

1 JUDGE FARRAR: Mr. Soper, before you
2 respond, let me tell you what we're thinking. This
3 is novel. It looks like a technical report, but it
4 isn't. It's kind of like rebuttal testimony. I
5 suppose it could be labeled "Additional cask
6 analyses (in the nature of rebuttal testimony)."
7 So it is novel, it is argumentative, it is leading.
8 But so is all our testimony.

9 So I guess we need to hear more about
10 why it's prejudicial. Given everything I just
11 said, why is this a bad idea and why aren't you
12 protected by your right to go through this and
13 cross-examine? I know you may be accustomed to
14 hearing rebuttal question by question and you
15 object as you go along, and this is a, you know,
16 here they dump on you 200 -- in fact, 200 questions
17 and you've got to pick it apart.

18 So as Mr. Turk suggested, there's some
19 efficiencies in doing it this way, and Mr. Gaukler
20 pointed out that by sending it to you in advance,
21 even though it's a draft, it's revised, you get
22 some notice. We're struggling here with why you
23 aren't protected -- in other words, we could defer
24 admission of this while you cross-examine, and at
25 the end of that how would your rights have been

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1 hurt?

2 MR. SOPER: I think, as Mr. Turk pointed
3 out, that this can be the subject of agreement by
4 the parties when they say, let's agree to put on
5 our rebuttal by prefiled testimony subject to the
6 Board's approval, of course, because ordinarily
7 it's not permitted. And in that event, both would
8 have an opportunity, an equal opportunity to
9 contain their rebuttal in a final document which is
10 much more coherent, subject to the review of
11 counsel and all the other niceties and trimmings
12 that go along with prefiling testimony.

13 JUDGE FARRAR: And you would get that in
14 advance and they wouldn't have had all this oral
15 testimony.

16 MR. SOPER: And we would get it in
17 advance knowing it was to be used for that purpose.
18 Now, just because you take a document, disguise it
19 as an exhibit and put prefiled testimony in it, not
20 in the form of question and answer but by just
21 inserting testimony, whatever you deem that to be
22 suitable to your purposes after consultation with
23 counsel and submit it, and you can't overcome the
24 fact that you're doing that just because you send
25 it to somebody in advance and say, gee, I sent them

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1 a copy, it's okay. Because if that's the rule,
2 then anyone now is free to prefile any of their
3 testimony whether it's permitted under the rules or
4 not and say, gee, we've been doing this.

5 Now, if we can't call it prefiled
6 testimony, then let's offer exhibits where our
7 witnesses, like Dr. Khan, for example, shows some
8 computer runs in the form of charts. Well, I guess
9 the practice will be in the future to at the bottom
10 of those go on to say that contrary to what the
11 other witnesses testified to, their testimony is
12 faulty, and carry on like this report does. I
13 don't think that that's what the Board wants to
14 open its doors to.

15 JUDGE FARRAR: You mentioned this is
16 testimony but not in Q and A format, but my
17 impression of the prefiled direct testimony is that
18 the Q's are just a vehicle for putting in the A's.
19 I mean, the questions are kind of nature of, well,
20 what do you think about that, and along comes a
21 long answer.

22 MR. SOPER: It does a number of things.
23 And I think we've required on motion, the Court has
24 ordered that the person answering the identified,
25 if we're referring to testimony, there's a

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1 transcript reference, there are things that go
2 along with that, rather than just a free-for-all --
3 I mean, all the rules of evidence break down. This
4 does not become an exhibit, it becomes some sort of
5 evidence. It's a combination of things. I think
6 that's the trouble we're having dealing with it.
7 It's not a defined piece of evidence that's
8 permissible under normal judicial proceedings.

9 MR. GAUKLER: Your Honor, if I could add
10 a couple things.

11 JUDGE FARRAR: Go ahead.

12 MR. GAUKLER: First of all, there's no
13 specific rule in terms of rebuttal evidence in
14 terms of whether it's written or prefiled. It's
15 basically up to the Board's understanding. I know
16 there's been orders in the past, so there's no rule
17 or regulation saying you can't do this, okay, and
18 there's no rule or regulation saying you can do it.
19 It's something that's just not addressed.

20 In terms of the opinions and statements
21 in the report, they would have been summarized and
22 expressed by the witnesses under oath, and this is
23 just a vehicle to put forth the analyses that
24 they've done, setting forth the results in one
25 place, certain exhibits and technical exhibit in

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1 all those senses, and we believe it's an
2 appropriate form for submission of evidence.

3 (The Board confers off the record.)

4 JUDGE LAM: Mr. Soper, if PFS Exhibit
5 225 is relabeled, instead of being labeled a
6 technical report, it was being relabeled as filing
7 rebuttal testimony, would that mitigate somewhat
8 your concern?

9 MR. SOPER: Well, had that been done and
10 the witnesses were shown this, they swore to this
11 as their testimony and then the State was permitted
12 to cross-examine, but they've had two opportunities
13 now. They've gone through and they've had question
14 and answer rebuttal, and in addition they've had
15 this rebuttal. They ought not to have two bites at
16 the apple. This is one of the problems. In other
17 words, they're expecting to get rebuttal testimony
18 in the form of this report in addition to having
19 all morning to give answers to Mr. Gaukler's
20 questions on rebuttal. So they've had two
21 opportunities, which is another unfairness, your
22 Honor.

23 MS. MARCO: Your Honor, if I may also.
24 I'm not totally convinced that the characterization
25 of the report, whether it's rebuttal testimony,

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1 whether it is a report, whether it's some sort of
2 hybrid combination of the two is really the issue
3 here. It is whether or not this information is
4 appropriate as rebuttal testimony, and it did come
5 out on the direct testimony regarding Dr. Khan's
6 testimony. It's just pertaining to the use of the
7 SAC 2000 -- SAP 2000, and I believe that therefore
8 it is germane to that and it is appropriate
9 rebuttal.

10 MR. SOPER: Well, in that case it's just
11 duplicative, if that's the case, and ought not to
12 go in.

13 MR. GAUKLER: It's not duplicative, your
14 Honor. We summarized it obviously in terms of the
15 presentation, but it's not duplicative. We have
16 not gone through all the results. We've not --
17 have to go through much more stuff if we want to
18 keep this up.

19 JUDGE FARRAR: Does the reporter have --
20 you don't have this morning's notes?

21 THE REPORTER: No. Susette has those.

22 JUDGE FARRAR: Because I was going to
23 ask for you to read back how this was presented and
24 what the witnesses said about it when PFS counsel
25 first mentioned it. But we don't have those.

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1 Mr. Soper, what would your side need --
2 again, the fact that this is novel doesn't make it
3 bad; the fact that, as Ms. Marco says, it's a
4 hybrid doesn't make it bad. The fact that they've
5 had two bites is a little bit of a concern, but
6 there's other ways he could have done that. What
7 do you need to make the introduction of this in the
8 way it's been presented not prejudicial to you? I
9 mean, do you need ten times as long
10 cross-examination as you would have had if this had
11 been in Q & A format?

12 MR. SOPER: I think, your Honor, that if
13 it were purged of the nontechnical comments, such
14 as "The conclusions of the state witnesses are
15 that," blah, blah, blah.

16 JUDGE FARRAR: Well, although -- I see
17 that as helpful in terms of directing us to why
18 this is in front of us. Now, if you disagree with
19 their characterizations of what the state witnesses
20 said, then certainly you should challenge that and
21 you can ask them to point out, you know, where did
22 they get that from, where is that in the transcript
23 and so forth. So that strikes us as the remedy for
24 that.

25 MR. SOPER: Well, there's a whole bunch

1 of that in this report, and I'm not sure I've even
2 identified it all. If that doesn't strike the
3 Board as being meaningful, then I'm not sure the
4 rest of our objection is particularly meaningful.
5 We have no problem to the witnesses identifying
6 runs they've made and explaining them. It's the
7 editorializing and the recharacterization of state
8 witnesses without identifying the witnesses or
9 representations they're talking about that removes
10 this from a technical report, and it permits them
11 without the benefit of objections, questions and
12 answers, to get more an orderly record on those
13 sorts of off-the-cuff remarks.

14 (The Board confers off the record.)

15 JUDGE FARRAR: This being a novel
16 situation, with the extraordinary assistance of my
17 colleagues, we have what might be a novel solution.

18 Two parts. Mr. Gaukler -- and bottom
19 line, we're going to defer any ruling on the
20 admission of this. Mr. Gaukler, why don't you and
21 your people go back and pull out or highlight for
22 yourselves the portions of this that are really not
23 technical but are pure rebuttal that we ordinarily
24 would see in the sense of if it weren't in this
25 report you would say to these witnesses, do you

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1 recall when Dr. Khan said such-and-such? Yeah, he
2 said such-and-such. Where did he say that? What
3 do you think of that? Don't think much of it, I
4 think he's wrong.

5 So we can have a witness say that not in
6 an exhibit, it's not sworn to, but they can say on
7 the stand that they think he's wrong for the
8 following reasons, and then they can refer to their
9 runs, their analyses that they did in here to
10 support that. Then what we'll do is, then we'll
11 have clearly on the record what's technical about
12 this and what is their rebuttal opinion to his
13 opinions.

14 We can't admit this until -- is it
15 Dr. Ostadan that it's also rebuttal to? Mr. Soper,
16 what that will do is give you time to take another
17 look at this. You'll get later to hear these
18 questions and answers about Dr. Khan, you'll be
19 better prepared and you can do your
20 cross-examination.

21 I hope that's a fair solution. It will
22 put in front of us everything that -- eventually
23 everything that PFS believes, and it will give the
24 State a fair chance to respond to it.

25 Part of it -- and I would make that

1 ruling without criticizing counsel for the
2 Applicant for trying to do, quote, the right thing
3 in terms of making it available ahead of time,
4 having it in documentary form. This whole nature
5 of, those of you who were around at the end of the
6 day yesterday, this whole nature of rebuttal -- I'm
7 sorry -- of simultaneous prefiling of direct
8 testimony makes rebuttal a confusing thing to deal
9 with.

10 In any future cases I sit on, I think I
11 would urge that when you put the witnesses on when
12 you've done prefiled direct, that as part of their
13 direct case they don't just adopt their own
14 prefiled case; their own lawyer asks them a few
15 questions about the other side's case. Because
16 what we have here at the end of the case which was
17 brought home yesterday in the off-the-record
18 scheduling discussion is now we've got, because of
19 the simultaneous prefiling of direct, now we're
20 trying to round up a whole bunch of witnesses to do
21 rebuttal that they could have said when they were
22 on the stand the first time. So I think this may
23 be just another version of that, and I wish we had
24 anticipated it better.

25 Maybe, as my colleagues tell me, in most

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1 cases you don't have 21 panels of witnesses on one
2 subject, and so maybe that's why no one thought of
3 this. I wish we had.

4 MR. TRAVIESO-DIAZ: Mr. Chairman, may I
5 ask a clarification, since the black ball is going
6 to follow me. Is your ruling that we will leave
7 Exhibit 225 untouched but will supplement 225 with
8 actually a set of questions and answers that are
9 intended to elicit the portions of the exhibit
10 they're not --

11 JUDGE FARRAR: I'd rather you do those
12 orally. In other words, we'll leave this exhibit
13 as is, but you'll come in at some future date and
14 call their attention to page 10 and you'll ask
15 them, you know, you'll ask a question that gives a
16 transcript reference to Dr. Khan's testimony, and
17 you'll ask them a question and they will go on the
18 record live about why they think he was wrong.

19 MR. TRAVIESO-DIAZ: And your preference
20 would be at least we do it orally as opposed to
21 written form?

22 JUDGE FARRAR: I think that's my
23 preference. Mr. Soper, what's your preference?

24 MR. SOPER: The notes I made, your
25 Honor, when you described the ruling was that they

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1 were supposed to remove the references --

2 JUDGE FARRAR: No, I think I used
3 highlight it, meaning highlight it for themselves.
4 In other words, you mentioned two or three examples
5 where it, you know, got into rank opinion.

6 MR. SOPER: Yes.

7 JUDGE FARRAR: And I meant for them to
8 highlight that, not take it out of the document but
9 so they could come back at some future date and
10 say, okay, on page 10 here's what we're dealing
11 with.

12 MR. SOPER: I see.

13 JUDGE FARRAR: You read into the record
14 what Dr. Khan said, you ask questions. This
15 document will remain the same, but then you will
16 have, when it's your turn you will have a much more
17 clear statement of them orally and you'll know
18 which witness said it and why they're challenging
19 Dr. Khan. Mr. Gaukler, you're looking puzzled, but
20 that's all right.

21 MR. GAUKLER: I guess I just question in
22 the sense of, I think they've stated their opinion
23 up here on oral testimony that corresponds to what
24 is stated in here, and I guess I don't see what
25 couldn't be covered in cross-examination based on

1 what's in here. And also in terms of if they may
2 not have exactly characterized what Dr. Khan said,
3 the work still stands for what it stands for and
4 the results still stand for what it stands for.

5 JUDGE FARRAR: But Mr. Soper is looking
6 for a chance to make sure he challenges it
7 correctly, and we do have the problem -- you know,
8 I'll use the word because I can't think of a better
9 one, but I don't really mean it, we have here
10 rebuttal testimony masquerading as a technical
11 report. And I don't -- "masquerading" is the wrong
12 term. But what he's trying to do is, let's
13 separate out what's opinion in response to Dr. Khan
14 from what's the technical content of this. And
15 that's what we're struggling with.

16 Now, it may be, if we'd focused on this
17 problem first thing this morning, some of your
18 questions may have already done this. And whoever
19 gets the privilege of doing this is welcome to grab
20 today's transcript and say, we already did that. I
21 don't hear -- here's something Mr. Soper objected
22 to on page 15 and we covered that on page 71,
23 whatever, of the transcript. That's fine.

24 And Mr. Gaukler, if your puzzlement is
25 this may be more protection of the State's rights

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1 than you think is needed, then we can just hearken
2 back to this morning's discussion and you'll know
3 why I'm doing it.

4 MR. GAUKLER: And I guess I want to
5 state for the record, we did it this way in part to
6 try to provide the State time, to give them more --
7 you know --

8 JUDGE FARRAR: This is no criticism --

9 MR. GAUKLER: We were trying to do it in
10 a way it would expedite by giving them the
11 information ahead of time.

12 JUDGE FARRAR: This is, we said about
13 something else this morning, this is no criticism
14 of what, of how you attempted to proceed.

