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NUCLEAR REGULATORY COMMISSION

Title: Private Fuel Storage, LLC

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

Location: Salt Lake City, Utah

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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

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

On May 13, 2002 the above-entitled matter came on for hearing, pursuant to notice, before:

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

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

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

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I N D E X

E X A M I N A T I O N

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E X H I B I T S

Monday, May 13, 2002 9:00 a.m.

P R O C E E D I N G S

JUDGE FARRAR: Good morning, everyone. Hope you all enjoyed your at least a one-day weekend. Back on Monday morning ready to continue the State's cross-examination of the Staff panel.

Any preliminary matters? Then we'll get started.

CROSS-EXAMINATION (CONTINUED)

BY MS. CHANCELLOR:

Q. Good morning.

DR. STAMATAKOS: Good morning.

Q. I'd like to just clarify a couple of things in your testimony. On answer 19, page 25 of your testimony, I guess this is you again, Dr. Stamatakos. No, Dr. McCann was responsible for 25. Is that right? No, 19. Beg your pardon. It's Dr. Stamatakos. I was right the first time. Page 25.

In the second paragraph which begins, Third, in adopting the regulations in 10 C.F.R. Part 72 the Commission indicated that the design

earthquake for an ISFSI should be determined on a case-by-case basis. What is your understanding of adopting regulations?

DR. STAMATAKOS: The adoption of regulations is to set standards for license applications. But in this instance, because of the ongoing efforts to revise Part 72 to incorporate a probabilistic approach, the Commission recognized that some work needed to be done, and I think our interpretation of that is that they wanted to look at a number of site-specific cases for coming to a complete decision on how to implement that in the regulation.

Q. And this regulation was enacted in 1980; is that correct?

DR. STAMATAKOS: I don't know the exact year. I'd have to check that.

Q. Is it your testimony that you can go around the regulations and not comply exactly with the regulations and use a case-by-case analysis that the regulations prescribe in a specific approach?

MR. TURK: Objection, your Honor. I think she's asking this witness for a legal interpretation of the regulations. He's an expert

in seismology and geological matters. He's not presented to interpret NRC regulations.

MS. CHANCELLOR: Well, then I suggest that this paragraph be stricken: Third, in adopting the regulations, the Commission indicated a case-by-case -- to determine the DBE on a case-by-case basis. Either this is not an interpretation of the -- of a legal issue, in which, other words, then I'm entitled to ask him about it; and if this is a legal interpretation, you've just said that he's not qualified to testify about that. So I don't -- your Honor, I don't think counsel can have it both ways.

JUDGE FARRAR: Why don't we do this. Why don't we let this line of questioning continue but with instructions to the witness, what the state and we are looking for is not your legal interpretation but perhaps the practice that's followed under this regulation. If you're familiar with that you can testify as to that, but not as to what the legal interpretation may be. And we'll see where we get with that, and then, Mr. Turk, you're free to renew your objection if that doesn't work.

MR. TURK: Thank you.

DR. STAMATAKOS: Could you read back the question?

Q. (By Ms. Chancellor) I'll rephrase it. Do you believe that it is an appropriate practice for the NRC Staff to review a design-basis earthquake on a case-by-case basis if the regulations prescribe a specific approach?

DR. STAMATAKOS: My interpretation in discussion with NRC Staff is that would only be appropriate in cases where an applicant has applied for a specific exemption from regulations, and then they would task us to evaluate the technical merits of that exemption if they deemed that the exemption was at least appropriate in terms of evaluation.

Q. Thank you. In answer 25, page 30, this one is Dr. McCann.

JUDGE FARRAR: Before you leave that, that statement in the middle of -- the quoted material in the middle of page 25, how could an ISFSI not involve a massive structure? It says for those which do not involve massive structures. What's an ISFSI without a massive structure?

DR. STAMATAKOS: I think you have to go back and look at what the Commission was deciding on it at that time. And I think when these were

first envisioned they were not envisioned as cask, canister and pad, so they were envisioning a different single structure storage facility for something of that nature. That's my interpretation of what that meant. And when you look at what was written in the TMI findings, I think that there's some clarification there. And I don't remember the details, but again, I think they did not envision the changes in the technology that allowed these newer types of storage facilities.

JUDGE FARRAR: Okay, thank you.

Q. (By Ms. Chancellor) Dr. McCann, answer 25, page 30, second paragraph. Are you there?

DR. McCANN: Yes.

Q. Beginning of this paragraph states that the underlying philosophy of DOE Standard 1020-94 is to use a risk-graded approach. And then you go on to state that although not expressed in the same terminology, NRC relies on consideration of risk. Is that a fair summary there to that point?

DR. McCANN: Yes, I see it.

Q. And then as a rationale for that, the NRC relies on consideration of risk just like DOE does in 1020. You actually use the standard to say that the NRC is the same as the standard; is that

correct? If you look at No. C on page 31.

MR. TURK: Are you asking if the Staff relies on the DOE standard?

MS. CHANCELLOR: Asking him to explain his testimony which -- the paragraph starts out, "The underlying philosophy of DOE Standard 1020-94 is to use a risk-graded approach," and he says NRC relies on risk. He uses three examples, and the third one is DOE Standard 1020. Trying to understand this logic.

DR. McCANN: And what's the question?

Q. (By Ms. Chancellor) The question is, are you justifying NRC's reliance on risk to show that it's similar to DOE Standard 1020 by relying on DOE Standard 1020?

DR. McCANN: The question isn't entirely clear to me. If you're asking are we in this testimony attempting to justify the NRC regulation by virtue of or reference to the DOE standard, no, we're not trying to justify the NRC regulation.

Q. No, what I'm getting at is the reference on page 31 of your testimony where you give three -- the Staff considered (a), (b), and (c), and (c) is DOE Standard 1020, and looking at your testimony, you seem to be saying that the Staff is

relying on DOE 1020 to say that it's the same as 1020. I'm trying to get at why this is not a circular logic, circular reasoning. If you look at page 31, item (c), can you explain why that is not circular reasoning?

MR. TURK: If we could, could you allow the witness to read through that answer?

MS. CHANCELLOR: Oh, certainly.

JUDGE FARRAR: Sure.

DR. McCANN: The answer that's provided to question 25, which is really the in-depth response to question 24. And question 24 relates to the State's assertion that in supporting a grant of exemption based on a 2,000-year return period, the Staff relies upon the Department of Energy Standard 1020. Reading this loosely. And specifically the category-3 facility SSC performance standard that has such a return period.

So the answer is being given to that. We're addressing the concern of the state that we have somehow adopted DOE standard 1020. What we're attempting to do in the response in 25 is recognize what is going on with the Commission in their evolution to a risk-informed regulatory environment. And at the same time, as a point of

reference in our thinking and in ultimately approving the exemption request, recognizing that DOE has gone through a similar evolutionary process in which they have, one, recognized the needs and benefits of going that direction, but more importantly, they have -- they have taken it to the level such that the practicing engineer can now utilize the specific products of a fully developed risk-informed approach.

And what we're attempting to do here is utilize what the Commission has given us in terms of what I'll call qualitative guidance, albeit with the foundation of what they've done on the reactor site both qualitatively and quantitatively in the sense of a risk-informed regulatory practice, we're trying to integrate those ideas together to show that this was part of our thinking, that we had a certain level of regulatory qualitative guidance, if you will, and the benefit of mature guidance as it had developed over in the DOE sector.

