers on here.

23 DR. SOLER: Column one in each of the
24 tables --

25 JUDGE FARRAR: Wait a minute,

1 Mr. Witness.

2 MR. TURK: I'm sorry, Your Honor, we're
3 short one copy of this exhibit. Does anyone have
4 an extra one they can locate? Thank you. I'm
5 sorry, Your Honor.

6 JUDGE FARRAR: That's all right. Go
7 ahead.

8 DR. SOLER: Let me ask for
9 clarification. Exactly what do you mean by your
10 question?

11 Q. (By Mr. Soper) Well, why did you select
12 these particular numbers to display on this
13 particular paper? Are these -- it says at the top,
14 input value for cases eight. Are these the numbers
15 that are necessary as input for the VisualNastran
16 program?

17 DR. SOLER: That is correct.

18 Q. With these numbers, would I be able to
19 duplicate the illustrated file that you ran this
20 morning?

21 DR. SOLER: I would presume that if you
22 became knowledgeable in the code, yes.

23 Q. And during the run, once you've inputted
24 these numbers, do you make any adjustments during
25 the run? In other words, do you --

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1 DR. SOLER: No, once the run starts, if
2 you try to make an adjustment, the run will
3 terminate, you're doing a new run. Maybe you could
4 clarify for me what you mean by adjustments.

5 Q. Well, once the run begins, at any point
6 in time, do you halt the run, check the results,
7 make any refinements and then continue the run?

8 DR. SOLER: No, I do -- I am able to
9 look just as the movie files appeared this morning
10 on the screen, appears a, what I'll call a less
11 detailed version of that picture. So I am able to
12 see what's going on in any particular run at any
13 time.

14 Q. If you would follow down the left-hand
15 column with me under the heading item.

16 DR. SOLER: Yes.

17 Q. And you come down to the KX paren, it
18 looks like -- I'll read -- do you see where I am?

19 DR. SOLER: Yeah.

20 Q. Can you explain that particular box,
21 first of all?

22 DR. SOLER: Okay. KX refers to the
23 entire set of data -- under the heading soil data
24 refers to the spring constants and values for the
25 damping coefficient associated with the soil

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1 springs.

2 K -- anything with a K refers to a
3 spring. Anything with a C refers to a damper. The
4 KX refers to the spring constant associated with
5 the shear resistance in the X direction. The items
6 in parentheses, LBF meaning pounds force and LBM in
7 the next line referring to pounds mass, the reason
8 I've differentiated here is because if you look in
9 the report in the particular figure I reference,
10 some of the data is input in terms of pounds force
11 per inch and other data is required to be input in
12 pounds mass. So I'm giving in each one of that
13 item column, either it's a K or a C with a -- it's
14 not a subscript here, but with a small letter
15 denoting its direction, and then in parentheses,
16 the units associated with the numbers that are then
17 showing up in column two.

18 Q. Okay. If you take the first time the KX
19 appears in the item and you follow over to the next
20 column of value and we have the number 9,796,000,
21 do you see where I'm at, sir?

22 DR. SOLER: Yes, yes.

23 Q. And then the reference is Figure 6?

24 DR. SOLER: Yes.

25 Q. Does that number appear in Figure 6

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1 somewhere?

2 DR. SOLER: Yes, it does.

3 Q. Could you direct me to that?

4 DR. SOLER: Okay. Figure 6 is on Page
5 30 of the report. And what Figure 6 represents is
6 a screen capture of the input data screen which is
7 required for the bushing that I identified as being
8 the soil spring.

9 Q. Okay, now, that is a number that was
10 required to be computed some way, was it not?

11 DR. SOLER: Yes.

12 Q. And can you tell me how that was
13 computed?

14 DR. SOLER: That was computed in
15 appendix -- let's see, this is Appendix A. Do you
16 wish me to point out the exact location?

17 Q. Would you please.

18 DR. SOLER: Okay. Page A5 in this
19 particular case, as I stated in the report, the
20 springs were tuned to give a natural frequency of
21 five hertz in all three directions, two horizontal
22 and one vertical. So the only value you see
23 reported is basically what's called K sub V-E-R-T,
24 the first formula 9.79, five, seven, eight times 10
25 to the six pounds force per inch. And that, if you

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1 will -- returning to Figure 6, if you will, you
2 will notice that for this particular case, all
3 three linear springs and all three linear dampers
4 associated with those springs have the same value,
5 because I was not dealing with soil data coming
6 from a geotechnical institution. I was dealing
7 with soil data that was chosen to give a resonance
8 of five hertz in the three directions, and
9 maximized cask response.

10 MR. SOPER: Could we have just a minute?
11 I think we're about done, Your Honor, if I just
12 might consult with our expert. Just one minute.

13 JUDGE FARRAR: Certainly.

14 (Discussion off the record.)

15 MR. SOPER: May I continue, Your Honor?

16 JUDGE FARRAR: Yes, sir.

17 MR. SOPER: Thank you.

18 Q. (By Mr. Soper) Dr. Soler, if I could
19 direct your attention to Page 29 of Exhibit 86.
20 There appears on that page a Figure 5?