15 MR. SOPER: We would go ahead with the
16 cross-examination now, though, I take it?

17 JUDGE FARRAR: If you want to.

18 MR. SOPER: Yes.

19 JUDGE LAM: If this will provide any
20 comfort to Mr. Gaukler, prefiled rebuttal testimony
21 has been seriously considered in the new part two.

22 MR. GAUKLER: Thank you.

23 JUDGE FARRAR: Off the record.

24 (Discussion off the record.)

25 JUDGE FARRAR: Mr. Soper, Judge Kline

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1 reminds me, why don't you go ahead now, but without
2 any prejudice to your rights to do something more
3 later.

4 MR. SOPER: Ms. Chancellor's reminding
5 me that I guess the Staff would have the first
6 opportunity to have questions. Is that correct?

7 JUDGE FARRAR: That's been our usual --

8 MR. O'NEILL: I think that's correct.

9 JUDGE FARRAR: Yeah, but -- do you want
10 to go first? The Staff urged they would like to go
11 last and you said nothing doing in this case, and
12 since the issue's raised and primed, you can go
13 first if you want. Or you may want more time --

14 MR. SOPER: I don't really have a
15 preference, your Honor. Whatever is convenient.

16 JUDGE FARRAR: Let's do this. What's
17 convenient is, we've been at it two hours. Let's
18 take a break, come back at quarter after and we'll
19 have the Staff go first.

20 (A recess was taken.)

21 JUDGE FARRAR: All right, we're back on
22 the record. Mr. Travieso-Diaz, you had a
23 suggestion before we start?

24 MR. TRAVIESO-DIAZ: Yes, Mr. Chairman.
25 As I would suspect that I drew the black ball on

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1 the issue of further rebuttal testimony by
2 Drs. Singh and Dr. Soler, what I would like to
3 propose if it is agreeable with counsel for the
4 other parties is that we set a time certain
5 tomorrow to conduct that examination on whatever
6 follow-up cross is required. Dr. Singh has to
7 leave to catch a plane at four o'clock, so we
8 suggest that we do it before lunch.

9 JUDGE FARRAR: His plane is at four, or
10 he has to leave at four?

11 DR. SINGH: Plane leaves at 4:40.

12 JUDGE FARRAR: So you've got to leave
13 the room here at two.

14 MR. TRAVIESO-DIAZ: So my recommendation
15 would be that we do it after the first break in the
16 morning.

17 JUDGE FARRAR: So that's when you would
18 ask questions of the nature we had talked about
19 before the break?

20 MR. TRAVIESO-DIAZ: Exactly, the
21 questions that relate to whatever testimony is
22 presented in Exhibit 225 that may be considered not
23 to be of technical nature.

24 JUDGE FARRAR: And then the State would
25 follow up on that. Now, will Dr. Singh and

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1 Dr. Soler be back at some future point in the case?

2 MR. GAUKLER: We're going to have
3 Dr. Soler here on Saturday to specifically discuss
4 the rebuttal with Dr. Ostadan. And I guess they
5 will be part, they will be coming back to testify
6 on radiation dose consequences the week of June 27.

7 JUDGE FARRAR: So if we have any
8 unfinished business with them, we could conduct
9 that then, unfinished business related to this
10 report, okay. Is that agreeable with the State and
11 the Staff, that whatever else we're doing at eleven
12 o'clock tomorrow we will take up these witnesses
13 for the purpose stated?

14 MS. CHANCELLOR: As long as we don't get
15 thrown up on the schedule with Dr. Bartlett and
16 Dr. Arabasz, because Dr. Arabasz -- or Dr. Ostadan
17 and Dr. Bartlett, because Dr. Ostadan has terrible
18 scheduling constraints and we need to get through
19 him on Friday. But that's my only concern.

20 JUDGE FARRAR: Tomorrow is Wednesday?

21 MS. CHANCELLOR: I believe so.

22 MR. GAUKLER: The parties have agreed
23 that no matter what, Friday morning we will get to
24 Dr. Ostadan. We're acceptable with that.

25 JUDGE FARRAR: Then let's -- then

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1 Mr. Travieso-Diaz, we will do that with these
2 witnesses at eleven, and we'll have now the Staff
3 cross-examination. Mr. O'Neill?

4 MR. O'NEILL: Thank you. Should be
5 fairly brief. Your Honor, actually I did want to
6 thank the other parties for granting us some
7 latitude in terms of who responds to certain
8 questions. I know relatively speaking, I'm a green
9 horn and sometimes I prefer to defer to Mr. Marco
10 or Mr. Turk, so I just wanted to acknowledge that.

11 JUDGE FARRAR: Sometimes even when you
12 don't defer to Mr. Turk you want to defer to him.
13 And I would have said that --

14 MR. O'NEILL: Certain evidentiary
15 procedural issues.

16 JUDGE FARRAR: I would have said that
17 even if he were in the room, which he now is. I'm
18 sure someone can -- we won't have the reporter read
19 it back.

20 Go ahead, Mr. O'Neill.

21

22 CROSS-EXAMINATION

23 BY MR. O'NEILL:

24 Q. My first question, this is kind of
25 largely as a matter of clarification. I guess I'll

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1 direct this to Dr. Singh. Yesterday during my
2 cross-examination Dr. Khan made reference to
3 damping, and I think I referred to it as the
4 interaction cask and cask internal to structural
5 damping. You would consider that to be impact
6 damping; is that correct?

7 DR. SINGH: Yes, strictly speaking.

8 Q. And I had also mentioned damping or
9 dissipation of energy associated with deformation
10 of the structure, and I think I referred to that as
11 material damping. May we consider that to be
12 impact damping? I just want to make sure we're on
13 the same page here.

14 DR. SINGH: Well, structural damping
15 would be damping that is produced because of
16 stressing of the material and because stress line
17 curves are not ideally, ideally elastic. In other
18 words, the stressing of any material is an event in
19 which there is invariably some dissipation of
20 energy. That is structural damping.

21 Material damping arises from inherent
22 nonlinearity in the material itself. And then you
23 have additional damping which occurs from impacts
24 specifically, and that is in the nonlinear dynamics
25 literature you referred to as impact damping.

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1 Q. Thank you.

2 MR. GAUKLER: Dr. Singh, can you make
3 sure your microphone is on?

4 DR. SINGH: It's on. I'm just not
5 putting enough energy in my voice.

6 Q. (By Mr. O'Neill) I want to refer you to
7 PFS Exhibit 225 at this point. In section 3.0 of
8 your analysis you indicated that you had used only
9 a 0.8 percent coefficient of friction between the
10 cask and the pad. Is that correct?

11 DR. SINGH: It's not percent. It's
12 coefficient of friction --

13 Q. Oh, sorry. Excuse me.

14 DR. SINGH: -- dimension, yes.

15 Q. But you did use a value of 0.8?

16 DR. SINGH: That is correct.

17 Q. Was this intended to correspond to a
18 specific run or runs in the Altran report?

19 DR. SOLER: Yes, it was, and I believe
20 it is case 3, Table 3.

21 JUDGE FARRAR: We can't hear you.

22 DR. SOLER: Oh. Case 3 of Table 3 of I
23 believe it's reference 1 in this report. Let me
24 check.

25 Q. That would be the Altran report itself,

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1 Table 3?

2 DR. SOLER: Yes, yes.

3 Q. Will you turn to section 4.1 of Exhibit
4 225. It's page 11 specifically.

5 DR. SOLER: Okay.

6 Q. You state there I guess what would be
7 considered to be the third paragraph beginning with
8 2,000-year return period?

9 DR. SOLER: Yes.

10 Q. See that paragraph? In the last
11 sentence you state that the effect of the soil
12 substrate and the soil cement were included in the
13 development of this time history set. What do you
14 mean by this specifically?

15 DR. SOLER: It's -- the time history set
16 was developed by Geomatrix and it was based on the
17 soil -- it was consistent with the soil data at the
18 site, to my understanding. And we were given time
19 histories that they developed, and along with those
20 time histories we were given moduli consistent with
21 that earthquake from which we developed soil
22 springs to use in a number of the runs that we did
23 here and also in the previous runs.

24 Q. So how would this compare to what was
25 used in the Altran report?

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1 DR. SOLER: I believe the Altran report
2 used the same time histories. There is no other
3 set. It's just that the Altran report and the
4 analysis that we've done in here which attempt to
5 duplicate the Altran results both ignored
6 soil-structure interactions. In other words, they
7 both, Altran and runs here did not include soil
8 springs in the analysis.

9 Q. The runs here --

10 DR. SOLER: The runs here that
11 specifically deal with looking at the Altran
12 simulations do not include the effect of
13 soil-structure interaction because the analysis
14 performed by Altran did not include soil-structure
15 interaction. But the time histories --

16 Q. So they were freefield time histories?

17 DR. SOLER: Well, they were labeled as
18 freefield time histories but they were used by us
19 imposed on the base of the soil springs when the
20 soil springs were included in any one of our
21 analyses. Altran's report and our report, the two
22 runs that we're talking about here, both applied
23 those time histories to the pad directly.

24 Q. And I think that was the case in State's
25 Exhibit 195 which was addressed yesterday that

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1 showed various damping plots, or plots of damping?

2 DR. SOLER: Well, yes, although I
3 suspect that those, as was discussed yesterday,
4 were simply taking the time histories and
5 effectively running them through, I won't call it a
6 filter, but a standard program that solves a mass
7 spring damper system, finds out for any given
8 spring, for a given damper and a given spring
9 constant, finds the peak displacement of the mass,
10 the peak acceleration of the mass, and plots that
11 as one point on the curve. So that is a standard
12 approach that does not involve soil springs or
13 anything like that.

14 Q. With respect to Exhibit 225 again, you
15 didn't model the pad, or this does include the pad?

16 DR. SOLER: The pad -- are we talking
17 about with respect to the Altran simulations?

18 Q. Well, does your particular sliding
19 analysis as laid out in Exhibit 225 take into
20 account pad flexibility?

21 DR. SOLER: No. All of our analyses
22 treat the pad as rigid, and the pad is either
23 attached to soil springs underneath or, in certain
24 cases, driven directly by the earthquake.

25 DR. SINGH: In this case it's driven

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1 directly by the earthquake.

2 Q. Well, in the Altran analysis, to your
3 knowledge, how is the pad treated? As a rigid
4 object?

5 DR. SOLER: It's a rigid object and the
6 time history accelerations are basically applied
7 directly to that.

8 Q. It's not specifically modeled, then?

9 DR. SOLER: It's not specifically
10 modeled, nor does it have to be in that particular
11 analysis.

12 MR. O'NEILL: I have no further
13 questions at this point. Thank you. Oh, I'm
14 sorry. Can I retract that statement?

15 JUDGE FARRAR: You may.

16 MR. O'NEILL: I'm finished. Sorry.
17 Thank you.

18 JUDGE FARRAR: Thank you, Mr. O'Neill.
19 Mr. Soper?

20 MR. SOPER: Thank you, your Honor.

21

22 CROSS-EXAMINATION

23 BY MR. SOPER:

24 Q. Dr. Singh, my notes show here when you
25 were asked earlier this afternoon whether shake

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1 table testing was necessary, and you said
2 "absolutely not." Is that right?

3 DR. SINGH: That is correct.

4 Q. And you were asked a couple follow-up
5 questions, to what extent could you get meaningful
6 data from a shake table test, and I think you
7 said -- well, explain your answer. Could you get
8 meaningful data from a shake table test?

9 DR. SINGH: No, you would not get any
10 meaningful data that can be correlated to a
11 computerized solution, that could be correlated to
12 a mathematical model.

13 Q. Well, whether it could be correlated or
14 not, wouldn't it give you some information about
15 whether or not your assumptions with regard to a
16 certain g force, certain seismic conditions bear
17 out in that the casks will or will not slide or tip
18 over? Wouldn't that be helpful in that regard?

19 DR. SINGH: I wouldn't put it that way.
20 The earthquakes are not predicted by the shake
21 table test. The earthquake is a calculated input
22 performed by the geotechnical engineers. So
23 that -- the shake table test will not do that. The
24 shake table test would be an attempt, as Dr. Khan
25 yesterday explained, would be an attempt to

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1 simulate what would happen on the pad when the cask
2 is actually situated on the pad. And I submit that
3 you cannot replicate the condition of a pad on a
4 simulated cask with a scale model or even full size
5 on the table. After all, realize that the table
6 itself is machinery. It's got certain rigidity to
7 it. It's a structure.

8 On that you will put a pad which will
9 be, will it be three feet thick with rebars? What
10 would you put in there? How flat would that pad
11 be? What would be the variation between that shake
12 table test and the real-life cask? If you don't
13 have information on the details of friction
14 distribution, on details of the rigidity of the
15 foundation on which your cask will be situated on
16 the shake table, then all you will get is that the
17 cask did not tip over. Well, we know that from all
18 the simulations we have done with extremely
19 conservative characterization of the structure,
20 that it does not tip over.

21 So any engineer trained in basic
22 mechanics would not need the shake table to come
23 up -- to get any new information. It would
24 strictly be a waste of money and waste of time.

25 Q. A waste of money. How much would it

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1 cost to do a shake table test?

2 DR. SINGH: A proper test, a test that
3 would need to be properly instrumented would take
4 in the order of two years as opposed to three
5 months that was offered yesterday, and it will cost
6 several millions of dollars.

7 Q. And what's your basis for saying that?
8 Have you ever done a shake table test?

9 DR. SINGH: I have participated in shake
10 table tests and I have done tests which would be
11 considered far simpler than shake table tests, and
12 I know the effort it takes up front to simulate a
13 real-life problem on a shake table. It will be
14 naive to suggest that one can simulate the motion
15 of a freestanding structure, subject it with a
16 variety of nonlinearities in it on a shake table
17 with a neatly specified input.