Q. Topic sentence of paragraph 2 is "The underlying philosophy of DOE Standard 1020 is to use a risk-graded approach." Then you say, although not expressed in the same terminology, the NRC relies on a consideration of risk. I still

don't understand why part -- and then you use -- the Commission's risk-related statement is (a); (b) is the previous approval of INEEL ISFSI; and (c) is DOE Standard 1020 itself. So maybe I'm beating a dead horse here, but you still haven't explained to me why this isn't circular reasoning. Aren't you relying on DOE Standard 1020 based on this topic sentence in paragraph 2 to say that NRC's risk approach is sort of like DOE Standard 1020 because of DOE Standard 1020?

MR. TURK: Excuse me. I would have to object. I don't understand why that's a circular reasoning.

MS. CHANCELLOR: It's fine. I'll move on.

JUDGE FARRAR: Before you move on, if I were the witness I would have answered, I think, this is not circular, this was how we integrated these different approaches. Is that what you wish you had said?

DR. McCANN: Well, I thought I was attempting to do that. And what I was going to add was that the third point, which appears to be that the point of concern is the case in point in the DOE standard that relates to the Commission's

qualitative statement. So the first sentence is introductory and item (c) is the detail, if you will.

Q. And in that same answer you say that you did not attempt to impose DOE Standard 1020 as a regulatory standard on the proposed PFS facility, correct?

DR. McCANN: Correct.

Q. Isn't it true that DOE Standard 1020 fundamentally couples the mean annual probability of exceedance of 5 x 10-4 with a target size and performance goal of 1x10-4? They interlink those two; is that correct?

DR. McCANN: Yes, they do.

Q. And NRC does not interlink the mean annual probability of exceedance of 10-4 with -- I guess it's 5x10-4 with the seismic performance goal of a specific probability. Is that correct?

DR. McCANN: My understanding is that at this time the Commission has not established a performance goal both in terms of level of physical performance, meaning damage to the facility, and a probability of occurrence of that damage. However, in the current state of affairs, as I interpret it, the Commission does specifically have that in mind

in the context of what they have done for nuclear power plants and their qualitative guidance with respect to ISFSIs, which is to say that the Commission has in mind that because the hazards are different, the radiological hazards are different at nuclear power plants and at ISFSIs, that indeed there is a difference in terms of performance goals, level of performance and likelihood of occurrence, and therefore the levels of design that would be imposed upon an ISFSI, meaning the probability of exceedance for a design-basis earthquake for an ISFSI would be different than it would be for a nuclear power plant.

Q. It doesn't fundamentally couple those two like DOE does; is that correct?

DR. McCANN: What does not?

Q. NRC Part 72 or the approach you've taken in granting the exemption doesn't fundamentally couple the mean annual probability of exceedance with the target size and performance?

MR. TURK: I object only to the compound part of that question.

MS. CHANCELLOR: I'm trying to compare two things.

MR. TURK: I understand, but you joined

both the regulation and their approach here, and I have no problem with this if you're asking about the approach.

MS. CHANCELLOR: Okay, their approach here is fine.

DR. McCANN: It would be incorrect to say that our review of the seismic hazard analysis and our ultimate conclusion as to the exemption request and what is an appropriate probability of exceedance of the design-basis ground motion is totally uncoupled to the performance of the facility. And let me expand upon that.

Q. That's fine. If that's what you think, that's fine.

MR. TURK: May the witness complete his answer, please?

DR. McCANN: The application --

JUDGE FARRAR: If it bears on the question.

Q. (By Ms. Chancellor) Does it bear on the question?

DR. McCANN: It bears on the coupling issue.

Q. Fundamentally coupled. Not uncoupled, but I said coupled.

MR. TURK: The witness stated that it would be wrong to state that the review is not totally --

MS. CHANCELLOR: Uncoupled.

MR. TURK: I'm sorry -- is totally uncoupled, but he said there is some coupling. He's going to explain that.

Q. (By Ms. Chancellor) Go ahead.

DR. McCANN: The application, as is obvious, is being submitted to the Nuclear Regulatory Commission. What is established are the engineering standards to which the facility would be designed. As, if you will, the practicing engineer among this group, that's one of the elements that I brought to this process. In recognizing that NRC standards, engineering standards were going to be imposed upon the design process, there are, therefore, levels of conservatism, seismic margin, if you will, that will be brought to bear in the design, and therefore it was recognized that that was a given. It wasn't something we had to address explicitly, but it was fully recognized as to what that meant.

Q. Is it a given that PFS complies with NUREG 0800 with respect to foundations? I think

it's 372. Maybe it's 371.

DR. McCANN: I can't speak to the foundations topic.

Q. What about NUREG 0800, seismic design? Is it a given that PFS complies with NUREG 0800?

DR. McCANN: I can't speak to it specifically. What I was referring to was the fact that the design would be submitted to the Commission for their review, and the other side of the house, if you will, would review and presumably judge as to whether or not the standards have been satisfied.

Q. I'd like to turn to the --

JUDGE FARRAR: Before you turn to that, Ms. Chancellor, I hope you didn't get the impression by me supplying the witness's answer that I was trying to help one side or the other. The point I was trying to make, which I think we've discussed earlier in the case, is I know your lawyers tell, you just answer the question, and that's fine. Lawyers have been telling witnesses that from time immemorial. You've been around here long enough to know we do things in this administrative proceeding a little differently, and so if a question, if you think a question isn't

exactly phrased right but you know what the questioner is getting at, we would encourage you in the interest of time to answer substantively the question, because sooner or later we'll get to that. Either counsel will ask you several times until you do understand it exactly, or lawyers will object and we'll skirmish, and 15 minutes later we'll get the answer you could have given at the beginning. I think Dr. Cornell was a good example the other day of taking the Board's questions, anybody's questions and helping us think about them correctly. So we would encourage witnesses to do that.

So Ms. Chancellor, that was the point I was trying to make rather than provide a helpful answer for the Staff.

MS. CHANCELLOR: Oh, your Honor, I would never think you were trying to put one side over the other.

Q. (By Ms. Chancellor) If you'd turn to answer -- on page 27, it's the carry-over of answer 23. 23 starts on page 26 and carries over to page 27. And you state -- who's responsible for 23? Dr. McCann, I believe. You state on page 27, the last paragraph, "Second, Reg Guide 1.165 determined

the Reference Probability." Is it correct that Reg Guide 1.165 is the appropriate starting point for guidance on how to determine the reference probability or an annual probability of exceeding the safe shutdown earthquake ground motions, otherwise known as SSE, at future nuclear power plant sites?

DR. McCANN: I think there were two questions there. Your first one I think is wrong, and I think that question was, is 1.165 the appropriate reference to determine the reference probability. The answer to that is no. It explains how the reference probability was determined, but it is not per se a guide to determine the reference probability.

The second question I believe was, is it the guidance for determining the SSE given that there is a reference probability recommended in that document, and the answer to that is yes.

Q. And that's at future nuclear power plant sites, right?

DR. McCANN: After some date in January 1997, yes.

Q. On page 27, the paragraph we're talking about through the next paragraph. From this

testimony is it fair to conclude that the weight of existing NRC policy considerations indicates that future nuclear power plants licensed by the NRC in the western U.S., W.U.S, should be designed to withstand the mean seismic ground motion with a 10,000-year return period?

DR. McCANN: Could you refer me to exactly where you're reading?

Q. I'm looking at paragraphs -- the last paragraph on page 27, the first paragraph on page -- through the first paragraph on page 29. That discussion there.

DR. McCANN: Okay.