21 DR. SOLER: Yes.

22 Q. Referring to the illustration in the
23 upper left-hand corner?

24 DR. SOLER: Yes.

25 Q. Could you describe for me, sir, how that

1 was modeled mathematically?

2 DR. SOLER: This -- the equations for
3 equilibrium of rigid bodies is built into the code.
4 I do not external model anything mathematically.
5 That is the beauty of this code. If you'll ask me
6 another question, perhaps I can elucidate further,
7 but I'm at a loss as to where to go.

8 MR. SOPER: I think that's all I have,
9 Your Honor. We have more on this witness on other
10 subjects, but I don't know if this is the time you
11 want to break for the evening or what you want to
12 do.

13 JUDGE FARRAR: We had said earlier this
14 week that we were quitting at five unless there was
15 a reason to go a little longer. I ask who would be
16 doing the further cross, would this excuse you if
17 we -- do you have further cross so you wouldn't
18 have to come back tomorrow?

19 MR. SOPER: No, I don't know that it
20 would excuse me. I think that I'm kind of done,
21 but I think I probably have to stay around.

22 JUDGE FARRAR: Then what's driving us is
23 Dr. Singh's airplane tomorrow. Again what time?

24 DR. SINGH: My flight is around 4:30.

25 JUDGE FARRAR: 4:30?

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1 DR. SINGH: 4:30, yes, in the afternoon.

2 JUDGE FARRAR: Off the record.

3 (Discussion off the record.)

4 JUDGE FARRAR: Back on the record. We
5 were discussing the current security waits at the
6 local airport, and realized we have to have this
7 witness off by 2:00 tomorrow.

8 (Board conferred off the record.)

9 MS. NAKAHARA: Your Honor, since I'll be
10 doing the rest of the cross-examination, if I may
11 offer, even though the issues are different, some
12 of them overlap, I think I can be more succinct if
13 I can have tonight to organize based on what both
14 Dr. Soler and Singh have answered today. I may not
15 have to ask so many questions.

16 JUDGE FARRAR: So if we start at nine,
17 can you be finished by noon?

18 MS. NAKAHARA: Oh, yes, definitely.

19 JUDGE FARRAR: Oh, good. Vicki, would
20 you put that in big letters in the transcript,
21 please.

22 The Board will have relatively few
23 questions. Mr. Gaukler, how about you?

24 MR. GAUKLER: I'm not going to have that
25 many questions.

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1 JUDGE FARRAR: On redirect.

2 MR. GAUKLER: Right now, 15 minutes to a
3 half hour roughly.

4 JUDGE FARRAR: Then we appear not to
5 have a problem in terms of getting this witness out
6 of town for his other obligations. We do have a
7 problem in that we did not finish this panel today
8 and if we're trying to do 21 panels in 20 days,
9 we're behind, although these people have longer
10 testimony than others, and we did have the
11 animation and the discussions about proprietary and
12 the Board's tutorial. So maybe that's not too bad.

13 Then while I have a few more -- a couple
14 of housekeeping things we can take up, can we
15 agree, then, we'll break now, let Ms. Nakahara
16 organize, that gives her more time to organize,
17 which would probably be time better spent than
18 starting out here at 20 after five.

19 Then we will excuse these witnesses for
20 the day, see you back here at 9:00. Again, all
21 counsel should have contacted their colleagues
22 about the fact that we're not having the Utah SS
23 argument tomorrow morning. Everyone in the room
24 who got a copy of State Exhibit 173 for
25 identification, you're under a very serious

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1 obligation to not leave that here, to keep it with
2 you and to protect it. Therefore, protect its
3 proprietary nature.

4 MR. SOPER: As housekeeping, Your Honor,
5 if it hasn't been admitted, I would like to move
6 for its admission.

7 JUDGE FARRAR: Any objection?

8 MR. TURK: Which?

9 JUDGE FARRAR: To the admission of the
10 State Exhibit 173, the proprietary document?

11 MR. GAUKLER: I would also like to move
12 -- I would like to move for the admission of PFS
13 Exhibit 86 and Exhibit OO at the same time, to take
14 care of them both.

15 JUDGE FARRAR: Any objection to OO,
16 which is the CD animation? Hearing no objection --

17 MR. SOPER: Well, yes, Your Honor.

18 Excuse me, I was just --

19 JUDGE FARRAR: Oh.

20 MR. SOPER: OO, if you recall the
21 subject to getting input information and we had
22 this as a starter. We would like the same
23 information for all the cases that are shown on OO,
24 and we'd also like overnight to study this to see
25 if this is satisfactory as far as completeness.

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1 JUDGE FARRAR: Okay. The first thing,
2 then, we will continue to hold the motion on 00
3 under advisement while they at least get to study
4 this information. Then the further question is,
5 Mr. Soper now wants information like that in
6 Exhibit -- PFS Exhibit 87 to be provided for the
7 other nine cases in the animation. Mr. Gaukler,
8 what's your -- what are your thoughts on that?