18 Q. But you say you have participated in
19 shake table tests. I guess you yourself have not
20 conducted one I guess for the reason you think that
21 they're of little value, or --

22 DR. SINGH: I wouldn't put it that way.

23 Q. Have you ever conducted one at your own
24 urging, your own instance for some purpose?

25 DR. SINGH: Well, I have actually

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1 devised shake table tests to confirm test data, to
2 confirm an evaluation that we were doing for the
3 Department of Energy back in the Clinch River
4 reactor project. I have participated in actual
5 experiments to confirm where there may be some
6 doubt as to the behavior of the structure or
7 component. My key point here, the reason I say it
8 would be useless is because first, there is no
9 doubt as to the behavior of this structure. We
10 know that the schematic stability of these casks be
11 assured with large margin, even when one uses
12 extremely conservative parameters.

13 The reason for test is when you have
14 some ambiguities and some concern, some possible
15 uncertainty with respect to performance. We have
16 no such thing here.

17 Q. But you do believe in the principle, it
18 appears, you've done tests to confirm your results
19 before and you do believe in the accuracy of shake
20 table tests as a tool that would confirm other
21 analytical work?

22 DR. SINGH: Oh, shake table has a place
23 under the sun, but certainly a shake table can be
24 used to supplement some work. But this is not the
25 place for it. This is absolutely not the place for

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1 it.

2 Q. It would have served no helpful purpose,
3 in your opinion, to do a shake table test to
4 confirm the seismic concerns at the Skull Valley
5 site?

6 DR. SINGH: None whatsoever.

7 Q. Well, I take it, then, you would not
8 recommend to your client, PFS, to do a shake table
9 test in this case?

10 DR. SINGH: That is true.

11 Q. Certainly wouldn't recommend to them to
12 spend any money on one, since they're expensive?

13 DR. SINGH: Well, money is not my
14 concern. No, when it comes to public health and
15 safety money should not be a concern.

16 Q. So I take it PFS has not ever suggested
17 to you to run a shake table test, nor you suggested
18 to them to run a shake table test?

19 DR. SINGH: I cannot speak to my entire
20 staff. Our relationship with PFS is quite broad
21 and they do have discussions with a number of our
22 people, but they have not personally discussed with
23 me; neither have I suggested that the shake table
24 test should be necessary.

25 Alan, you can speak to this also.

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1 DR. SOLER: To my knowledge, I will
2 reiterate what Dr. Singh says.

3 Q. Now, your testimony, then, that in
4 November of '97 you did not propose to do a shake
5 table test for PFS and ask them for funding of
6 approximately \$580,000 to do that?

7 DR. SINGH: I have no such recollection.

8 MR. SOPER: We're asking the reporter to
9 mark a document as State Exhibit 197. This is a
10 document that's marked confidential. I would like
11 to point out that any precautions that are required
12 in connection with that should be observed, and I'm
13 not sure what they should be, your Honor.

14 JUDGE FARRAR: If I recall earlier, the
15 court reporter treats them separately in some
16 procedure they've devised, and everybody here in
17 the room who gets one has to maintain that
18 confidentiality themselves, don't leave it around
19 the room and so forth. And I don't know offhand
20 how they're handled back with the secretary of the
21 Commission, but they've been doing this for years
22 and know how to do it.

23 (STATE'S EXHIBIT-197 WAS MARKED.)

24 JUDGE FARRAR: In terms of
25 confidentiality, can we discuss it, how we handle

1 the transcript?

2 MR. GAUKLER: I think that in terms of
3 confidentiality, the reason why this document would
4 have been marked confidential is because it
5 includes prices and monetary information.

6 JUDGE FARRAR: Prices about the facility
7 or about the --

8 MR. GAUKLER: Potential costs and et
9 cetera would be treated as proprietary information.
10 So I think if we do not discuss the dollar figures,
11 that we can discuss the document generally. The
12 document should be treated as confidential in the
13 same sense that we treat the Holtec documents. And
14 I should say the Holtec reports we submitted today
15 are also proprietary and should be handled under
16 the agreement that we've had in connection with the
17 Holtec documents. It's my fault for not mentioning
18 that earlier, 86 B and 225.

19 JUDGE FARRAR: And why are they
20 confidential? I notice now that it says on them
21 they're confidential, but when they're prepared for
22 litigation purposes --

23 MR. GAUKLER: Well, we held them
24 confidential. We had this discussion the first
25 time around in terms of analysis, the Holtec

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1 analyses, and --

2 JUDGE FARRAR: I thought those were of a
3 different character than this.

4 JUDGE FARRAR: Well, 86 B is just an
5 update -- or 86A or B is just an update of 86 which
6 we had decided should be confidential this time
7 around. So that certainly is of the same ilk as
8 the document we discussed the first time around.

9 JUDGE FARRAR: Well, if at any point the
10 conversation gets into matters that are
11 proprietary, let us know and we'll clear the room
12 of all the many people who are not associated with
13 one of the parties.

14 MS. CHANCELLOR: Your Honor, I'd like to
15 know about the status of PFS Exhibit 225, whether
16 that is proprietary, because it is prepared in
17 response to litigation and it's not part of the
18 typical documents that we hold as confidential that
19 we get from Holtec.

20 JUDGE FARRAR: Mr. Gaukler, you recall
21 the Board went to great lengths earlier to make
22 sure that some documents, no privilege was waived
23 as --

24 MR. GAUKLER: Right.

25 JUDGE FARRAR: So we're sensitive to

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1 this concern, but it just strikes me that this kind
2 of document --

3 MR. GAUKLER: Let me talk with Holtec in
4 terms of whether there's anything in this
5 particular document that is of that ilk or not.

6 JUDGE FARRAR: I'd rather that you point
7 to particular pages that are rather than claim that
8 the whole document is.

9 MR. GAUKLER: Fine, okay.

10 JUDGE FARRAR: All right, Mr. Soper, we
11 had marked this Northern States Power fax cover
12 sheet and related pages as State Exhibit 197.

13 MR. SOPER: Thank you, your Honor. I'm
14 a little unclear in my examination if it's limited
15 by what I can ask about under the claim of -- this
16 is not proprietary, but it is stamped PFS
17 Confidential. I notice it's not indicated Holtec
18 confidential. I would not like to be limited in my
19 cross-examination of what appears in these pages.
20 And with my apologies, if we just have one witness
21 in the room, if that's what it would take to allow
22 free questioning, then I would ask her to be
23 excused.

24 JUDGE FARRAR: But we also have to then
25 protect the transcript. We'd have to go to a

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1 different transcript procedure.

2 MR. SOPER: Well, is there anything
3 particular in here that -- this looks to me like
4 it's perfunctorily stamped confidential.

5 MR. GAUKLER: It's the dollar figures
6 that would be confidential, I'm sure. That's the
7 reason we stamped proprietary information in terms
8 of costs, et cetera for the reasons why the
9 documents like this were stamped confidential.

10 JUDGE FARRAR: For example, in the March
11 5th letter it refers to a Holtec proposal to do
12 some tests for a certain amount of money, so -- and
13 apparently tests weren't done, so that's -- I can't
14 imagine any court upholding that as still being
15 proprietary to PFS.

16 DR. SINGH: I have no problem if he
17 wants to ask questions.

18 MR. GAUKLER: I have no problems with
19 those cost figures there.

20 JUDGE FARRAR: This is not --
21 unfortunately, this is not Holtec's claim of
22 confidentiality, it's PFS's.

23 MR. SOPER: I guess that clears the way.
24 They both indicated that they didn't have a
25 concern.

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1 JUDGE FARRAR: Were you speaking, Mr. --
2 I didn't know, Mr. Gaukler, if you were speaking or
3 just passing on to Holtec you just said, or whether
4 you waive the privilege for your client.

5 MR. GAUKLER: I was looking for my
6 client right now in the back of the room.

7 JUDGE FARRAR: Why don't we proceed,
8 Mr. Soper. I think as long as you're asking about
9 what Holtec was doing, they're not making any claim
10 of privilege, and just be alert if you get into
11 something that looks like it could be a
12 sustainable -- or Mr. Gaukler, if you think it's a
13 sustainable PFS confidentiality claim. We'll be
14 alert for that.

15 MR. SOPER: Thank you. Dr. Singh,
16 directing your attention, sir, to page 2 of the
17 document that was just handed to you identified as
18 State 197, page 2, the second to last paragraph,
19 let me read it. If you'll follow along, please.
20 "In a letter from Holtec in November '97 (11/22/97
21 letter attached) they proposed to verify the
22 analytical work by conducting scale model tests on
23 a shake table, and asked for financial support to
24 complete the work." Then I would ordinarily go on
25 to read the amounts that were requested there. Any

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1 objection to that?

2 DR. SINGH: No, you can go ahead. I
3 have no problems with dollars or the context.

4 Q. Okay, thank you. The sentence goes on
5 to say, "\$250,000 for the topical report
6 preparation, \$180,000 for experimental work, and
7 \$150,000 allowance for responding to NRC
8 questions." Does that refresh your memory,
9 Dr. Singh, whether or not Holtec requested
10 financial support to conduct shake table tests in
11 this matter?

12 DR. SINGH: In this context in which you
13 bring this out, and frankly, I had completely
14 forgotten about the developments that went on in
15 1997, but in the context you bring it up, I would
16 say it's -- if it's explained properly, it is
17 correct.

18 We were asked by the NRC to run scale
19 model testing, and that was in 1997. I guess my
20 letter later explains it. In 1997 we had made a
21 submittal to the NRC -- it's very important to
22 understand what we were doing then. We made a
23 submittal to get a general certificate in our
24 general certificate of compliance to qualify
25 HI-STORMs to be freestanding at high earthquake

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1 levels. The NRC had at that time a very, what I
2 call in my letter, a simpleminded static analysis.
3 No offense intended to the NRC here. That's what I
4 wrote in this letter dated November 27, 1997 as
5 part of this exhibit. They were unwilling to budge
6 from the, quote-unquote, simpleminded static limit
7 for general deployment.

8 Now, our customers, quite a number of
9 them have high earthquakes, as you know, and they
10 wanted to band together and satisfy the NRC to
11 perform the test. NRC, incidentally, had also
12 undertaken to go out and get data from some limited
13 tests done in Japan. Turned out, to make a long
14 story short, the Japanese data never came, the
15 evaluations that we informally did by directly
16 talking to the Japanese researchers that the shake
17 table data was meaningless, and the whole idea of
18 shake table testing was dropped. And this letter
19 that went to Max DeLong at PFS and must have gone
20 to several other utilities who were interested was
21 to hold their resources together in one place so
22 such a scale model testing could be done. They
23 have long slipped away from my memory since, since
24 that time.

25 Q. There's your letter that begins on page

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1 Bates stamp 47927, letter on Holtec stationery
2 dated November 22nd, 1997.

3 DR. SINGH: Yes, sir, I see it.

4 Q. And I direct you to page 3 of that,
5 Bates stamp 47929. Do you see that page?

6 DR. SINGH: I'm unable to find -- is
7 this the last page in the letter?

8 Q. Yes.

9 DR. SINGH: Yes, I see it.

10 Q. And does that bear your signature there?

11 DR. SINGH: It says, "We can hold the
12 above prices." Is that what you're referring to?

13 Q. Yes.

14 DR. SINGH: Yes.

15 Q. And is that your signature on the --

16 DR. SINGH: It's signed by someone for
17 me.

18 Q. I see. Did you ever see this letter
19 before?

20 DR. SINGH: I must have.

21 Q. Now, if I would direct you back to page
22 2 of the letter, 47928.

23 DR. SINGH: Yes.

24 Q. Under No. 2, recommendation.

25 DR. SINGH: Uh-huh.

1 Q. "We recommend that we perform the
2 HI-STORM seismic qualification on the Skull Valley
3 pad as a freestanding structure as part of the
4 ongoing new docket effort. This will eliminate
5 seismic considerations as a matter of regulatory
6 contention in the site-specific licensing effort.
7 PFS's licensing and engineering costs will also be
8 reduced because of PG&E's support and Holtec's
9 contribution to the project.

10 "We ask that PFS provide funding which
11 is roughly equal to PG&E's. Requested funding is,"
12 first bullet point, "\$250,000 towards preparation
13 of the topical report." What would that topical
14 report provide, sir?

15 DR. SINGH: Topical report would provide
16 the background of how nonlinear dynamic analysis is
17 done, should be done.

18 Q. And the second bullet point, "\$180,000
19 for experimental work," what would that entail?

20 DR. SINGH: That will presumably entail
21 some testing on scale models.

22 Q. That would be shake table tests; is that
23 right?

24 DR. SINGH: It would be shake table
25 tests.

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1 Q. And the next bullet point, "payment not
2 to exceed \$150,000 to respond to all NRC
3 questions." Would those be questions relating to
4 the shake table results?

5 DR. SINGH: On the topical report, which
6 will contain any experiments that I've done. As I
7 said, there could be shake table or other
8 experiments.

9 Q. Let me direct your attention, sir, to
10 page -- I'm referring now to the Bates stamp in the
11 lower right-hand corner, 47930.

12 DR. SINGH: Okay, I'm there.

13 Q. Okay. That's page 1 of a letter dated
14 March 5th, 1998 on Holtec stationery. Is that
15 correct?

16 DR. SINGH: Yes, sir.

17 Q. I direct your attention to page 3 of
18 that document, which would be Bates No. 47932,
19 bottom of that page. Does your signature appear
20 there?

21 DR. SINGH: It seems to be, yes.

22 Q. Any question about that, whether it's
23 your signature?

24 DR. SINGH: Oh, I'm not going to contest
25 to you if it's on Holtec stationery whether it's my

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1 signature or not.

2 Q. Thank you for that.

3 DR. SINGH: People sometimes sign for
4 me.

5 Q. Right above your signature there, the
6 second bullet point from the bottom, it says, if I
7 might read this and if you'll follow along, "If PFS
8 elects not to support this effort, then we can
9 provide all high seismic material stripped from
10 Rev. 1 of the HI-STORM TSAR for direct
11 incorporation in the Skull Valley site-specific
12 submittal, and we will proceed with only anchored
13 cask certification on this new docket." Did I read
14 that correctly?

15 DR. SINGH: It seems so, yes.

16 Q. Can you explain that for me, please?

17 DR. SINGH: Well, at the time we did not
18 know, we were kind of at a crossroads. We had a
19 freestanding cask with high seismic application in
20 front of the NRC. NRC appeared to be reluctant to
21 grant a general certificate. We also had some
22 interest in developing an anchored certificate that
23 would allow one to at appropriate sites anchor the
24 casks, and we were still debating which way to go.
25 These correspondences with PFS, and I'm sure there

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1 are others in our files, were intended to basically
2 decide what course of action we would take.