Q. And from that discussion, can you conclude that the weight of existing NRC policy considerations indicates that future nuclear power plants licensed by the NRC in the West should be designed to withstand a mean seismic ground motion with a 10,000-year return period?

DR. McCANN: There's a reference cited there that is a paper presented by members of the NRC Staff. In that paper, and I believe the current DOE 10-20 document suggests that if you were to repeat the process that was going through in developing 1.165 in which they elected to use

the median but repeated the process using the mean seismic hazard results, you would end up with a result that suggests that the reference probability would be approximately 10-4.

Your question also, though, referred to, would that be the design basis for plants located in the western United States. If 1.165 was based on the mean, the indication is both from folks in the NRC Staff who carried out the analysis that's referenced as well as by others, 10,000 years would be the starting point. 1.165 also -- and 1.165 is very explicit in that regard. 1.165 also indicates that for sites located in the western United States that an applicant might want to consider an alternative to the reference probability. But they're very clear that if nothing else is done, then the reference probability as stated in the guide would be the starting point.

Q. Do you know whether the Staff has any plans to submit to the Commission a proposal to use a reference probability for new nuclear power plants in the western United States that is greater than the mean annual probability of exceedance of 1 x 10-4?

MR. TURK: Again, this is to his

knowledge?

MS. CHANCELLOR: Of course, yes.

DR. McCANN: To my knowledge, I don't know of any plans, I just know what's documented in 1.165, which is their guidance to western power plant owners or future owners that the Staff recognizes that the reference probability would likely be higher in the western United States, but the wording in the document suggests it's up to the applicant to come forth and make that case. But they haven't -- they had enough evidence at the time to make that statement.

Q. Dr. Stamatakos, do you know if the Staff has any plans to submit to the Commission the use of a 10,000-year earthquake for new nuclear power plants in the West?

DR. STAMATAKOS: I have no knowledge of that.

Q. Dr. Chen, do you?

DR. CHEN: No, I don't.

MR. TURK: For the record, your Honor, I think it's self-evident that these are not NRC Staff employees and they may not be familiar with whatever is going on in the Staff's thinking. Perhaps I would ask that question of the witnesses

while we're here. Could I ask him to confirm that?

MS. CHANCELLOR: He may do that on redirect, your Honor.

JUDGE FARRAR: Confirm --

MR. TURK: That they're not familiar with what may be current Staff plans.

JUDGE FARRAR: We can almost take notice of that.

Q. (By Ms. Chancellor) Dr. McCann, are you familiar with the Yucca Mountain Topical Report 2, PFS Exhibit FFF?

DR. McCANN: I'm generally familiar with it, yes.

Q. Do you understand that in this document DOE needs to set a reference probability for frequency category-2 design events?

DR. McCANN: No. That category-2 -- no, the design process I'm not real familiar with.

Q. Dr. Stamatakos?

DR. STAMATAKOS: I'm a little more familiar with it because of the work we've done on Yucca Mountain. But I think the intent of topical report 2 by DOE was to establish the reference probability for seismic events for pre-closure activities at Yucca Mountain.

Q. Is it true that in the topical report they distinguish between frequency category 1, which is an accident or unusual events that occur fairly regularly, and frequency category 2, which are events that occur such as 10,000-year earthquake, such as earthquakes that they are trying to distinguish between frequency category 1 and frequency category 2 events?

DR. STAMATAKOS: I recognize that they were trying to distinguish between those two events. I don't remember all the details of that in the topical report. But I would note that that thinking has evolved a little bit because DOE is adjusting to Part 63 regulations as opposed to when that was first put forward by DOE when they were addressing things that were in Part 60 in the regulations.

Q. Dr. Chen, are you familiar with DOE Yucca Mountain Topical Report 2?

DR. CHEN: Yes, I've read that report, but that was many years ago. I was still working at the center.

Q. Do you understand that DOE needs to set a reference probability for frequency category 2 design events?

DR. CHEN: I'm not, no.

Q. Any of you aware that in this DOE document they, DOE refers to or develops the reference probability as a chart of the five nuclear power plants from which the reference probability was developed for the western U.S.?

DR. STAMATAKOS: Yes, I'm familiar with that.

DR. McCANN: Yes.

Q. Okay, you have some familiarity. Is it true that DOE's strategy to justify the probability of whatever they were trying to justify -- if you agree it's frequency category 2 events, that's fine, but whatever they were trying to justify in here, that they were comparing the mean annual exceedance of probability of seismic design basis events of nuclear power plants in the United States? Is that correct?

MR. TURK: I don't understand the question at this point.

MS. CHANCELLOR: Well, your Honor, these witnesses have testimony referring to --

MR. TURK: I'm not objecting to the line. I just don't understand the question as phrased.

MS. CHANCELLOR: Well, the reason it's very difficult to phrase a question, Mr. Turk, is that these witnesses are not intimately familiar with the topical report for Yucca Mountain, and it's the topical report from Yucca Mountain that compares and contrasts the site of site with the western U.S. site, and DOE's struggling with how to -- design frequency, category-2 design-basis events. If the witnesses are not familiar with this document, I shall move on.

DR. STAMATAKOS: The --

MR. TURK: I don't know if there's a question pending.

JUDGE FARRAR: Did you understand the question?

DR. STAMATAKOS: I think I understood the question. I think the question was how -- what was DOE's approach in Appendix C of the topical report in establishing probability for at that time what were considered category 2 SSE's, design of category 2 SSE's.

MR. TURK: Is that the question?

MS. CHANCELLOR: Sure.

DR. STAMATAKOS: In doing so, they applied a methodology very similar to what was in

Reg Guide 1.165 in that they looked at the safe shutdown earthquakes for five power plants in the western United States, and based on the same approach and use of combined I think spectral frequencies of 1 Hz and 5 Hz, using the very same methodology they determined what would be the corresponding probability exceedance levels for those safe shutdown earthquakes at those five nuclear power plants. And they took the - they used mean values and they took the average of those to establish what would be a starting point for the reference probability for their SSE, at that time category frequency two.

Q. Isn't it correct that Yucca Mountain -- DOE at Yucca Mountain selected a 1x10-4 point of reference rather than a 2 x 10 to the minus four or five thousand year return period based on those five nuclear power plants in the western United States?

DR. STAMATAKOS: That's correct, they used 10,000 years; but the application here is different because the DOE design incorporates more, if you will, more risky parts. As was discussed I think in Dr. Cornell's testimony, the Yucca Mountain facility is not just a storage facility,

that there will be fuel that has to be remixed and exposed. And I believe, my recollection is that the current design also includes a wet cell where fuel will be stored in pools similar to how fuel is stored at a nuclear power plant.

MR. TURK: And just for clarification, the question only had to do with PC-2 rather than PC-3? Which category?

DR. STAMATAKOS: No, the question was not at all related to the PC parting in 1020. The question was addressing what was done in Topical Report 2.

MR. TURK: Thank you.

Q. (By Ms. Chancellor) Just to underscore the point, DOE used a -- for point of reference they used a 10,000-year return period rather than a 2,000-year return period as the point of reference?

DR. STAMATAKOS: In this particular instance, yes.

Q. In this particular instance, okay. Okay, switching gears, I'd like to talk about rulemaking plans. Who's answer 19? Oh, Dr. Stamatakos, you get it again.

DR. STAMATAKOS: Which page would you like?

Q. Answer 19 on page 24. In the first sentence there you state that a rulemaking plan is a proposed regulatory approach, correct?

DR. STAMATAKOS: That's correct.

Q. And you say that SECY-01-0178 is NRC's favored option?

MR. TURK: NRC Staff?