9 MR. GAUKLER: I need to talk to my
10 witness, Dr. Soler and discuss that.

11 JUDGE FARRAR: Okay. When you discuss
12 it -- well, let's discuss it before we leave
13 tonight. We'll resolve all the other housekeeping
14 things and then you can talk to him about that and
15 then come back and tell me -- tell us whether you
16 can provide it or whether you object to providing
17 it, and if not, how long it will take to provide
18 it.

19 Mr. Gaukler, you move the admission of
20 86, which we no longer have, but when we get it
21 back in our possession, the proprietary version,
22 will there be any objection to that?

23 MR. SOPER: Well, as I recall, 86 and 00
24 are kind of one in the same, in that they describe
25 these particular runs.

1 JUDGE FARRAR: Okay, then we'll hold
2 that under advisement, also.

3 MR. SOPER: Ms. Chancellor is asking if
4 87 is proprietary. As far as I know, there hasn't
5 been any discussion.

6 DR. SOLER: That's this?

7 MR. SOPER: Yes.

8 DR. SOLER: No.

9 JUDGE FARRAR: Okay. All right, then,
10 we'll leave these things pending. How are we
11 coming on the different proposals we had for
12 finishing this case? There was the thought of four
13 weeks of seismic here or two weeks of seismic here
14 and then aircraft here, and that was all subject to
15 the parties being able to juggle their witnesses.
16 Who wants -- Mr. Gaukler, do you have a thought on
17 that?

18 MR. GAUKLER: I talked -- Ms. Chancellor
19 and I talked this morning. We decided we would
20 talk today at the end of the day to see how far we
21 got today. So that's where we stand. So we will
22 be talking this evening about that.

23 JUDGE FARRAR: Okay. Remembering to the
24 extent that the research uncovered the convenience
25 of the Board plays some weight, we would prefer to

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1 keep plowing on with seismic and do aircraft back
2 in -- do four weeks of seismic and do aircraft back
3 in D.C.. If that's not possible to do, then
4 whatever you work out is fine.

5 Mr. Gaukler, why don't you confer with
6 your witnesses about the other nine cases and we'll
7 all just take a break in place until you do that.

8 (A recess was taken.)

9 JUDGE FARRAR: Mr. Gaukler, you've had
10 time to confer with your clients about the
11 information on the other nine cases?

12 MR. GAUKLER: Yes. In terms of the
13 other nine cases, as well as this table of
14 displacements for the casks, particularly cask one,
15 we believe we can have that information available
16 for the State by Thursday morning. Dr. Soler will
17 be on the stand tomorrow to preclude him from
18 working on it tomorrow. Also, we are receiving
19 some of the information by Federal Express tomorrow
20 morning. Not all the information is right here to
21 be able to do it tonight. So between those two
22 things, we think we can provide that information by
23 Thursday morning.

24 I should state one caveat, which is on
25 the random coefficient of friction, it's just an

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1 input that identifies as a random coefficient of
2 friction. But he has a sample screen showing that
3 in the report already.

4 JUDGE FARRAR: So you provide that
5 information, and then I take it the procedure would
6 be, Mr. Soper, your people would look at it and at
7 some future time, we might have to bring the
8 witnesses back? Is that how --

9 MR. SOPER: I guess that's possible,
10 depending on what we --

11 MR. GAUKLER: Dr. Soler will be
12 remaining here beyond tomorrow, so Dr. Singh needs
13 to go back tomorrow.

14 JUDGE FARRAR: Okay, so that we could
15 then -- we could put on another panel and come back
16 and cross-examine Dr. Soler at greater length.

17 Is there any other business we can
18 usefully conduct either that's -- needs to be
19 conducted or wrap up today's events, or that we
20 could usefully conduct to get a head start on
21 tomorrow?

22 MR. SOPER: Did we get off Exhibit 173
23 or did that get admitted? It seems like we started
24 that and then the conversation --

25 JUDGE FARRAR: We started talking about

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1 that, got off onto the other exhibits which are not
2 being acted on at this time. Is there any
3 objection to State Exhibit 173, which is the
4 proprietary Holtec Multi Cask Response?

5 Mr. Gaukler?

6 MR. GAUKLER: No objection.

7 JUDGE FARRAR: Mr. Turk?

8 MR. TURK: I don't object, Your Honor.

9 Just a clarification, do we maintain it as
10 proprietary?

11 JUDGE FARRAR: It's maintained as
12 proprietary, yes. The court reporter handles that
13 in a special fashion, and each of you who has one
14 has to guard it.

15 No other business, it's 5:30 and we'll
16 adjourn. See you at 9:00 here tomorrow morning.
17 Ms. Nakahara, you will begin your cross. Thank
18 you.

19 (The proceedings were concluded for the
20 day at 5:30 p.m.)

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CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Private Fuel Storage, LLC

Docket Number: Docket No. 72-22-ISFSI

ASLBP No. 97-732-02-ISFSI

Location: Salt Lake City, Utah

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

151 Diana Kent
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Official Reporter
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