3 In the end that led to doing some
4 freestanding cask analysis under high earthquakes
5 and submitting it to the NRC as a topical report.
6 We did do that part, but later the decision was
7 made and NRC essentially at that point in time was
8 willing to -- did not want to look at high seismic
9 in a general CoC, not knowing what specific seismic
10 characteristics a different size would be. A
11 general CoC, as you know, is a certificate to
12 install anyplace without any further assessment if
13 you meet the criteria. And NRC was not willing to
14 do that so we decided to delete it from our
15 application, and the work we did for PFS has been
16 done strictly for PFS.

17 Q. In any of these documents did you inform
18 your client that these shake table tests that you
19 were recommending were meaningless?

20 DR. SINGH: First, I will not put it --
21 shake table I don't think came up specifically in a
22 discussion. It may have, but I don't remember.

23 Second, understand the golden rule in
24 licensing. The guy who has the gold makes the
25 rule, and NRC, they decide what they will review

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1 and approve at a particular time. It became
2 apparent to us that to continue with the general
3 certification at high seismic will delay the
4 certification of our entire system, so we basically
5 took that material out of our TSAR and resubmitted
6 it with that material removed.

7 Q. Now, if I direct your attention, sir, to
8 Bates page 47928. Are you with me there?

9 DR. SINGH: I am there now, yes.

10 Q. The second sentence from the top in
11 paren small v, it says, "perform scale model
12 testing on a shake table."

13 DR. SINGH: It does say that, yes.

14 Q. Do these documents now refresh your
15 memory as to your recommendation of performing
16 shake table tests in this matter now?

17 DR. SINGH: I would not characterize
18 recommending shake table tests. I would
19 characterize this as taking the regulatory posture
20 into account and then developing a licensing
21 strategy. That is precisely what we were doing.
22 If we had believed the shake table tests were
23 necessary to qualify a cask for high seismic under
24 our general certificate, then we would have
25 performed it ourselves before we would submit the

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1 document. Realize that when we make an application
2 to the NRC we seek to get certification, not to get
3 into a lengthy response process.

4 Q. Nevertheless, the NRC requested that you
5 perform shake table tests in this matter
6 originally; is that right?

7 DR. SINGH: Well, NRC doesn't request.
8 NRC asks questions. They request -- they ask
9 questions and they ask you to provide information.
10 The sum total of what we gather by our interactions
11 with NRC including the request for additional
12 information that they gave us is that for us to
13 take the high seismic forward under a general
14 certificate would mean that we will have to run
15 tests. Now, this is in 1997, early '98 time frame.
16 They may not have that position today. The art and
17 science of predicting seismic response of casks
18 have advanced considerably over the past five
19 years.

20 Q. Let me direct your attention back to
21 page 47925. It's the second page of this group of
22 documents. If I might read from the second
23 paragraph, second sentence. If you'll follow
24 along, sir. "In a July '97 Holtec/NRC meeting, the
25 NRC suggested decoupling the high seismic issue

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1 (and three other issues) from the HI-STAR and
2 HI-STORM dockets, and in a Holtec/PG&E/NRC meeting
3 in November '97 the NRC endorsed the Holtec
4 proposal to experimentally confirm the seismic
5 analysis approach." Is that a correct statement of
6 what happened there?

7 DR. SINGH: The statements made here are
8 politically correct. You're dealing with the NRC.

9 Q. And as a result, you asked PFS to fund
10 shake table tests?

11 DR. SINGH: As a result, we asked PFS
12 and other utilities who were our clients at the
13 time to participate in developing a test and
14 conducting tests that will satisfy the NRC.

15 Q. And those would be shake table tests?

16 DR. SINGH: It appears from the letter.

17 Q. Dr. Soler, do you have anything to add
18 on that regard?

19 DR. SOLER: No, I don't.

20 Q. Let me ask you, Dr. Soler, in connection
21 with the document that's been marked as PFS 225, in
22 the analysis and simulations that are the subject
23 of this document, did you use the same model for
24 each analysis that you performed in this document?
25 And I'm not talking -- I'm not talking about the

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1 model now, I'm talking about how you model the
2 system, not the computer program. Unless they
3 can't be separated.

4 DR. SOLER: Well, let me try to answer
5 your question. You can stop me if I'm not
6 answering it correctly.

7 For the models in which we compared our
8 simulation of the Altran report with the Altran
9 report, we of course used Visual NASTRAN. We used
10 the same model of the cask, meaning it was a rigid
11 cylinder. We eliminated the soil-structure
12 interaction effects. So to that extent it was the
13 same model. But if you're asking me whether it was
14 the full design-basis model that we have used using
15 either DYNAMO or some confirming runs with Visual
16 NASTRAN, it obviously was a subset of that.

17 Q. No, I'm asking within this document.
18 Did you use the same model, not compared to other
19 runs on --

20 DR. SOLER: Oh, you mean -- well, I
21 think the -- I'm not sure I understand or can
22 clearly give you a simple answer on that.

23 Q. Okay, let me ask you some more
24 questions.

25 DR. SOLER: Okay.

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1 Q. When you modeled the cask system for
2 purposes of this Exhibit 225, how many beam
3 elements did you use?

4 DR. SOLER: There are no beam elements
5 in this model.

6 Q. I see. How would you describe the
7 model, then, in terms of beam elements --

8 DR. SOLER: I wouldn't.

9 Q. -- or lack thereof?

10 DR. SOLER: The simulation code that we
11 have used here is one in which all bodies are
12 treated as rigid bodies, and they may or may not be
13 coupled by various kinds of stiffness elements, but
14 I would not characterize those stiffness elements
15 as beam elements. So this is not a finite element
16 representation of any system. In other words, you
17 could not take this system response and easily
18 calculate stresses from it without resorting to
19 another program. So it's not a finite element
20 representation of the cask.

21 Q. So it could not be described even as a
22 single beam element?

23 DR. SOLER: It could -- unless you are
24 willing to describe a 133-inch diameter cylinder
25 that's 230 inches long and classify it as a rigid

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1 beam, I will go along with that. But I'd prefer to
2 think of it as a stubby cylinder.

3 Q. So you did not model the system the same
4 exact way that was modeled by the Altran report?

5 DR. SOLER: That is correct as far as
6 the cask is concerned.

7 Q. Is there more that you want to explain
8 there? You say as far as the cask is concerned.

9 DR. SOLER: Well, we did model it to the
10 extent necessary as far as the location and number
11 of contact elements, and I believe that -- I know
12 that our model of the pad was rigid, and I believe
13 the Altran pad was also rigid to the extent that it
14 needed to be modeled, which I don't think it needed
15 to be modeled. But as far as the representation of
16 the actual cask structure, the model was different.

17 Q. In addition to the cask being modeled
18 differently, were the -- see, would you describe
19 the model as having beam elements, then, or not?

20 DR. SOLER: No, unless you want to
21 consider one cylinder as a rigid beam. But I would
22 not characterize it as consisting of beam elements.

23 Q. How many nodes would you say you used in
24 the cask model?

25 DR. SOLER: The only --

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1 Q. I'm sorry, Dr. Singh, what? I need to
2 hear your response if you're going to make one.

3 DR. SINGH: Yes, if you'll allow me to
4 speak I would interject.

5 Q. Well, you're speaking --

6 DR. SINGH: In the past you have
7 forbidden me. So I was talking to myself. Can I
8 answer?

9 Q. Actually, the question was to Dr. Soler
10 since he prepared the report. It's just if you
11 make a response, I would like to hear what it is,
12 sir.

13 DR. SINGH: Well, just to help you --

14 Q. No, I don't want your explanation. I
15 want to hear your response to Dr. Soler.

16 DR. SINGH: I was saying that Visual
17 NASTRAN has the capability to model HI-STORM, the
18 entire cylinder in one model. One does not need to
19 use, like in SAP use a series of beam elements to
20 model it. It's not -- it's a dynamics program.

21 Q. Well, I don't think your comment to
22 Dr. Soler was that short, actually. Sorry to
23 interrupt you, but the question is to Dr. Soler. I
24 wanted to hear your comment to him that you made is
25 all.

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1 DR. SINGH: I think that's what I was
2 saying.

3 DR. SOLER: That long?

4 Q. Let me stop and re-ask the question to
5 Dr. Soler. I'm sorry, sir. I don't mean to be
6 rude to you, but Dr. Soler prepared this, is my
7 understanding. I'd like his response.

8 DR. SOLER: The notation of nodes that
9 you characterize the model with is not appropriate
10 for Visual NASTRAN. If you want to talk about
11 locations, I will say that the only important
12 locations in this model from the Visual NASTRAN
13 point of view were the eight locations where I
14 permitted contact to be tracked between the cask
15 and the pad and any other locations that I
16 identified to track results. But the development
17 of this cylinder does not require defining multiple
18 numbers of nodes and connecting them by elements as
19 a finite element program would require.

20 Q. And how many degrees of freedom for the
21 cask only?

22 DR. SOLER: The cask only is a rigid
23 body. It has 6 degrees of freedom.

24 Q. Did you use 3D finite elements like
25 solids in this model?

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1 DR. SOLER: Well, there is a solid, but
2 I would not characterize it as a finite element
3 solid, because you -- let me back off one second.
4 Visual NASTRAN does have the ability to do a stress
5 analysis subsequent to a dynamic analysis. We have
6 never used that part of the program for such an
7 analysis. We have not QA'd that part of the
8 program, and therefore we have not attempted to
9 employ it here.

10 So for the purposes of our use here, I
11 would rather not characterize it as a finite
12 element program. It does not require you to define
13 nodes, it does not require you to define elements.
14 The only requirement is that you draw within the
15 program or you have a CAD program develop suitable
16 rigid bodies that you are trying to put together
17 and analyze in a dynamic environment.

18 Q. And why didn't you use the LS-DYNA
19 program for your analysis?

20 DR. SOLER: The LS-DYNA program is
21 optimized for shock phenomena, things like drop
22 analyses where the event occurs in orders of
23 fractions of a second and then it's over. To run
24 an entire earthquake with LS-DYNA, I can't even
25 begin to calculate the amount of time that would be

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1 spent to do it. I would not use that program to
2 simulate an earthquake analysis if I wanted or felt
3 that I needed to use a classical finite element
4 program.

5 Q. And did you compare your results with
6 the analysis that Dr. Luk did?

7 DR. SOLER: Are we talking about this
8 problem?

9 Q. Yes.

10 DR. SOLER: Well, Dr. Luk didn't do this
11 problem.

12 Q. Well, his analysis. Is it consistent
13 with the analysis that he did?

14 DR. SOLER: The only attempt that I made
15 to compare the results, because Dr. Luk used a
16 finite element model and had to define nodes and
17 elements and of course paid the time penalty
18 involved in that, the only comparison I made was
19 essentially that we both predicted in all cases, no
20 matter what set of parameters we ran, that the
21 casks did not tip over and did not experience the
22 deflections of the order of magnitude that Altran
23 was suggesting would evolve.

24 Q. Of course you used a different model.
25 Had you used the same model and run it on SAP 2000,

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1 you have got the same results; isn't that correct?

2 DR. SOLER: The same results as whom?

3 Q. As the Altran report.

4 DR. SOLER: Presumably, unless there was
5 an error in input data, I would have gotten the
6 same bad results.

7 Q. Now, did you look at the Altran results
8 to see if there were any rotational movements that
9 were beyond the scope of the program?

10 DR. SOLER: We asked for such data. We
11 never received any.

12 Q. So you haven't reviewed that?

13 DR. SOLER: There was nothing given to
14 us that we could review.

15 Q. So assuming, sir, if Dr. Khan were
16 correct in saying that his review of that data did
17 not show any large rotations, you would have no
18 reason to find fault with the results that he got,
19 I take it?

20 DR. SOLER: I would find fault with
21 those results regardless of what Dr. Khan said,
22 because they belied reality.

23 Q. Well, I'm not talking about your choice
24 of input parameters. I'm just talking about
25 whether or not the program would yield the same

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1 results.

2 DR. SOLER: If I were given an input
3 file and I ran it on SAP 2000, I would presume that
4 I would get the same results that were gotten from
5 Altran. I would not believe them, but I presume I
6 would get the same results.

7 Q. And you would not believe them because
8 you believe that the large rotations would render
9 the results unreliable?

10 DR. SOLER: I would believe that the
11 rotations, if this program were predicting
12 rotations, which the report claims it was, okay,
13 that those rotations coupled with the magnitude of
14 displacements that were reported in the report,
15 coupled with the fact that SAP 2000 is strictly a
16 small motion analysis, coupled with the fact that
17 I've been in this field for 40 years and I have run
18 into situations before where computer programs have
19 been used indiscriminately and predicted results
20 that did not indicate something blew up because
21 they had numbers on the order of 10 to the 32nd,
22 but yet gave what I would consider meaningless
23 results and upon deeper examination found the
24 reason why these results were meaningless.

25 Q. Now, if this were a sliding analysis

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1 only, which I believe part of the Altran analysis
2 was -- is that correct?

3 DR. SOLER: I believe that the results,
4 as far as I could read from the information in that
5 report, I believe that certainly the results in
6 Table 1 were strictly a sliding analysis, and I
7 believe that the results in Table 2, because the
8 body was -- the dimensions of the body were such
9 that it would probably be mostly sliding, I would
10 say the response from those two tables would be
11 predominately sliding.

12 Q. Let me direct your attention, sir, to
13 the Altran report for a moment. Do you have that
14 before you?

15 DR. SOLER: I think I have a copy in my
16 briefcase. Yeah.

17 Q. You have that before you, sir?

18 DR. SOLER: Yes.

19 Q. I call your attention to page 11.

20 DR. SOLER: Okay.

21 Q. And Table 2 there. Do you see that?

22 DR. SOLER: Yes.

23 Q. Study run No. 1, and reading across the
24 input parameters used and the displacements, is
25 that a case that you ran for comparison in Exhibit

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1 225?