MS. CHANCELLOR: Yes.

DR. STAMATAKOS: Well, I don't say it's the favored option. What I say there is that SECY-01-0178, I believe that's the number for the new -- for the revised rulemaking plan, supersedes the approaches that were first set forth in the 98-0126 SECY document.

Q. The favored option, if you look at the third sentence, the favored option proposes a design methodology based on a 2,000-year return period ground motion.

DR. STAMATAKOS: That's correct. That's my understanding of reading option 4 in the revised SECY guide.

Q. As part of the rationale for adopting SECY or submitting to the Commission for approval or negative approval SECY-01-0178, and this is on Staff's Exhibit U at page 7, and it states, the

rationale for the proposed mean annual probability of exceedance of a 2,000-year return earthquake for the DBE is based on several points. And the second point is, "The total probability of exceedance for a design earthquake at an ISFSI facility within an operational period of 20 years (20 years x 5.0E-04 = 1.0E-02) is the same as the total probability of exceedance for an earthquake event at the proposed pre-closure facility at Yucca Mountain with an operational period of 100 years (100 years x 1.0E-04 = 1.0E-02)". Do you have Exhibit U?

DR. STAMATAKOS: I have Exhibit U. I was trying to find the pages we were reading.

Q. It's page 7.

DR. STAMATAKOS: Okay. The second bullet?

Q. Second bullet.

DR. STAMATAKOS: Okay.

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

JUDGE FARRAR: Yes.

(Discussion off the record.)

JUDGE FARRAR: Back on the record. We've solved this problem. The witnesses have the material in front of them, and the question is?

Q. (By Ms. Chancellor) The question is, part of the rationale for adopting or proposing 2,000-year return period deals with the operational period of 100 years of Yucca Mountain as contrasted to a 20-year operational life of an ISFSI; is that correct?

MR. TURK: Your Honor, I'm going to object. She has not established that the witnesses were involved in the rulemaking development. If she asks them to read the document, they can do that, but until she establishes that they were part of this and they understand the rationale, I think all they can do is provide their own views which may or may not be correct with respect to the Staff's ruling on the process.

MS. CHANCELLOR: I believe Exhibit U is an exhibit to these witnesses' testimony.

MR. TURK: Yes, it is.

MS. CHANCELLOR: Then --

JUDGE FARRAR: Read back the question, if you would, please.

(The record was read as follows: "The question is, part of the rationale for adopting or proposing 2,000-year return period deals with the operational period of 100 years of

Yucca Mountain as contrasted to a 20-year operational life of an ISFSI; is that correct?")

DR. STAMATAKOS: That's --

MR. TURK: Excuse me. There's an objection pending. I'm asking the witness not to answer until it's resolved.

JUDGE FARRAR: Are you familiar with this attachment? It is -- it was part of your -- admitted as part of your testimony. Whether -- are you familiar with that -- with the attachment and specifically with the statement on page 7 about what the rationale was?

DR. STAMATAKOS: We've all read this document and we have some familiarity with it. We did not, any of us on the panel here, participate in the rulemaking revision tasks. That was not something we were tasked to do.

JUDGE FARRAR: Why don't you answer the question, being careful in this instance to limit yourself to what you know as opposed to what you might speculate about.

DR. STAMATAKOS: If the question is are we aware of what that says, the answer is yes.

Q. (By Ms. Chancellor) In the second

bullet does it address a 100-year operational period for Yucca Mountain and a 20-year operational period for an ISFSI?

DR. STAMATAKOS: Yes.

Q. And does it say that a 100-year operational period for Yucca Mountain and a 20-year operational period for an ISFSI has the same total probability of exceedance?

DR. STAMATAKOS: That's what the bullet says, yes.

Q. If the operational period for an ISFSI were changed from 20 years to 40 years, would you still be able -- would this statement still hold, that there's the same total probability of exceedance?

MR. TURK: I have to object, your Honor. I understand the math of it. They're reading the document and they say what the documents state, they can calculate how it might change. I think the witnesses have indicated they are not part of the development of this bullet.

JUDGE FARRAR: I thought that that was a -- given what it says here, I thought she was just asking them to apply their knowledge to what's said here, given their expertise, what would their

opinion be in the 40-year situation about the total probability of exceedance.

DR. STAMATAKOS: Yeah, can I defer? I would defer to Dr. McCann on this issue because of his expertise.

DR. McCANN: This relates to one of the later questions in our testimony. I think to answer your question, if I remember it right, yes, the math would change if one put in a 40-year operating period.

We have submitted our testimony that the consideration of the operating period was not a direct consideration of our agreement to the exemption and the selection of the 2,000-year return period --

Q. And that's --

DR. McCANN: -- for the PFS.

Q. And you put that proposition forward in answer 31 on page 35, is that correct, that you look at the licensing period and not the total operation term?

DR. McCANN: I believe that's right. Let me check.

Q. Last page of your testimony.

DR. McCANN: Yes, that's where we make

that statement, correct.

Q. So you disagree with this rationale and the rule, proposed rule as it relates to your review of the PFS licensing exemption -- not licensing exemption -- exemption request. You disagree with the rationale in bullet 2 where they're comparing operational periods?

DR. McCANN: I personally disagree with that bullet, not with respect to PFS in particular but in general. In other words, I disagree with that approach as numerically articulated.

Q. And what is the basis for annual risk?

DR. McCANN: I'm not sure I understand the question.

Q. Are you saying that you should -- is it your testimony that you should look at annual risk rather than the operational risk of the facility?

DR. McCANN: Yes.

Q. And what is the basis for that approach?

DR. McCANN: For the use of annual risk?

Q. Right.

DR. McCANN: As opposed to a lifetime risk?

Q. Exactly.

DR. McCANN: The basis for that is on a

couple of levels. And let me preface it by saying, despite the fact that building codes and other guidance type documents, particularly in the conventional engineering construction industry as opposed to the nuclear, often express design-basis ground motions in terms of probabilities of exceedance over a lifetime of a facility -- 50 years, 10 percent chance of exceedance, etc. My interpretation of that is that that is a more comfortable language for the non-risk articulate, if you will, meaning the engineers in practice, the owners who must decide what kind of risk they want to take, it is more convenient for them to talk in those terms.

On a technical level there are a number of aspects that they come into play, in my opinion, with regard to focusing on annual risk. One is, our seismic hazard analyses typically are computed on the basis of an annual probability of exceedance. That numeric result can be extrapolated to a future time period rather directly.

But what that extrapolation does not take into account is whether or not there are natural processes in place that might in fact lead

to a time-dependent estimate of the rate of future earthquake occurrences. So the hazard analysis results that are readily available both for critical facilities such as nuclear power plants as well as conventional facilities as represented by the USGS studies and basically all studies typically do not produce results that are easily extrapolated if in fact a time dependence exists.

And on the engineering side, the facilities side, if one were to do a risk assessment, typically the risk analysis does not account for processes in place at the facility that might change over time. They tend to be snapshots in time with the understanding that these things are typically reviewed and come up for review in the regulatory sense, and that if updates are required either on the characterization of the hazard or on the condition and operation of a facility, those things are handled over the lifetime of the facility.

Q. Do you agree that part of the rationale for using annual risk is that spent fuel must be stored somewhere, so it doesn't matter whether it's in Utah or at a reactor or at Yucca Mountain, so you look at annual risk?

MR. TURK: I have to object. Part of the rationale where? In whose behalf?

MS. CHANCELLOR: I believe that's in Dr. Cornell's testimony.

MR. TURK: Do you understand --

JUDGE FARRAR: Could you restate it? I'm not quite sure I got the whole essence of the question.

Q. (By Ms. Chancellor) I believe Dr. Cornell testified that he relies on a paper by Patte-Cornell to state that you look at the risk to the nation and that eventually, taking the spent fuel as an example, it must be stored somewhere. So you look at annual risk rather than the risk of operation of a facility. Do you agree with that concept for annual risk?

MR. TURK: I object to the question. I'm not familiar with that characterization.

MR. GAUKLER: I think it was, he would look at annual risk as opposed to the cumulative risk over the life of the facility.

MS. CHANCELLOR: Fine. As corrected by Mr. Gaukler, that's fine.

DR. McCANN: I'm generally aware of that thought, and I am aware that the issue of

characterizing risk at the national level where national costs and benefits are considered, that that thought process would come into play. My answer to your prior question was more at the technical level, if you will, in which risk would be calculated for a particular facility as opposed to another level, which is a national level, which is the reference you're referring to.

Q. (By Ms. Chancellor) And do you agree that the issue before the Board is the risk acceptance decision specific to the PFS site and not on a national level?

DR. McCANN: Well, my general understanding would be that the Commission must deal with safety issues at a particular facility as it's submitted for their consideration.

Q. Would it be prudent to look at both annual risk and lifetime risk?

DR. McCANN: Not in my opinion, no.

Q. Getting back to the rulemaking plan --

JUDGE FARRAR: Ms. Chancellor, I'm going to interject something here. The last sentence of your answer on page 35 I'm having a little trouble with. If you ended with the previous sentence I would have followed it, but this seemingly

introduces a new element. You weren't here or you didn't listen in to the oral arguments on Friday about the economic analysis and the 20-year versus 40-year?

DR. McCANN: No. Not Friday, no.

JUDGE FARRAR: Your last sentence seems to raise the question we discussed there, which seemed to be saying here, we're looking at it based on the 20 year, and if it comes at the end of 20 years that they apply for renewal, then the Staff will consider it at that point with all the facts, information and analyses.

The question we raised on Friday was, if you've got 4,000 casks on the pad at the end of year 20 and the Staff were to deny a request for an extension, you'd still have 4,000 casks on the pad for some appreciable length of time. Whether that's another 20 years at the same rate it came in, or whether that's shorter than 20 years additional remains to be seen. Given that view of the situation, the 4,000 casks are not going to leave at the end of year 20, does that change, given your last sentence here, does that new way of looking at things change anything you say in this paragraph?

DR. McCANN: No, not from the perspective that this answer was submitted, which is a non-economic --

JUDGE FARRAR: Forget the economics. From a seismic standpoint, the seismic risk standpoint, does your answer -- does what you say in this paragraph change if I tell you, let's assume the casks will be there for 40 years? Do you still give the same answer that you give here?

DR. McCANN: Yes.

JUDGE FARRAR: You can follow that up, Ms. Chancellor, if you choose to, or not, or choose not.

Well, let me follow it up. If your answer wouldn't change, then is that last sentence surplusage?

MR. TURK: Your Honor, if I may help. This answer explains the basis for the answer to question 30, so maybe if the witness could look back to what the question was, he can decide whether that last sentence is needed or not.

MS. CHANCELLOR: Uh --

JUDGE FARRAR: Wait. He's thinking about answering my question.

MS. CHANCELLOR: Okay.

DR. McCANN: That last sentence, again, from a purely technical perspective, is, you might call it surplus, but it -- I think it's also a recognition. Generally speaking, in the context of technological risk analysis in which we are calculating risk which is often referred to as a snapshot in time, it has some direct applicability in exactness, quote-unquote, if you will, to the time in which it was performed, and gives you a level of confidence as to the risk that exists for the facility as it is designed. And it does not explicitly take into account how it will operate in the future, what new advances might come along that might, say, dictate a change in the design basis. So it's a recognition that in a regulatory environment there is always the regulator whose eyes are open and paying attention to things that might occur, whether precipitated by a reapplication or just new information.

JUDGE FARRAR: So it's surplus in terms of today's snapshot, not surplus in terms of thinking about the future?

DR. McCANN: Yes.

Q. (By Ms. Chancellor) Dr. McCann, were you involved in all of the various iterations of

the SAR relating to PFS's exemption request?

MR. TURK: SER?

MS. CHANCELLOR: Safety Evaluation Report, yes.

DR. McCANN: Yes.

Q. And the first Safety Evaluation Report came out on December 15, 1999?

DR. McCANN: Yes, I believe that -- I don't know the exact date, but yes, that time period.

Q. At about that time period. And in the preliminary SAR --

MR. GAUKLER: Are you saying SER?

MS. CHANCELLOR: Pardon?

MR. GAUKLER: You meant to say the SER?

MS. CHANCELLOR: I guess it isn't a preliminary SAR. Preliminary SER, the December '99 SER, one of the rationales for, I think this is where you almost granted the license exemption request but not quite, you state that consideration of radiological safety aspects of dry spent fuel storage facility conservative peak ground acceleration values that have a 99 percent likelihood of not being exceeded in a 20-year licensing period of the facility are considered

adequate for seismic design. Isn't this the first time that the -- isn't it correct in this rationale that you're considering not just the annual probability of exceedance but you're relating it to the Uniform Building Code?

MR. TURK: May I only note an objection to the characterization that the Staff almost granted the exemption at that time? And also to clarify, when she says this rationale, she's speaking about the 1999 document?

MS. CHANCELLOR: That's correct. Well, I don't know how else to characterize it, your Honor. That was -- when we filed those many contentions and amendments to contentions, maybe it's wrong to say almost granted, but I got the impression that, reading the document, it appeared that the Staff had granted or recommended the grant of the exemption, but in response to our contentions it was, well, it looks like it but not quite. That's what I was getting at.

MR. TURK: Your Honor, I'm only objecting to the predicate. If we can do it with predicates, we can get the question answered.

MS. CHANCELLOR: Fine.

Q. (By Ms. Chancellor) In the December

1999 SER, isn't it true that you compare both the annual probability of exceedance to the Uniform Building Code which deals with the lifetime risk?

DR. McCANN: That -- you're correct. That document, which there were many hands involved in the preparation of that document and various bullets, does state that. Subsequently that has been removed, and I would say at this time we do not agree with that statement.

Q. So you've dropped that from the 1999 SER -- you kept your reference to DOE Standard 1020. That appears throughout all of the iterations of the SER, correct?

DR. McCANN: I believe so, yes.

Q. And also the Three Mile Island ISFSI exemption at INEEL?

DR. McCANN: Yes.

Q. You keep that reference throughout.

At the time PFS submitted its request for an exemption, SECY-98-071 was the guidance document, was the rulemaking plan in effect. Is that correct?

MR. TURK: Again, is the rulemaking plan not the guidance document? If that's the question, I don't object.

Q. (By Ms. Chancellor) That was the document in -- the rulemaking plan in effect at the time PFS submitted its license application, correct?

DR. STAMATAKOS: That was the proposed rulemaking plan at the time.

Q. Proposed rulemaking plan. And SECY-98-071 had two selections, either 1,000-year design basis earthquake or a 10,000-year, depending on --

MR. TURK: No. 98-126.

MS. CHANCELLOR: It's 98 -- oh, 126. Thank you, Sherwin.

MR. TURK: I'm sorry to interrupt.

MS. CHANCELLOR: That's fine. I don't mind be corrected, when you're right.