2 DR. SOLER: No.

3 Q. Study run No. 2, did you run that one?

4 DR. SOLER: No.

5 Q. Let me just go on, please. Study run
6 No. 3, did you run that one?

7 DR. SOLER: No.

8 Q. No. 4?

9 DR. SOLER: No.

10 Q. No. 5?

11 DR. SOLER: No.

12 Q. No. 6?

13 DR. SOLER: No.

14 Q. No. 7?

15 DR. SOLER: No.

16 Q. No. 8?

17 DR. SOLER: No. 9 to 11 also no.

18 Q. So you didn't run any of these cases?

19 DR. SOLER: That's correct.

20 Q. Now I'm going to direct your attention,
21 sir, to Table 3.

22 DR. SOLER: That's correct, okay.

23 Q. It's on page 13.

24 DR. SOLER: Yes.

25 Q. Study run No. 1, did you run those

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1 parameters?

2 DR. SOLER: No, I did not.

3 Q. Study run No. 2?

4 DR. SOLER: No.

5 Q. No. 3?

6 DR. SOLER: To the extent I needed to
7 simulate those parameters, that was the case that I
8 reported earlier this morning.

9 Q. I'm a little confused with that answer.
10 Did you run this case or not?

11 DR. SOLER: Well, I ran the .8
12 coefficient of friction between cask and pad, 1
13 percent damping, 1 million total vertical
14 stiffness. Visual NASTRAN does not require me to
15 input a horizontal stiffness, so that's why I
16 qualified my answer.

17 Q. Thank you. Study run No. 4, did you run
18 that one?

19 DR. SOLER: No.

20 Q. No. 5?

21 DR. SOLER: No.

22 Q. No. 6?

23 DR. SOLER: No.

24 Q. No. 7?

25 DR. SOLER: No.

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1 Q. No. 8?

2 DR. SOLER: No.

3 Q. And No. 9?

4 DR. SOLER: No.

5 MR. SOPER: Your Honor, may I indulge
6 the Board, if we could have just a moment, I think
7 we're close to wrapping this up.

8 JUDGE FARRAR: All right, go ahead.

9 MR. SOPER: If we could make have five
10 minutes so we could walk around, because we need to
11 get some copies.

12 JUDGE FARRAR: Okay, five won't be
13 enough. Let's say a ten-minute break. It's 25
14 after, we'll be back at 25 of.

15 MR. SOPER: Thank you.

16 (A recess was taken.)

17 JUDGE FARRAR: All right, Mr. Soper, you
18 were getting ready to wrap up?

19 MR. SOPER: Thank you, your Honor.

20 Q. (By Mr. Soper) Dr. Soler, we were
21 talking about LS-DYNA a moment ago, and you did use
22 that program, as I recall, in your impact, drop
23 impact analysis?

24 DR. SOLER: Correct.

25 Q. Can you tell me what the impact damping

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1 you used was in that analysis?

2 DR. SOLER: I did not have to input any
3 value for impact damping into the input file to run
4 that simulation. All we did was to model the
5 various components as finite element
6 representations, model the concrete using the
7 material characteristics that had been approved by
8 the NRC to simulate the behavior of pads, model the
9 soil beneath the pad as a linear elastic media, and
10 then apply the appropriate initial velocity to the
11 cask corresponding to a particular problem we were
12 doing.

13 Q. So does that mean that there is no
14 damping in the computation or that it's applied
15 internally?

16 DR. SOLER: I believe it's applied
17 internally.

18 Q. And do you know what the amount is that
19 would be used?

20 DR. SOLER: No, I do not.

21 Q. Dr. Singh, you told us earlier that
22 DYNAMO was named after some process, I believe.
23 Can you help me on that? What did you say DYNAMO
24 was named after?

25 DR. SINGH: It's an acronym for dynamic

1 motion.

2 Q. And where did it get that acronym?

3 DR. SINGH: Oh, one of our clever guys
4 invented it, I guess.

5 Q. You invented it, did you say?

6 DR. SINGH: I'm not sure I invented it.

7 Q. Is your microphone not on sir? Because
8 I can't hear you.

9 DR. SINGH: It wasn't on. I didn't
10 invent the name. The name was invented at Holtec.
11 It's an acronym to give the program a name. The
12 program was given a name.

13 Q. I see. It was given that name by
14 Holtec?

15 DR. SINGH: By Holtec, yes.

16 Q. Your company?

17 DR. SINGH: Well, I do not speak in the
18 person of the company, I speak for myself here.

19 Q. I see. And you also referred to a
20 manual that you had sent for from your office
21 that's on the witness table before you there?

22 DR. SINGH: Yes, sir.

23 Q. And that's the DYNAMO -- what would you
24 call it? User's guide?

25 DR. SINGH: It says training manual for

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1 DYNAMO computer program. That's the heading on it.

2 Q. And you say that there are some example
3 problems in there that are given and have been
4 verified; is that right?

5 DR. SINGH: That is correct.

6 Q. And the DYNAMO training manual again is
7 a document that you wrote?

8 DR. SINGH: Holtec.

9 Q. That Holtec, your company wrote?

10 DR. SINGH: That's correct.

11 Q. And I think you told me that the error
12 that we saw to the Holtec report that we changed a
13 little earlier today was the first error that you
14 recall having been included in a Holtec report
15 before. Is that right?

16 DR. SINGH: No, sir, I didn't say that.

17 Q. I see. Didn't you tell us something
18 about how rare it was to find any mistakes in a
19 Holtec report?

20 DR. SINGH: Yes, I said that there
21 are -- let me restate what I said, in of course new
22 words. There has never been an error in a Holtec
23 report that has gone through the QA process and
24 submitted in methodology, which is the highest
25 level of error you can have in numerical

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1 computational work.

2 The second level of work would be error
3 in major assumptions that could again invalidate
4 the result. There has never been a case where we
5 had to retract a report because there was an error
6 in any of the major assumptions in the model.

7 The third level is where you have
8 significant input variables. We have never had a
9 situation where we have had an error in variables,
10 input it into the solution, and the report was
11 prepared, it was QA verified and later we had to
12 change it that changed the conclusions. That has
13 never happened.

14 MR. SOPER: I see. I'm handing out now
15 a document to have marked as State's 198.

16 (STATE'S EXHIBIT-198 MARKED.)

17 Q. Dr. Singh, do you have State Exhibit 198
18 before you, sir?

19 DR. SINGH: Yes. I have a letter from
20 the NRC to us. Is that the letter you're referring
21 to, November 30th, 1998?

22 Q. Yes. When you say "us," I see it's
23 addressed to you personally. Is that correct?

24 DR. SINGH: Yes.

25 Q. And do you recall receiving this?

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1 DR. SINGH: I don't recall receiving
2 this particular letter, but I presume I have seen
3 it in the past.

4 Q. I see. Might I direct your attention,
5 sir, to the first paragraph and the last two
6 sentences, and I'm going to ask you some questions
7 about those. I'm going to read those two
8 sentences. "The poor quality of the HI-STORM TSAR
9 indicates that Holtec may not have factored in all
10 of the lessons learned from the completion of the
11 HI-STAR 100 storage cask review. Several of the
12 major omissions, errors, and apparent
13 contradictions in the TSAR are of a fundamental
14 nature." Does that refresh your memory, sir, about
15 this letter and whether or not you received it?

16 DR. SINGH: It does not refresh my
17 memory, but I can speak to the NRC position in this
18 letter.

19 Q. To the NRC what?

20 DR. SINGH: NRC's position stated in
21 this letter.

22 Q. If I can direct your attention, sir, to
23 the third paragraph, which reads as follows.
24 "Among the major problems identified and detailed
25 in the RAI are:" the welding deals -- excuse me.

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1 Let me start over. "The welding details do not
2 meet the requirements of the specified American
3 Society of Mechanical Engineers design code. The
4 concrete design does not meet the requirements of
5 ACI-349. ACI-318, the code proposed by Holtec, is
6 not acceptable. An incorrect pad thickness was
7 used to benchmark drop test analyses. The
8 postulated fire/accident/thermal analysis needs to
9 be recalculated with appropriate assumptions. The
10 results must be interpreted properly to account for
11 excessive local concrete temperature and thermal
12 gradients. The complete-blockage-air-inlets
13 accident needs to be reanalyzed to evaluate
14 transient maximum inner concrete wall temperature
15 response instead of the median concrete
16 temperature. Again, appropriate assumptions
17 regarding properties and correlations must be made
18 in this calculation." And do you recall having
19 addressed those concerns with the NRC, Dr. Singh?

20 DR. SINGH: Oh, I'm sure in the
21 licensing process we dealt with every one of them,
22 but I should add that none of this that you read in
23 the record negates anything I said before.

24 Q. Dr. Soler, I'm going to hand you a CD
25 that I'd like you to put in your CD player and

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1 display for me, please. It's a video file.

2 MR. GAUKLER: Your Honor, I'd like to
3 request to know what CD it is, and I do not have a
4 copy, so --

5 MR. SOPER: Well, similar to the CD that
6 was played this morning without us having a copy or
7 any advance warning, this is a CD that was produced
8 by PFS to us, so...

9 MR. GAUKLER: Could you just tell me
10 which CD it is?

11 MR. SOPER: Yes, we will do that. In
12 fact, Paul, maybe you could read that for the
13 record what it says on there.

14 MR. GAUKLER: CD that we did produce to
15 the state? Movie of cask response for 10,000-year
16 earthquake. And then there was also a movie of a
17 presentation Dr. Soler made to a conference.

18 Q. (By Mr. Soper) Now, Dr. Soler, when you
19 open the file can I see what the icons are that
20 come up?

21 DR. SOLER: Let me see. I think I've
22 got the CD, and it says here item 5, PG letter;
23 item 10, PG letter. I'll open item 5 first and see
24 what's in it.

25 Q. Would you play the video file that's in

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1 item 5 there?

2 DR. SOLER: I would -- if you'll give me
3 an opportunity, I'd prefer to load it from the CD
4 onto the computer and then play it. It will look
5 more realistic.

6 MR. SOPER: That's fine. Thank you.
7 It's a large file, so --

8 Q. (By Mr. Soper) This particular CD,
9 Dr. Soler, has an audio track.

10 DR. SOLER: Oh, it does?

11 Q. Yeah. Are you able to play that?

12 DR. SOLER: I suppose so. I don't
13 guarantee it, but let's see.

14 Q. Maybe if you point your microphone down
15 at your --

16 JUDGE FARRAR: Do we want the reporter
17 to --

18 DR. SOLER: Yes, I remember now. Okay.
19 It should come out nicely.

20 JUDGE FARRAR: Do we want the reporter
21 to do the audio?

22 MR. SOPER: There are no transcribable
23 sounds that I'm aware of.

24 DR. SOLER: Let me start over, because I
25 don't know -- I've lost track of where I've pasted

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1 it, so let me try again. Here we go.

2 Q. (By Mr. Soper) Now, in connection with
3 that video, you did a presentation on predicting
4 the structural response of freestanding spent fuel
5 storage casks under seismic events?

6 DR. SOLER: That's correct.

7 DR. SINGH: Where did this come from?

8 MR. SOPER: That was produced to the
9 State in discovery.

10 JUDGE FARRAR: Mr. Soper, at this point
11 the record doesn't reflect what the animation
12 showed.

13 MR. SOPER: I think that we have that
14 same -- did we describe earlier today what
15 animations were being shown? How did we handle
16 that earlier? We're willing to do the same thing,
17 your Honor.

18 JUDGE FARRAR: Well, the witness made
19 brief comments about --

20 MR. SOPER: Let me ask a few questions,
21 and I'll see if I can --

22 JUDGE FARRAR: I mean, I don't want to
23 interrupt your cross-examination, but seems if this
24 was important enough for you to put on, you ought
25 to describe the animation, because it seemed

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1 different from previous animations.

2 MR. SOPER: Very well. Thank you, your
3 Honor.

4 Q. (By Mr. Soper) Dr. Soler, this is an
5 animation showing a HI-STAR 100 cask tipping over.
6 Is that right, sir?

7 DR. SOLER: That is correct.

8 Q. And according to the -- I'm now reading
9 your report that I assume goes along with this. Do
10 you know what I'm referring to, or should I pass it
11 out?

12 DR. SOLER: I believe you're referring
13 to a technical paper, a presentation at a
14 conference.

15 Q. Let me, to make things clear, let's pass
16 this out so you'll have it. We'll mark it as
17 Exhibit State 199.

18 (STATE'S EXHIBIT-199 MARKED.)

19 As I understand it, Dr. Soler, the
20 object of your paper shown in Exhibit 199 was to
21 present a dynamic analysis methodology for
22 analyzing spent fuel storage casks on reinforced
23 concrete pads. Is that correct?

24 DR. SOLER: That is correct.

25 Q. And as I understand it, the animation we

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1 just saw of a HI-STAR 100 cask tipping over was the
2 product of an analysis that's consistent with this
3 paper. Is that right?

4 DR. SOLER: That is incorrect. Would
5 you like me to elaborate?

6 Q. Well, let me ask you this. Is this a
7 Visual NASTRAN computed animation?

8 DR. SOLER: This animation is a Visual
9 NASTRAN animation.

10 Q. I see. Does it have anything to do with
11 this paper that is shown in Exhibit 199?

12 DR. SOLER: It has to do with a
13 presentation that I made. It was not part of the
14 paper, but when I gave the presentation I added
15 this animation to make a point.

16 Q. Let me ask you this, sir. On the bottom
17 of page 7 of Exhibit 199, I'm reading the last
18 sentence that begins at the bottom of page 7, which
19 reads, "To begin with, it is desired to establish
20 the ZPA level at which HI-STAR 100 would be at the
21 verge of 'tipping over' at some instant during the
22 simulated seismic event. This sub-tipping ZPA for
23 HI-STAR 100 was determined to be 0.6 g." Now, are
24 we seeing -- and I'm not reading the rest of it
25 there. I just wanted to ask you about that

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1 particular statement. Are we seeing in this
2 animation a ZPA that is in excess of 0.6 g?

3 DR. SOLER: Yes.

4 Q. And would it be correct that if it were
5 less than 0.6 g the HI-STAR 100 cask would not tip
6 over?

7 DR. SOLER: I would like to explain an
8 answer. I can't give you a simple yes or no. I
9 need to explain the context of this simulation in
10 relation to this paper. Would you allow me to do
11 that?

12 MR. GAUKLER: I would ask the Board to
13 allow the witness to do that.

14 Q. (By Mr. Soper) Yes, why don't we have
15 you do that.

16 DR. SOLER: Okay. This paper was
17 originally written using DYNAMO alone. And it was
18 written and results were predicted from DYNAMO, and
19 on the basis of certain DYNAMO results we drew some
20 conclusions for the paper.