Q. (By Ms. Chancellor) SECY for 1998 proposed rulemaking plan gave two options, correct? 1,000-year mean annual return period earthquake or a 10,000-year?

DR. STAMATAKOS: I believe that's correct.

Q. And as part of the rationale for granting the exemption request, that's based on the INEEL exemption that the Commission granted to DOE;

is that correct?

DR. STAMATAKOS: It's the granting of exemption plus all of the statements that surrounded that statement -- or SER that supported that. I think there are a number of documents that we cite in reference to the TMI-2 exemption.

Q. In answer 19 on page 25 of your testimony, one of you state that the approach proposed in SECY-98-126 was not followed by the Commission in approving the TMI-2 ISFSI exemption request. Do you see that?

DR. STAMATAKOS: That's correct. I see it's the -- if I can count better than the lawyers, it's the fifth line down, the sentence beginning with "thus."

Q. And INEEL submitted its exemption request to NRC on September 15, 1997, correct? And look at I believe the staff exhibit with the INEEL exemption.

DR. STAMATAKOS: Dr. Chen, who worked on that, the INEEL project, says yes.

MR. TURK: And this would be Staff Exhibit S for the TMI-2 exemption.

Q. (By Ms. Chancellor) And the 1998 rulemaking plan was adopted on -- the Commission

approved the INEEL exemption request on April 8, 1998; is that correct? SECY-98-071, Staff Exhibit S; is that correct? You have the first page of Exhibit S?

MR. TURK: For clarification, you may want to look at the SRM rather than the SECY paper in terms of whether the Commission finally approved it.

MS. CHANCELLOR: Which one is the SRM?

Q. (By Ms. Chancellor) On April 8th, 1998 it states, two requests by negative consent Commission approval of the Staff's intent. So that was when the request went up to the Commission; is that correct?

DR. STAMATAKOS: I believe so.

Q. And the rulemaking plan was -- a negative consent of the rulemaking plan was obtained on April 4th, 1998; is that correct?

MR. TURK: If I may. In the same exhibit, I believe it's either the ninth or tenth page, you'll see the SRM.

Q. (By Ms. Chancellor) What I'm trying to establish is that you say that SECY-98-126 was not followed by the Commission's approval of the TMI-2 ISFSI. Isn't it correct that the Three Mile Island

exemption request came well before the Commission approved the 1998 proposed rulemaking plan? To any of the three of you.

DR. STAMATAKOS: Without having to piece through all the dates, if your calculation of those dates is correct, I would agree.

MR. TURK: I think it may be relevant to get the exact dates on the record rather than have the witnesses assume you're correct. If you would turn to the tenth page of this exhibit, I think you'll see the date the Commission issued its approval.

DR. STAMATAKOS: This is Exhibit T?

MR. TURK: Exhibit S.

JUDGE FARRAR: Since, Mr. Turk, the pages are not numbered sequentially in the exhibit, what document are you referring to?

MR. TURK: It's the tenth sheet of paper in Exhibit S which is titled Staff Requirements.

JUDGE FARRAR: The May 20th?

MR. TURK: May 20th, 1998.

JUDGE FARRAR: Okay.

Q. (By Ms. Chancellor) I'll rephrase my question. Is it correct that the INEEL exemption request, that the recommendation by the Staff

through the Commission for approval of that exemption request came prior to the Commission's negative consent of the 1998 rulemaking plan?

DR. STAMATAKOS: If I'm reading this now correctly, it looks like the page that Mr. Turk pointed us to is May 28th, 1998 for the exemption request, and the SECY rulemaking memorandum in Exhibit T is June 24th, 1998.

Q. That was my previous question. My new question is, didn't the Staff recommend approval of the INEEL exemption request to the Commission on April 8th, 1998? What's the cover page of Exhibit S?

MR. TURK: He's answered that question. He's confirmed that that's the date.

MS. CHANCELLOR: Okay.

JUDGE FARRAR: We're taking too long to get some basic information. Can somebody go through a time line for us, establish the dates, and then we'll talk about the significance of them.

MS. CHANCELLOR: That's fine, your Honor. I think that's about all that I need to get out of this.

JUDGE FARRAR: I mean, to some extent the documents speak for themselves, but to another

extent it may be important to know how things progressed and what was going on behind the scenes in between these -- the actual documents being issued. But we seem -- we don't seem to be getting what we need here.

MS. CHANCELLOR: Do you want me to go through a chronology?

JUDGE FARRAR: Yeah, somebody should, and then you could ask the question.

Q. (By Ms. Chancellor) INEEL submitted its exemption request to NRC on September 15th, 1997; is that correct?

MR. TURK: It's been asked and answered. They said yes.

MS. CHANCELLOR: Your Honor, I think I'll just --

JUDGE FARRAR: No, we're starting again. We're going to get this down. If Ms. Chancellor wants to --

MS. CHANCELLOR: Will you take my representation that INEEL submitted -- your Honor, I think I'm just wasting too much time. I'll just move on. It's just fine.

JUDGE FARRAR: Wait. We won't take your representation. Cite a document and we'll see what

it says.

MR. SILBERG: It's all in Exhibit S.

MS. CHANCELLOR: It's all in Exhibit S.

JUDGE FARRAR: Well, if it's in there, then we don't need to ask questions about it.

MS. CHANCELLOR: I'll move on.

MR. TURK: She's correct about the dates, your Honor.

MS. CHANCELLOR: I'll move on, your Honor.

Q. (By Ms. Chancellor) Just to establish a general framework of when PFS submitted its exemption request, is it -- PFS's first exemption request, they requested a 1,000-year return period earthquake; is that correct?

DR. STAMATAKOS: In their first exemption request, that's correct.

Q. And that was April 2 of 1999? Does that sound about right?

DR. STAMATAKOS: That sounds about right.

Q. And then PFS on a commitment resolution around about August 6th, 1999 changed their request to request a 2,000-year mean return interval?

DR. STAMATAKOS: Yeah, that's correct;

but I would also point out that in the original -- or in the 1999 Geomatrix document all references in there were for a 2,000 year as well.

Q. And then in December 1999 the Staff issued the first version of the Safety Evaluation Report?

DR. STAMATAKOS: That sounds right.

MR. TURK: Well, is the witness sure of the date?

MS. CHANCELLOR: I'm just trying to get a general chronology. We agreed before with Dr. McCann that that was the date.

MR. TURK: I think there's good reason to move expeditiously, but I don't think the witness should be asked to speculate if he's not sure of the date himself.

Q. (By Ms. Chancellor) Do you recall whether it was around about Christmas of 1999?

DR. STAMATAKOS: That's my recollection.

Q. And then the SER final -- what was then termed the final SER came out in the fall of 2000?

DR. STAMATAKOS: That's correct.

Q. And then in November of 2001 the new rulemaking SECY-01-0178 came out for the Commission?

DR. STAMATAKOS: I don't know. I wasn't involved in that revised rulemaking, so I don't know the exact date. I'd have to check that, but if that's what the exhibit says.

Q. Okay. Well, that's fine. We'll just move on in the exhibit.

MR. TURK: Well, may I note, your Honor, it was September of 2000 when the rulemaking plan was submitted to the Commission, not November.

MS. CHANCELLOR: No, I said was granted negative approval. I didn't say sent up.

Q. (By Ms. Chancellor) And that the final SER supplement 2 that addressed PFS's revised seismic investigation came out in -- around about near Christmas of 2001?

DR. STAMATAKOS: Yeah. Ruined Christmas, yeah.

Q. Sure did. Thank you.

Dr. Chen, I can't have you sitting there silent. If you would turn to answer 29. This deals with the INEEL exemption request that Staff relied on in part for granting the exemption. And I understand that you're responsible for answering questions 28 and 29 that relate to INEEL. Is that correct?

DR. CHEN: Correct.

Q. And you were involved in the review of the INEEL TMI-2 exemption request by DOE; is that correct?

DR. CHEN: Correct.

Q. And in your testimony you refer to the Idaho chemical processing plant site. That's where the Three-Mile Island 2 ISFSI was located, correct?

DR. CHEN: Yes.

Q. And it's referred to as ICPP?

DR. CHEN: Correct.

Q. And is the ICPP licensed by NRC?

DR. CHEN: Yes, to my knowledge.

Q. But you're not sure?

DR. CHEN: Just my recollection.

Q. And the ground motions, the peak design-basis horizontal acceleration for the IPP was established as 0.36 g; is that correct?

DR. CHEN: For ICPP, yes.

MR. TURK: Could I hear the question again, please?

(The record was read as follows: "And the ground motions, the peak design-basis horizontal acceleration for the IPP was established as 0.36 g; is that correct?")

MR. TURK: I'm sorry. May have it one more time?

(The record was read as follows: "And the ground motions, the peak design-basis horizontal acceleration for the IPP was established as 0.36 g; is that correct?")

Q. (By Ms. Chancellor) And the Three Mile Island ISFSI, the design basis to which that was designed to was .36 g ground motion; is that correct?

DR. CHEN: Yes. That was DOE's decision.

Q. And a .36 design-basis earthquake would be greater than a 2,000-year return period earthquake; is that correct?

DR. CHEN: Yes. It enveloped the 2,000-year return period earthquake, the ground motion.

Q. .36 ground motion earthquake -- let me back up. The peak horizontal acceleration for a 10,000-year earthquake at the ICPP site is .47 g; is that correct?

DR. CHEN: Yes.

Q. Could you estimate where between -- let me ask one more question. The peak ground

acceleration for a 2,000-year return period earthquake of the ICPP site is .30 g; is that correct?

DR. CHEN: That's correct.

Q. What is the return period for the .36 g ground motion?

DR. CHEN: We did not at that time attempt to estimate the return period of a .36 g ground motion. And the reason was because the approval was granted for 2,000-year return period earthquake. But we did not do a calculation, and I do not think the Applicant did a calculation, either, but to speculate because .36 g fall in between 2,000 earthquake ground motion and 10,000 earthquake ground motion, so I would suspect somewhere between 3,000 to 4,000 years.

Q. Thank you, Dr. Chen. You state in your testimony that the TMI-2 ISFSIs show that the consequences were bounded by a canister drop onto a concrete pad. And the INEEL site, you visited that site?

DR. CHEN: Yes, I did.

Q. Have you visited the PFS site?

DR. CHEN: No, I did not.

Q. Have you seen diagrams showing where the

PFS site is and the configuration of the facility?

DR. CHEN: Yes, I did.

Q. The INEEL site is on a federal reservation, correct?

DR. CHEN: Correct.

Q. And that's about 800, 900 square miles, that reservation? Do you know?

DR. CHEN: I believe so.

MR. TURK: What was the number given?

MS. CHANCELLOR: About 800 or 900 square miles.

MR. TURK: May I ask if Dr. Chen is aware of that?

DR. CHEN: That sounds about right, but I can't give you the exact number.

MS. CHANCELLOR: Eight hundred, nine hundred square miles --

DR. CHEN: Okay.

(Interruption.)

JUDGE FARRAR: Is Counsel instructing the witness?

MR. TURK: Yes. I told her if she doesn't know the answer, she should not assume that the questioner is correct that she knows the answer.

Q. (By Ms. Chancellor) What are the total number of casks to be stored at the TMI-2 ISFSI?

DR. CHEN: 30 at HSMS. HMS is a horizontal storage -- they use horizontal storage module, and it's 30, I believe, according to my record.

Q. And then these storage modules, approximately what size are they?

DR. CHEN: I can't recall right now.

Q. Are they big, square, rectangular concrete modules? Have you seen them?

DR. CHEN: Yes, I have, but many years ago.

Q. Could you describe them in general?

DR. CHEN: I was not involved in the design, so I did not pay a lot of attention on the design details. I'm aware there are concrete, reinforced concrete containers, but I can't tell you the other specifics.

Q. The NUHOMs is a different design concept than the HI-STORM storage cask; is that correct?

DR. CHEN: That's correct.

Q. These modules join together?

DR. CHEN: I can't tell. I don't believe so. I do recall they are horizontally

placed on the concrete pads.

Q. And is there a hole in the center which the canister sits into?

DR. CHEN: Yes.

Q. And at INEEL, are those modules allowed to slide during an earthquake?

MR. TURK: Objection.

Q. If you know.

MR. TURK: Objection to characterization of they're allowed to slide.

Q. In any of INEEL's design to meet seismic design, is there anywhere where you have seen in your review of the INEEL exemption where under certain earthquake conditions the NUHOMs storage modules may slide?

DR. CHEN: I do not believe so. As I said, I was not involved in the design but I do recall reading the relevant documents, and I recall from the accident analysis that accidents due to earthquake ground motion, the accident consequence was bounded by cask drop on the concrete pad. I do not recall that they would slide.

Q. And the nearest resident to the INEEL federal reservation, do you know if that would be about 15 to 20 kilometers away?

DR. CHEN: I believe it's 50 miles.

Q. Fifty, okay.

DR. CHEN: I could be wrong.

Q. That's fine, just to the best of your recollection.

MR. TURK: Again, I would ask the witness if she doesn't recall not to speculate. If she doesn't know, not to guess.

JUDGE FARRAR: If you recall generally you can give us a range, but if you don't recall, don't, you know, kind of make it up. You said, I thought, 50, five-zero miles, but how well do you remember that?

DR. CHEN: Not very well. Only based on the field trip that I went.

JUDGE FARRAR: Okay. So based -- okay, based on the field trip, that's your sense of how far you went?

DR. CHEN: Yes.

Q. (By Ms. Chancellor) And do you know how far the nearest resident is from the PFS ISFSI site?

DR. CHEN: No.

Q. Do you know, is it true that the INEEL ISFSI will take labialized fuel debris from the

Three Mile Island Unit 2 reactor?

DR. CHEN: Yes.

Q. And is that about 3,000 pounds of core debris -- 300,000 pounds?

DR. CHEN: I do not remember the weight of the fuel.

Q. That's fine. And do you know how many casks there are that PFS will store?

DR. CHEN: Could you repeat that?

Q. How many casks will PFS store at its facility?

DR. CHEN: How many --

Q. Casks.

DR. CHEN: Casks. How many casks --

Q. Storage casks?

DR. CHEN: For TMI-2?

Q. No. You stated that there are about 30 casks for TMI-2.

DR. CHEN: Right.

Q. And PFS will be permitted to store how many casks?

DR. CHEN: I guess people here probably know better than I do, but 4,000.

Q. Right. Thank you.

JUDGE FARRAR: Ms. Chancellor, if you're

moving to a new subject, why don't we take a break. If whoever is in the room when the sound technician shows up, please tell him about your problem. I summoned him to tell him about the problem we're having. Thanks. Let's come back at ten of.

(A recess was taken.)

JUDGE FARRAR: All right, we're back on the record and the sound technician is here to try to fix the static problem as we proceed.

Ms. Chancellor?