21 At the presentation I felt it was
22 appropriate to point out to the listeners that you
23 could not rely on the results of a small deflection
24 program when it gave you responses that clearly
25 indicated you might be in the large deflection

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1 range. And to illustrate that point, I ran the
2 same problem in terms of input earthquake and the
3 same characteristics, diameter and height using
4 Visual NASTRAN, which is a large deflection
5 program, and demonstrated to the audience that for
6 this particular large earthquake where DYNAMO was
7 predicting the responses that you just quoted, if
8 you ran it on a program that was suitable for large
9 deflections and capable of handling them, you could
10 quite likely get a very different result, and this
11 was a dramatic example of it. The sound effects
12 were added for emphasis.

13 Q. Now, in this case is it true that DYNAMO
14 predicted the tipover at g forces in excess of 0.6?
15 Is that correct?

16 DR. SOLER: I will reiterate that all I
17 predicted from the output of DYNAMO was that a
18 certain -- at a certain ZPA, DYNAMO past 29
19 degrees, 29, 22, whatever the CG over -- okay, 22
20 and a half degrees -- below that it would presume
21 to be okay. And at that point I said to my
22 audience that you have to be careful. It's one
23 thing to use a program where it predicts five, six
24 degrees of rotation, then you're pretty comfortable
25 with saying, I might not be predicting the exact

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1 value of the displacement, but I'm pretty
2 comfortable that I'm not going to be predicting
3 three, four times that displacement. But when I
4 get up near the range where simple statics tell you
5 that there might be a problem, then you can't just
6 blindly use a small deflection program and get
7 results.

8 This program, DYNAMO, indicated that at
9 .6 g's I still had a valid solution. It didn't
10 turn over, it just moved a large amount. The top
11 excursion was considerable, but I cautioned the
12 audience that you can't just say, because the
13 computer program says it's so, that means it's so.
14 If you run a computer program that's suitable for
15 the problem, you might get different answers. And
16 this was done to illustrate that you have to be
17 very, very, very careful when you're doing a large
18 rotation problem to use a program that's suitable
19 for the job and don't blindly take an answer from a
20 program that's not suitable for it. This was
21 designed to educate the audience. I suspect that
22 it serves the same purpose here.

23 Q. Okay, let me just ask you about that,
24 then. Referring again to at the bottom of page 7
25 and the continuation at the top of page 8, you're

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1 telling us, I take it, that DYNAMO predicted that
2 at sub-tipping levels, in other words, below 0.6
3 g's ZPA, there would not be tipping, according to
4 DYNAMO?

5 DR. SOLER: There would not be
6 overturning. Perhaps my terminology --

7 Q. Overturning.

8 DR. SOLER: It would not overturn,
9 according to DYNAMO, with the event that we imposed
10 on it.

11 Q. However, at less than 0.6 g's using
12 Visual NASTRAN you may in fact get a tipover?

13 DR. SOLER: I suspect, and I can't be
14 sure since there's no written documentation of the
15 Visual NASTRAN run, I suspect that I simply ran it
16 at this .6 g to demonstrate that for this
17 particular case where DYNAMO said it was okay,
18 Visual NASTRAN said it wasn't okay.

19 Q. I see. If I might direct your
20 attention, sir, back to page 7, the paragraph that
21 follows the subheading "A numerical example." Do
22 you see where I'm at, sir?

23 DR. SOLER: Yes.

24 Q. And I'm going to the third sentence in
25 that paragraph. Reads as follows. "Detailed

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1 computations to determine over a hundred input
2 quantities needed to input in the dynamic model may
3 be found in Reference 2." Let's just take that
4 sentence.

5 DR. SOLER: Okay.

6 Q. You're saying here that over a hundred
7 input quantities are needed to input this
8 particular model; is that correct?

9 DR. SOLER: With DYNAMO, yes. And I was
10 referring to the TSAR to go get those.

11 Q. I see. So your methodology explained in
12 this paper would require over a hundred inputs?

13 DR. SOLER: To characterize the cask
14 according to DYNAMO, I think that's a fair number.
15 Because with the DYNAMO model that I'm talking
16 about here, we're modeling not only just the casks,
17 we're modeling the internal MPC, and for HI-STAR at
18 least we were also modeling the internal fuel
19 bundle inside the MPC. So there were a lot more
20 inputs than are required for the DYNAMO model of
21 the HI-STORM.

22 Q. Dr. Soler, I'm looking at I believe it's
23 Exhibit 173, PFS Exhibit 173, which is the
24 multicask response at PFS for the 2,000-year
25 seismic event, revision 2.

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1 DR. SOLER: I'll have to get a copy of
2 that.

3 Q. Would you, please.

4 DR. SOLER: I need a copy of that
5 report.

6 MR. TRAVIESO-DIAZ: I think if the State
7 wants to ask questions, they should supply a copy
8 of the paper.

9 JUDGE FARRAR: Well, that would be a
10 technical way to do things, but since we're dealing
11 with response to the PFS rebuttal, we're at a point
12 where we'll take help from anybody.

13 MR. SOPER: I wish I had a stack of
14 those handy, but I don't.

15 MR. TRAVIESO-DIAZ: I don't think it was
16 referred to in rebuttal testimony.

17 JUDGE FARRAR: I wasn't suggesting that,
18 but to the extent it's --

19 MR. O'NEILL: It's a state exhibit.

20 MR. SOPER: State Exhibit 173, excuse
21 me.

22 DR. SOLER: Okay, I've got it.

23 JUDGE FARRAR: I'm sorry,
24 Mr. Travieso-Diaz. I thought that was a PFS
25 document.

1 Q. (By Mr. Soper) Now, my question,
2 Dr. Soler, is, DYNAMO was used, was it not, to run
3 the 2,000-year analysis shown in state 173?

4 DR. SOLER: Yes.

5 Q. Now, my recollection was that there were
6 not a hundred input quantities used.

7 DR. SOLER: As I stated just a moment
8 ago, the input to run a similar model with HI-STAR
9 was more extensive because of the way we modeled
10 HI-STAR on DYNAMO.

11 Q. Is that because the cylinder and the
12 fuel basket were not modeled independently?

13 DR. SOLER: That was because in HI-STORM
14 the fuel assemblies in the fuel basket were lumped
15 as part of the MPC, and it was treated just as one
16 single body.

17 Q. Let me ask you then, sir. It says in
18 the next sentence --

19 DR. SOLER: Which document?

20 Q. I'm sorry. We're going back to State
21 199, your presentation.

22 DR. SOLER: Okay.

23 Q. And I'm again at the bottom of page 7,
24 second to last paragraph, second to last sentence.

25 DR. SOLER: Gotcha.

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1 Q. "In particular, the computation of the
2 inertia properties of the various regions of the
3 structure and evaluation of the contact spring
4 stiffness involve tedious numerical work." Is that
5 correct?

6 DR. SOLER: That's what it says.

7 Q. Now, the evaluation of the contact
8 spring stiffness in State 173 --

9 DR. SOLER: Okay.

10 Q. Are all those computations set forth in
11 that document?

12 DR. SOLER: I do not believe so. I
13 think that there are some references to earlier
14 documents where the theory was set forth and we
15 simply referred to the earlier documents.

16 Q. So those computations are not a part of
17 173?

18 DR. SOLER: No. I believe that we made
19 reference to I would say the original document.
20 But the computations that were specifically
21 relevant to the new earthquake were included in
22 here, and Appendix C, which includes mass and
23 inertia properties, was put in for reference.

24 JUDGE FARRAR: Your Honor, I'd like to
25 move the admission of Exhibits 197, 198, and 199.

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1 We could take those one at a time if there are
2 issues.

3 JUDGE FARRAR: See if we can do them all
4 at once. Applicant have any objection to any of
5 them, or do you need a minute to look at them?

6 MR. GAUKLER: No objection to 197, no
7 objection to 198. With respect to 199, I believe
8 that it is irrelevant because it involves the
9 HI-STAR cask and it's not the HI-STORM. Might go
10 into questions of Dr. Soler why it's irrelevant,
11 but I think where he's identified differences, et
12 cetera, it's not a HI-STORM cask. Therefore we
13 believe it's irrelevant, would be misleading.

14 JUDGE FARRAR: Staff?

15 MR. O'NEILL: We don't have any
16 objections to 197 or 198. Take a look here at 199.

17 JUDGE FARRAR: All right, then 197 and
18 198 will be admitted.

19 (STATE EXHIBITS-197 AND 198
20 WERE ADMITTED.)

21 JUDGE FARRAR: Mr. Soper, to help us
22 with 199 with the irrelevancy objection, what's the
23 purpose for which you offer it?

24 MR. SOPER: In the 2,000-year analysis
25 itself, it's State 173 at page 6 that describes, "a

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1 recent technical paper contains similar information
2 regarding the methodology, acceptance criteria, and
3 modeling of the HI-STAR 100 metal cask storage
4 system." Makes specific reference to this report,
5 and, as Dr. Soler says, this is the methodology to
6 model a freestanding cask.

7 JUDGE FARRAR: And what is 173?

8 MR. SOPER: 173 is the Holtec 2,000-year
9 seismic event analysis for PFS that is their -- it
10 supports their license application.

11 JUDGE FARRAR: And why was that a state
12 exhibit?

13 MR. SOPER: I guess because we offered
14 it first. I'm not trying to be flippant. I have
15 been advised by Ms. Chancellor that Holtec cited
16 certain portions of this report but not put the
17 whole thing in. As a result, we entered the whole
18 thing.

19 JUDGE FARRAR: And you're saying in that
20 is a reference to this proposed State Exhibit 199.
21 Mr. Gaukler?

22 MR. GAUKLER: First of all, it's just a
23 reference to it. It doesn't tie it to any
24 particular issue in 173. Dr. Soler's already
25 explained why the particular sections that he's

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1 talked about are not relevant here. And there may
2 be portions of the document may be relevant to 173,
3 but he's not talking about those in his examination
4 of Dr. Soler, and therefore it would be irrelevant
5 and misleading to put it in.

6 JUDGE FARRAR: Well, if it's relevant,
7 if some portions of it are relevant, I'm not much
8 concerned it would be misleading because it's only
9 us.

10 MR. SOPER: We have two things, your
11 Honor. The relationship between DYNAMO and Visual
12 NASTRAN is explained in terms of this report, and
13 this is a paper by Dr. Singh and Dr. Soler on this
14 very subject, methodology of analyzing casks under
15 seismic conditions. And it's cited in their own
16 report. So I don't know what greater relevance we
17 could get here.

18 JUDGE FARRAR: Dr. Soler, let me ask
19 you, maybe I misunderstood, but I thought earlier
20 you said that in what I thought was a large
21 deflection case DYNAMO predicted no cask turnover
22 and Visual NASTRAN predicted it would. I thought
23 that's the opposite of what we were concerned about
24 earlier in the day.

25 DR. SOLER: No, I don't believe so. The

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1 point I was trying to make is that DYNAMO is a
2 small deflection program, and whatever it predicts
3 has to be looked at carefully when the results are
4 obviously showing large deflections.

5 JUDGE FARRAR: So in this case, a large
6 deflection case, DYNAMO resulted in the error of
7 not showing turnover --

8 DR. SOLER: You could say that.

9 JUDGE FARRAR: -- and when you ran
10 Visual NASTRAN in which you had confidence, it
11 showed.

12 DR. SOLER: That is an appropriate
13 characterization.

14 JUDGE FARRAR: Now, this animation we
15 just saw, that was under DYNAMO?

16 DR. SOLER: No, that animation is Visual
17 NASTRAN. There is no visualization capability in
18 DYNAMO.

19 JUDGE FARRAR: Okay, thank you.

20 JUDGE LAM: So is it true, Dr. Soler,
21 your point is this: DYNAMO is a small deflection
22 program but a tipover angle is 22 and a half
23 degrees; when you see 20 degree, a red flag was
24 raised.

25 DR. SOLER: Right.

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1 JUDGE LAM: So you reran your model with
2 Visual NASTRAN which subsequently predicted a
3 tipover?

4 DR. SOLER: Well, I wouldn't necessarily
5 characterize a specific angle as being one that
6 would raise a red flag. The results that we
7 obtained using DYNAMO in the 2,000-year earthquake
8 study were sufficiently small, on the order of
9 three, four, five inches, that we did not raise any
10 red flag at the time this report was submitted.
11 But in this presentation, this report where we
12 essentially without regard for worrying about
13 whether DYNAMO was a small or large deflection
14 program, we simply ran it for .6 g's, the HI-STAR,
15 and it predicted that the cask, the top of the cask
16 would, I believe the top of the cask would move 70
17 inches but yet the program didn't blow up. It
18 predicted 70 inches, and then at the end of the
19 earthquake it was still there in the sense that the
20 cask was still vertical.

21 We made certain plots from it, but
22 they're just plots that you can't really see what
23 happens. And at 70 inches when you have a cask
24 whose base is only 83 inches in diameter compared
25 to the 133 inches we're talking for HI-STORM, it is

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1 not unreasonable to suspect that a cylinder of a
2 133-inch diameter base is a lot more stable than a
3 cylinder with only an 83-inch diameter base. There
4 are some height differences and weight differences,
5 obviously, but it was certainly not something that
6 I would call a small deflection result; and
7 therefore, for the purposes of illustrating that
8 fact to the people at the conference, I ran the
9 second simulation. The second -- this simulation
10 with Visual NASTRAN was not part of the submitted
11 paper. It was part of the presentation.

12 MR. TURK: May I suggest that perhaps
13 there's a clarification that we need in order to
14 understand the testimony? The witness has talked
15 about small deflection versus large deflection.
16 Perhaps I've missed the explanation of what
17 deflection the witness is referring to. And maybe
18 if we clarify that, it will be understandable
19 whether this is relevant or not relevant.

20 JUDGE FARRAR: Go ahead, Dr. Soler.

21 DR. SOLER: Perhaps my characterization
22 in the paper referring to deflections is
23 inappropriate. The correct representation of what
24 I mean is if the body starts here and ends up over
25 here or ends up with a significant rotation, in

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1 other words, it's a rigid body, so that if it
2 significantly changes its position or orientation,
3 meaning the location of its center of mass and the
4 orientation of the longitudinal, lateral and the
5 two lateral axes, if a program that I'm using which
6 I know to be only a small deflection program is
7 predicting large changes in any or all of those
8 characters of a rigid body, I am going to take a
9 second look at it in practice. And it's an
10 engineering judgment as to when you start worrying
11 about the results of your analysis.

12 MR. TURK: I note for the record, your
13 Honor, as Dr. Soler was giving that explanation he
14 was holding a glass in his hand, and he either
15 moved the glass noticeably to one side or he tilted
16 it noticeably to one side so that the center of
17 mass, i.e., the center point of -- at the top of
18 the cylinder was moved relative to where it had
19 started out. And the reason I'm making this
20 point -- and I'd ask the witness if that's correct,
21 if that's what he was doing.

22 DR. SOLER: That is correct.

23 MR. TURK: It seems to me that the
24 difference here is talking about a HI-STAR cask,
25 which is narrow, tall and thin, versus HI-STORM,

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1 which is a stubby cylinder, as Dr. Soler refers to
2 it. That's -- it's the deflection of the center of
3 mass of that cask that we're addressing here. And
4 I guess my question to Mr. Soper, if your Honors
5 permit it, is what is the purpose of the offer,
6 which is what Judge Farrar yourself asked. If it's
7 not relevant to HI-STORM, then what's the purpose
8 of it?

9 JUDGE FARRAR: I thought he answered
10 that already.

11 MR. TURK: And it was just because it
12 explains the way to do an analysis?

13 JUDGE FARRAR: Yeah. Well, let's short
14 circuit this. What's Staff's position on
15 admissibility of this document?

16 MR. TURK: May we have a moment, your
17 Honor?

18 JUDGE FARRAR: No, because you're going
19 to say one of two things. You're going to say it's
20 out, but we're going to admit it. So it doesn't
21 matter if you say it's out or it's in. The
22 document's admitted.

23 (STATE'S EXHIBIT-199 WAS ADMITTED.)

24 MR. TURK: Thank you very much.

25 JUDGE FARRAR: I'm sorry. Sometimes I

1 try to be funny. I wasn't trying to be funny.

2 MR. TURK: If we're all going to -- if
3 there's a certain number of words to speak in life,
4 you've helped me spend my life.

5 MR. SOPER: Your Honor, this would
6 conclude our cross of their rebuttal, of Dr. Singh
7 and Soler's rebuttal. If I might, to --

8 JUDGE FARRAR: Hold on a minute. I
9 thought you were going to -- we gave you the right,
10 but we reserved your right to do more cross after
11 you had more time to study this document and after
12 the presentation.

13 MR. SOPER: I meant for the day. I'm
14 sorry. Excuse me.

15 JUDGE FARRAR: And you want to do what
16 with Dr. --

17 MR. SOPER: Well, we'd like to call
18 Dr. Khan back briefly, and he would like to leave
19 in 20 minutes. I'm almost afraid to say that,
20 but...

21 JUDGE FARRAR: Okay, let me ask
22 Dr. Singh one question. Back a couple hours ago
23 when we were talking about shake table tests, you
24 gave a number of reasons why you didn't think they
25 needed to be done. One of the reasons I think you

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1 gave was that if you did it and you went through
2 all that effort and time and expense, at the end it
3 would just show the casks standing up anyhow.

4 DR. SINGH: That's correct.

5 JUDGE FARRAR: So you're, I take it from
6 that answer you're 100 percent certain in the
7 validity of your analyses that without that test
8 you know to a moral certainly it's going to stand
9 up?

10 DR. SINGH: I know to absolute technical
11 certainty, as long as the laws of nature don't
12 change on us, this cask will not tip over under the
13 earthquakes postulated for the PFS site. There's
14 absolutely no doubt.

15 JUDGE FARRAR: I just wanted to clarify
16 that. All right.

17 MR. GAUKLER: Your Honor, I don't mind
18 taking Dr. Khan here, but I do have some redirect.
19 Can we put that off until tomorrow when we call
20 them back? That's fine with me.

21 JUDGE FARRAR: They're here tomorrow,
22 and Dr. Khan needs to leave now? All right. Thank
23 you, gentlemen, for your testimony. You'll be
24 excused until tomorrow.

25 Dr. Khan, let's get you up there.

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1 You're still under oath.

2 JUDGE FARRAR: Mr. Soper, this is
3 rebuttal or response of some kind to Dr. Singh and
4 Dr. Soler?

5 MR. SOPER: Yes

6 JUDGE FARRAR: All right, go ahead.

7

8 DIRECT EXAMINATION

9 BY MR. SOPER:

10 Q. Dr. Khan, let me direct your attention,
11 sir, to State 197. Do you have that before you?
12 I'll get that for you.

13 Let me direct your attention, sir, to
14 the Bates stamp 47933 of that document.

15 A. Yes, sir.

16 Q. Have you reviewed that particular page?

17 A. Yes, I have reviewed it.

18 Q. Now, can you tell me if the information
19 that's shown there supports or influences your
20 theories in this matter?

21 A. I guess this is the reason why we felt
22 that rocking behavior should be adequately modeled
23 in any dynamic simulation of the cask, and how that
24 is done has to be verified by test analysis alone
25 is being used as a justification.

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1 Q. Let me direct your attention, sir, to
2 the second full paragraph there. That reads as
3 follows. "The use of nonlinear finite element
4 analysis is a new method for determining seismic
5 stability. If SNC wants to calculate overturning
6 stability by new a methodology, it must be
7 appropriately validated." Do you see that, sir?

8 A. Yes, sir.

9 Q. And do you agree with that statement?

10 A. Yes, sir.

11 Q. And if I were to direct attention
12 further down to the last full paragraph that reads
13 as follows, "The response spectrum for the
14 acceleration time history chosen for the nonlinear
15 analysis for a confirmatory testing must be
16 enveloped by the response spectrum." Do you see
17 that sir?

18 A. Yes, sir.

19 Q. And do you agree with that statement?

20 A. Yes, sir.

21 Q. Is there anything particular about this
22 document, this particular page that you would like
23 to point out in addition?

24 A. Well, I guess the last sentence is, if
25 you continue on, it says, "Furthermore, the

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1 duration of the seismic event must be consistent
2 with high acceleration levels. Large earthquakes
3 that have high acceleration levels are associated
4 with long strong ground motion durations."

5 I guess the duration has been
6 considered, but if you could see the questions that
7 NRC was asking to Sierra Nuclear basically had the
8 similar concern of questions at that time about use
9 of a nonlinear analysis for predicting sliding and
10 rocking. And as you can see in this paper here,
11 testing was one of the means of justifying asking
12 some of these questions.

13 Q. Dr. Khan, the report identified as PFS
14 Exhibit 225, do you have that with you, sir?

15 A. Yes.

16 JUDGE FARRAR: Mr. Soper, before we
17 leave this, who is Sierra Nuclear?

18 THE WITNESS: I guess NRC can answer
19 that. This was to --

20 JUDGE FARRAR: It's all right. Then
21 I'll ask them later. And Mr. Soper read you a
22 question or read something about response spectrum
23 and asked you if you agreed with the sentence. You
24 said yes, but after the blank in the line that
25 sentence continues about in Reg Guide 160 and so

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1 forth and so on. Did you read that whole sentence?

2 THE WITNESS: Yeah.

3 JUDGE FARRAR: Do you agree with the
4 whole sentence.

5 THE WITNESS: Yeah, the damping --

6 JUDGE FARRAR: I just asked you if you
7 agree with it.

8 THE WITNESS: Yes, sir.

9 JUDGE FARRAR: Okay, thank you.

10 Q. (By Mr. Soper) PFS Exhibit 225,
11 according to the testimony of Dr. Soler, was done
12 to contrast or to evaluate the conclusions that you
13 reached in the Altran report that has been
14 introduced as Exhibit 122. Have you reviewed the
15 PFS 225 exhibit, Dr. Khan?

16 A. I did read cursory because the time was
17 not enough, but I read it. At least I know what
18 was -- what is being said in this report.

19 Q. And you saw it for the first time this
20 morning?

21 A. That is correct, sir. A draft copy was
22 sent to me on Federal Express on Saturday.

23 Q. But the revised copy in its present form
24 you saw this morning; is that correct?

25 A. That's correct, sir.

1 Q. For the first time?

2 A. That's correct.

3 Q. From your cursory review so far, do you
4 find any inaccuracies in the attempt to compare or
5 invalidate your results in the Altran report?

6 A. My read on this report is that Dr. Soler
7 chose the model that he has been using on and on
8 that in my judgment does not predict the rocking
9 behavior of the cask adequately. And then use that
10 model and simply change the number of stiffness
11 values, contact stiffness values to match what was
12 given in Altran report and apply the ground motion
13 at the top of the pad or bottom of the spring
14 contact stiffnesses.

15 So they basically use the same model and
16 change a few parameters to do a dynamic analysis.
17 So of course it would show the same behavior as it
18 has been shown in previous analyses by Visual
19 NASTRAN. So I'm not surprised with the results
20 which are being shown here.

21 Q. Does anything in Exhibit 225, in your
22 opinion, serve to invalidate the results of your
23 report shown in Exhibit 122?

24 A. It's just a different analysis by a
25 different program with a different set of

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1 assumptions. So I won't say it invalidates, it
2 just entered a data point in the analysis. That's
3 the way I would describe. We have seen so many
4 analyses, and every time you run an analysis, a
5 different set of assumptions, your sliding
6 displacements are going to change, your rotations
7 are going to be changing; and as you can see, the
8 results are all over for various sort of input
9 assumptions.

10 Q. Dr. Khan, we saw an animation presented
11 by Dr. Singh and Soler earlier today that showed
12 three bouncing balls and another animation showing
13 three casks that also appeared to bounce in slow
14 motion, and they were presented as representing
15 damping factors of 1 percent, 5 percent, and 40
16 percent. Do you recall that video, sir?

17 A. Yes, sir.

18 Q. Can you tell me whether or not that
19 animation was a valid analogy as far as
20 representing the appropriate damping factors to be
21 used in this matter?

22 A. No, sir. If you go and look at the
23 impact analysis that is done in LS-DYNA, and I
24 would like to see what damping LS-DYNA has
25 simulated when impact analysis was performed. And

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1 in general when you have a high impact analysis,
2 most of the energy is absorbed by the distortion of
3 the target object. So the effect of damping is
4 very minimum. For short duration impact problems
5 the effect of damping is almost insignificant. So
6 you basically don't use high damping values in
7 those situations.

8 Now, the damping that we are of concern
9 is how much damping you are going to use to rock a
10 rigid body, or in this case a cask at a certain
11 frequency. And cask is not anchored, therefore,
12 for the rocking mode it is not fixed, it is not
13 rigid. And I think the question from NRC to
14 Sierra, I believe -- to Sierra Nuclear is
15 reflecting, my assumptions, basically, what those
16 contact stiffness should be and what kind of
17 damping one should have to simulate a rocking
18 behavior appropriately. It has nothing to do with
19 the vertical bouncing of an object on a rigid
20 surface.

21 Q. Dr. Khan, is there anything additionally
22 that with your limited review of PFS Exhibit 225
23 that you would like to call to our attention at
24 this time?

25 A. I think this again shows that testing,

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1 some limited testing or some testing should form a
2 basis of all these simulation that we are seeing
3 here by Visual NASTRAN or SAP 2000 or any other
4 program. They are all theoretical representation,
5 a numerical representation of analyst idea of how
6 this is going to behave. And in reality how this
7 is going to behave, tests and only tests is going
8 to predict. And that's all I would comment on.

9 Q. So would you say that this Exhibit 225
10 strengthens your resolve that testing is necessary
11 at the PFS site?

12 A. That is correct, sir.

13 MR. SOPER: That's all that we have for
14 Dr. Khan right now.

15 JUDGE FARRAR: Dr. Khan, what time do
16 you have to leave? Do you have a plane?

17 THE WITNESS: Yeah. I'm going to get a
18 ride from somebody. 7:35 is my flight.

19 JUDGE FARRAR: Okay, Mr. Gaukler?

20 MR. GAUKLER: Yes.

21 JUDGE FARRAR: How long do you need?

22 MR. GAUKLER: I would guess about ten,
23 fifteen minutes.

24 JUDGE FARRAR: Do five.

25

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CROSS-EXAMINATION

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BY MR. GAUKLER:

Q. Dr. Khan, you claim that Dr. Soler did not replicate your model in Exhibit 225 because you used the same old model as before. I think those were your words.

A. That is correct.

Q. And you say the model did not predict rocking of the cask. First of all, you've seen simulation of the casks where you've seen rocking using Visual NASTRAN, isn't that correct?

A. Yes, sir.

Q. So it can predict rocking of the cask, correct?

A. It depends how you represent rocking in your mathematical simulation.

Q. But it can predict rocking, correct?

A. Sure, it will predict it.

Q. And next thing. You said that they only changed the input parameters to the model. But if I recall correctly, you said that the Holtec model was inappropriate because they used the wrong contact stiffness and they used the wrong damping value. Isn't that what you said in your report?

A. Those were -- I said they did not use

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1 range of parameters to show the dynamic sensitivity
2 of their model. The range of -- I still don't know
3 which model is correct and which one is not
4 correct.

5 Q. My point, though, was, you took issue
6 with the Holtec model because of the contact
7 stiffness and the damping, correct?

8 A. That is correct, sir.

9 Q. Those were the bases on which you took
10 issue with that model, correct?

11 A. That is correct, sir.

12 Q. And isn't it true that in PFS Exhibit
13 225, Holtec used your input parameters for contact
14 stiffness and damping that paralleled your case 3
15 in Table 3, correct?

16 A. That's correct.

17 Q. So therefore they used the parameters,
18 one set of parameters that you said should have
19 been used, correct?

20 A. Sure.

21 Q. And in that sense they duplicated your
22 model, correct?

23 A. They -- no, they did not duplicate the
24 model. They just used the stiffness for the
25 contact portion. The model is not duplicated the

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1 way I have modeled in SAP 2000. They're entirely
2 different modeling techniques.

3 Q. But they put the same input parameters
4 that you used in your model and they put it into
5 the their model, correct?

6 A. That's correct, sir.

7 Q. And you have taken issue specifically
8 with those input parameters. You did not take
9 issue with other aspects of the Holtec model, did
10 you, in your report?

11 A. We just said -- yes, damping, and the
12 stiffness would be --

13 Q. Right. So you did not take issue with
14 other aspects of the model, correct?

15 A. That's right.

16 Q. And therefore Holtec took what you had
17 suggested and put into their model?

18 A. That's right.

19 Q. Which presumably would correct what you
20 had perceived to be incorrect in their model.
21 Wouldn't that be the case, Dr. Khan?

22 A. I should -- I hope so.

23 Q. I want to -- Exhibit 197, you were
24 referred to a page which was an NRC question, I
25 guess, to Sierra Nuclear. What do you know about

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1 this exhibit and the origin, if anything?

2 A. I have seen this first time, sir.

3 Q. Excuse me?

4 A. I have seen this first time today.

5 Q. This is the first time you saw it today?

6 A. Exactly.

7 Q. So you have no understanding of the
8 background or the history of this?

9 A. Only with respect to this, it was
10 attached to this shake table testing.

11 Q. Do you know if the NRC actually said
12 these things or followed through on these things?

13 A. No, sir.

14 Q. In terms of -- you claim that it
15 supports you in terms of damping. Strike that.
16 You mentioned something about this exhibit
17 supporting you with respect to contact stiffness,
18 et cetera. I see no reference to contact stiffness
19 in this exhibit. Do you?

20 A. No. What this exhibit was trying to
21 address is the sensitivity of a use of nonlinear
22 finite element matter and how one is going to model
23 the cask stability and all the parameters
24 associated that would affect the cask stability.

25 Q. Is SAP 2000 a finite element model?

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1 A. Yes, sir.

2 Q. Is Visual NASTRAN a finite element
3 model?

4 A. I don't really know, because I have not
5 seen it. Dr. Soler said yes, so I would believe
6 him.

7 Q. I don't think you've characterized
8 Dr. Soler's testimony correctly, but the record
9 will speak for Dr. Soler as he testified.

10 A. Sure.

11 MR. GAUKLER: Give me two seconds, your
12 Honor.

13 JUDGE FARRAR: Dr. Khan, while counsel's
14 consulting, the company you work for you're an
15 employee of, not an owner?

16 THE WITNESS: That is correct, sir.

17 JUDGE FARRAR: Do you have to leave
18 tonight because you have some business related to
19 your employer?

20 THE WITNESS: That's right. I could
21 come back, sir, if you need me to.

22 Q. (By Mr. Gaukler) One other question.
23 In terms of the dropping of the ball and the cask,
24 in reality there's no difference between that
25 impact and the impact of a cask that's rocking

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1 against the pad, correct?

2 A. It's the duration of impact that's
3 important. It is the duration of impact. When two
4 objects strike together at a certain velocity or
5 high speed, then your damping is one value. If you
6 have a rocking motion -- I think the point which is
7 being missed is how the contact stiffness at the
8 bottom are amplifying or deamplifying the rocking
9 motion.

10 Q. Really, in terms of duration and how
11 hard it hits, isn't it just a matter of how you
12 model the damper in your model?

13 A. When you have a rigid body sitting only
14 by X number of contact stiffness, the motion of
15 that body is simply being driven by those
16 stiffnesses.

17 Q. Isn't a matter of -- in terms of
18 modeling, damping just a matter of the appropriate
19 input parameters in terms of the damping you put in
20 in terms of taking into account the velocity and
21 the impacts and how hard it hits, and do you have
22 any reason to believe that Holtec did that wrong?

23 A. No. We are using the regulatory
24 guidelines which are provided for rocking, which is
25 bending, those sort of behaviors under certain

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1 parameters. You may find those damping values to
2 be smaller. Unless you have a test data to show
3 high values, you cannot use 30 percent or 40
4 percent as been shown, and I think one of the
5 things that I tried to do yesterday was when you
6 look at the 40 percent -- spectra plotted at 40
7 percent damping, object was not responding because
8 it was almost rigid.

9 Q. When you're referring to the Reg Guide,
10 you're referring to Reg Guide 1.61 that you talked
11 about yesterday?

12 A. That's correct.

13 Q. And which documents we've addressed
14 today?

15 A. That is correct.

16 Q. And that addresses structural damping,
17 correct?

18 A. That's right.

19 MR. GAUKLER: I have no further
20 questions.

21 JUDGE FARRAR: Okay. Thank you,
22 Mr. Gaukler. If you need to do something further
23 later, we'll do that. And Staff has no questions,
24 I assume?

25 MR. TURK: We have a limited number.

1 JUDGE FARRAR: Why?

2 MR. TURK: Because Dr. Khan has assumed
3 explicitly that the Staff's documents cited here
4 supports him, and he has no knowledge.

5 JUDGE FARRAR: Okay, you're going to
6 have to ask him next time.

7 Go ahead, catch your airplane.

8 MR. TURK: Two questions?

9 JUDGE FARRAR: Two questions, go ahead

10

11 CROSS-EXAMINATION

12 BY MR. TURK:

13 Q. What cask was at issue in this Sierra
14 Nuclear document?

15 A. It was considered -- it was attached as
16 a part of this --

17 Q. My question was, what cask was at issue
18 in this document?

19 A. I don't know sir.

20 Q. Do you know what Sierra Nuclear
21 Corporation is?

22 A. I heard about it, but I do not know.

23 Q. Do you know what their submittal to the
24 NRC Staff consisted of?

25 A. No, sir.

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1 Q. Do you know why the Staff raised these
2 questions with Sierra nuclear?

3 A. No, sir.

4 MR. TURK: Thank you very much.

5 JUDGE FARRAR: Good job, Mr. Turk. Good
6 job, Dr. Khan. Go about your employer's business.
7 Thank you, and we'll see you again sometime.

8 Mr. Gaukler and Mr. Turk, if on
9 reflection you need to ask further questions, we'll
10 find a way to do that. Appreciate your letting us
11 extend the same courtesy to this witness was we've
12 done for others.

13 Okay, what's up for tomorrow?

14 MR. GAUKLER: I believe Dr. Arabasz.

15 MS. CHANCELLER: Dr. Arabasz will be
16 here at nine o'clock if that's your desire, or do
17 you want to put Dr. Singh and Dr. Soler on first
18 thing?

19 MR. GAUKLER: Well, it will take us some
20 time to go through and do what the Board suggested,
21 and my thought was that I would be here with
22 Dr. Arabasz and Mr. Diaz will take care of that and
23 come back.

24 MR. TRAVIESO-DIAZ: The reason I
25 suggested eleven is, I would like to review the

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1 transcript of today to see if there's anything
2 created by looking at what was said. And that's
3 what I will do first thing.

4 MS. CHANCELLOR: I'll ask Dr. Arabasz to
5 be here at 9:00 a.m.

6 JUDGE FARRAR: Mr. Turk, we all seem to
7 have misplaced your cross-examination plan. We
8 were looking for it, all three of us. Who did you
9 ship it to?

10 MR. TURK: I received that message
11 yesterday. I did fax you last night a revised
12 cross-examination plan, and I brought hard copies
13 with me. I'll hand them to now.

14 JUDGE FARRAR: Let me see them. Is that
15 the same plan you've given us before?

16 MR. TURK: No. I tried to reflect the
17 additional questions that I wanted to raise based
18 upon Mr. Gaukler's previous cross-examination. You
19 may recall that I had indicated I had more
20 questions because of what had transpired, so this
21 one blends them together.

22 JUDGE FARRAR: Where did you fax it to?

23 MR. TURK: To the hotel. But it was
24 three o'clock in the morning Washington time, so I
25 don't know if they were able to get it to you this

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1 morning or not Probably not.

2 MR. GAUKLER: Off the record.

3 (Discussion off the record.)

4 MS. CHANCELLOR: Should Dr. Bartlett
5 also be prepared in case he is the next witness
6 after Dr. Arabasz tomorrow?

7 JUDGE FARRAR: You were going to give --
8 that's the one where you were going to have new
9 testimony just by him instead of as a panel?

10 MS. CHANCELLOR: That's correct. And I
11 need to go over something with him in the morning.

12 JUDGE FARRAR: Well, I'll give you the
13 answer to that question in a moment.

14 Mr. Turk --

15 MR. TURK: Four hours.

16 JUDGE FARRAR: How did you know what I
17 was going to ask?

18 Let me make this comment, because the
19 Commission requires that we manage our proceedings
20 well, and that applies to everybody. In reflecting
21 over the events of May 17th and your
22 cross-examination of Dr. Arabasz where I kept
23 asking you to connect things up, and you may have
24 an opinion about whether you did and I may have an
25 opinion about whether you didn't, one of the

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1 concerns that was on my mind is that this is an
2 unusual situation that, as I think we've said a
3 couple of times, in most instances in these
4 proceedings what's at issue is the Applicant's
5 presentation. That's something I think some people
6 have tried to attack in the past, that the
7 Applicant shouldn't get its license because the
8 Staff didn't do a good job. And I think the juris
9 prudence is, Staff can be asleep for four years if
10 the Applicant has a good preservation and they can
11 win. And that's reflected in the notion that the
12 Staff, the caliber of the Staff work is not an
13 issue in the proceedings. In this particular case
14 we have the very unusual situation where because of
15 the exemption and the fact that it was tied in with
16 the litigation, the Staff judgment is under attack.

17 My concern about the tenor of your
18 cross-examination last time was that perhaps having
19 staff judgments under direct attack had led someone
20 somewhere to issue instructions that your
21 cross-examination would be defending the Staff's
22 honor and therefore had to be of a different nature
23 than all the other kinds of cross-examination we've
24 seen here. I thought there was too much -- that we
25 were focusing too much on minutia and not what was

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1 going on. I could be wrong in this impression, but
2 that cross-examination seemed to be different from
3 other cross-examination you've done in this
4 proceeding. And so I wanted to make sure we were
5 on the same wavelength before we started tomorrow.

6 MR. TURK: As I understand May 17th's
7 cross-examination, if you recall, I was sitting
8 here alone that day. I had sent all my technical
9 staff back to their respective offices, because
10 they had been out here for two weeks plus and I
11 thought they should not be burdened.

12 During the cross-examination of --

13 JUDGE FARRAR: I've been out here for
14 six weeks.

15 MR. TURK: You have done more than any
16 of us your Honor, you and Judges Kline and Lam.

17 So I was sitting here without
18 assistance. But also the cross-examination that I
19 think was of concern to you had to do with the Juan
20 de Fuca and Pacific plates. It was the tectonic
21 plate theory that Dr. Arabasz had advanced that day
22 he was describing the epiphany that he had. That
23 epiphany caught me by surprise and without support,
24 and I think that may have caused more labored
25 cross-examination than I would have liked, and I

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1 believe that we had the same feeling, if not
2 stronger. I think we can tailor it more tomorrow.

3 JUDGE FARRAR: Okay. I just wanted to
4 make sure that whatever time you needed was well
5 spent and was not -- and the reasons you've given
6 are excellent ones for why -- for the events of
7 that day, and I was just concerned that it had to
8 do with the unusual situation we're in with the
9 staff rather than other people being challenged.
10 And I'm happen to hear that's not the case.

11 MR. TURK: I should also point out,
12 nobody has instructed me to defend the Staff's
13 honor or to defend the Staff. It's the natural
14 instinct of a litigator when somebody's pointing a
15 finger at your team, as a lawyer you take the blow
16 and you try to address it where you believe it
17 belongs.

18 JUDGE FARRAR: Okay, that's fair.

19 MS. CHANCELLOR: Your Honor, I think
20 during Mr. Turk's cross I noted at one stage that I
21 thought he was being hostile, and I hope that that
22 tenor doesn't pervade in the hearing tomorrow.

23 JUDGE FARRAR: I'm sure it will not.

24 MR. TURK: I'm sure Ms. Chancellor will
25 catch me if I --

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1 JUDGE FARRAR: I just want to make sure
2 that whatever time you said you needed was for a
3 valid purpose. Ms. Chancellor, Mr. Turk then said
4 he needs four hours, so that gives you an idea. So
5 we should -- have you had your chance?

6 MR. GAUKLER: I do have some recross
7 based on Mr. Turk and the Board questions.

8 JUDGE FARRAR: But have you had one
9 chance already?

10 MR. GAUKLER: I'm taking cross. I just
11 say I have some recross based on the Board's
12 questions, some of Mr. Turk's questions, and my
13 best guess right now is 15 to 20 minutes based on
14 that.

15 MS. CHANCELLOR: That means an hour.
16 But we have to factor in Dr. Singh and Soler. Is
17 that tomorrow, your Honor, and then come back at
18 11? Or Thursday?

19 JUDGE FARRAR: No, that's tomorrow.

20 MR. TRAVIESO-DIAZ: I cannot predict how
21 long it will take for Mr. Soper to follow up on my
22 questions, but looking at the report in a
23 superficial manner, I don't expect that my question
24 of Dr. Singh and Dr. Soler will take more than half
25 an hour. I will estimate half an hour to an hour

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1 at the very outside. So my hope is that we can
2 finish with Dr. Soler and Dr. Singh by the lunch
3 break.

4 JUDGE FARRAR: I think if you add up all
5 those numbers, we maybe do and maybe don't get to
6 Dr. Bartlett. But he's local, right?

7 MS. CHANCELLOR: Yes, he's local, and he
8 will be here anyway.

9 JUDGE FARRAR: Then if we get him
10 started and get things going, we can at least
11 accomplish that, and then we can refamiliar at the
12 end of the day about where we are. Is there
13 anything else we need to do tonight?

14 MR. TURK: I didn't understand something
15 Mr. Travieso-Diaz just said. Are we starting with
16 Dr. Arabasz in the morning?

17 JUDGE FARRAR: We're starting with
18 Dr. Arabasz first thing, but at eleven o'clock
19 we're breaking for --

20 MR. TURK: Dr. Singh and Soler.

21 JUDGE FARRAR: -- for Dr. Singh and
22 Soler on the document that we were arguing about
23 today.

24 MR. TURK: And then I'll pick up
25 afterwards.

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JUDGE FARRAR: Then you will resume.

Okay, good. Thank you all.

(Proceedings adjourned for the day
at 6:01 p.m.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Private Fuel Storage, LLC

Docket Number: Docket No. 72-22-ISFSI

ASLBP No. 97-732-02-ISFSI

Location: Salt Lake City, Utah

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

15/ Diana Kent
Diana Kent
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