MR. TURK: Your Honor, may I tend to a minor matter first?

JUDGE FARRAR: Yes.

MR. TURK: I'd like to mention that we're joined this morning by Mr. John Greeves, G-r-e-e-v-e-s, who is director of the Division of Waste Management at NRC, and included within his jurisdiction is the Yucca Mountain proposed facility.

JUDGE FARRAR: All right. Glad to have you here. We had noticed the new face and wondered who it was. Thank you for the introduction.

Q. (By Ms. Chancellor) Dr. Stamatakos, our discussion the other day about slip tendency, was your analysis of that, the sensitivity analysis

that you referred to, was that conducted after you prepared Staff's Exhibit Q in September of 1999?

DR. STAMATAKOS: Yes.

Q. And you testified on Friday that you had analyzed the sensitivity of the slip tendency analysis results to variations in your assumption about stress field, correct?

DR. STAMATAKOS: We tuned -- in doing the slip tendency analysis, it's an interactive program that you can easily modify those parameters, and so we tuned the slip tendency, as I said, so that we would attempt to reach some critical value of .67 for known active faults like parts of the Wasatch Fault.

Q. And you say that the sensitivity analysis was tuned to give a high that is greater than .65 slip tendencies on faults in the Skull Valley area?

DR. STAMATAKOS: No.

Q. Which are not to slip from paleoseismological studies.

DR. STAMATAKOS: For parts of faults I think we used the Wasatch as a better example of tuning the slip tendency directions.

Q. I don't want to get into that analysis,

but where is this analysis document, the sensitivity analysis?

DR. STAMATAKOS: As I say, it's an iterative approach to doing it. What we documented was the final assumptions that we used in the slip tendency analysis.

Q. Do you know if the sensitivity analysis for the slip tendencies was -- your analysis was turned over to the state?

DR. STAMATAKOS: The analysis as we used it to draw a conclusion was turned over to the state.

Q. Or turned over to Mr. Turk, I should say.

DR. STAMATAKOS: Turned over to Mr. Turk. Whatever happens to it beyond that is out of my control.

Q. Is it documented in your scientific notebook?

DR. STAMATAKOS: What's documented in my scientific notebook is was what were the bases for what we were going to write, what we wrote in the supplemental SER. So what I referred to as doing some assessment of sensitivity was done just iteratively as we established the parameters in the

program. What we're showing you there is the final result.

But you can look at that, I mean, you can easily judge yourself. If you look in the submittal there are some plots of the -- screen plots of what the program looks like as you're performing the tasks. And if you look at the fields for the high-slip tendency, you can see that what you asked me about, a small change in the principal direction for sigma 3 would not change the results very much at all.

Q. I'd like to turn to seismic hazard curves. And in simple terms, can you describe how you, just in generic terms, how do you develop a seismic hazard curve? What goes into it?

DR. STAMATAKOS: Probabilistic seismic hazard curve, or --

Q. Yes, probabilistic.

DR. STAMATAKOS: Well, we provided some discussion of that at length when we were asked those questions by the Board a lifetime ago or two weeks ago. I'm not sure which.

Q. But can you just categorize in sort of gross general terms what actually goes into the development of a probabilistic assessment?

DR. STAMATAKOS: You look at all potential seismic sources, both fault sources and what were defined by Dr. Cornell as aerial sources. You decide on parameter distributions for the size of the earthquake that can be generated by those faults or in those areas. You make a distinction about the rate of activity or the slip rate that can -- that those sources can produce, how often those earthquakes might occur to make parameters that describe the distribution of the different sizes of earthquakes up to what you've deemed to be the maximum earthquake for that particular source and characteristics of what the shape of that frequency distribution of earthquakes looks like. You make some estimates about the distance, the rupture of that earthquake is from the site based on some modeling of ruptures on what you've considered to be the fault sources are, within the area sources.

All of those are parameter distributions that then get, if you will, sampled in many, as Dr. McCann explained in his testimony several weeks ago, many iterations. You develop many possible hazard curves and you put those all together to come up with a distribution of the hazard with a

mean and some estimate of the uncertainty about that mean.

Q. And I believe Dr. McCann also mentioned site response. Does that also go into the hazard --

DR. STAMATAKOS: That's on the other side of the -- you have to evaluate how the earthquake energy is propagated through the rock and then through the soil, and there are various methods for doing that probabilistically, as well.

Q. And that goes into the --

DR. STAMATAKOS: That goes into estimating the ground motions, yes.

Q. In the hazard curve?

DR. STAMATAKOS: In the hazard curve, that's correct.

Q. Okay. Are you aware of the site soil conditions at PFS?

DR. STAMATAKOS: Somewhat, yes.

Q. Would you call it a subsoil site?

DR. STAMATAKOS: I call it a soil site. I don't know when the relative terms when soft and hard soil are used.

Q. And there are two faults that dip under the PFS site; is that correct? The east fault and

the west fault?

DR. STAMATAKOS: I believe the east fault dips under the site. I thought the west fault was also west of the fault and its trace was west of the site.

Q. Maybe a kilometer or two away?

DR. STAMATAKOS: It's close, yes.

Q. And the Stansbury fault, the Stansbury fault is -- how far is that from the site?

DR. STAMATAKOS: Roughly ten kilometers. I'd have to look at the map to be sure.

Q. And what would you consider to be the controlling fault at the PFS site?

DR. STAMATAKOS: Well, based on what was done at Geomatrix, I would say the two controlling faults were the east fault and the Stansbury fault.

Q. And what are the -- what magnitude of earthquake could be predicted for the Stansbury?

DR. STAMATAKOS: I'd have to again defer to what was done in the Geomatrix '99 study. My recollection based on assumptions about the dimensions of that fault is upwards of magnitude 7.

Q. Maybe 7.5?

DR. STAMATAKOS: I would say that if there's a 7.5, that would be at an extreme end of

the distribution of magnitudes.

DR. McCANN: Can I just clarify something there? Your question wasn't clear. You asked what magnitudes were considered. Dr. Stamatakos's answer referred to maximum magnitude, but in fact magnitudes from a lower bound of 5 to whatever the maximum magnitude was was considered. So a full range of magnitudes were considered in the analysis.

JUDGE FARRAR: And that's magnitude on what scale?

DR. McCANN: I believe they used moment magnitude.

JUDGE FARRAR: How does that tie in with Richter and Mercalli?

DR. McCANN: Mircalli is a subjective intensity scale based on the effects of the earthquake shaking. The Richter magnitude, which sort of has made it into the general vernacular, is a particular magnitude scale originally developed by Dr. Richter. The moment magnitude scale has, relatively speaking, been developed and represents, if you will, a truer measure of the actual size of the earthquake. The other scales that you hear, Richter magnitude, surface wave magnitude, all have

I'll say accuracy or saturation problems with regard to measuring the size of earthquakes as they get larger and larger. And moment magnitude is a bit truer.

JUDGE FARRAR: And it's a fairly recent development?

DR. McCANN: Fairly recent, yes.

JUDGE FARRAR: What years?

DR. McCANN: Maybe the late 80's.

JUDGE FARRAR: That's close enough.

Q. (By Ms. Chancellor) Dr. Stamatakos, do you have your report, Staff Exhibit Q?

DR. STAMATAKOS: Yes.

Q. Seismic Ground Motion and Faulting, etc., dated September 1999 --

DR. STAMATAKOS: Yes.

Q. -- for the PFS site?

DR. STAMATAKOS: Yes, I do.

Q. You look on page 2-3, isn't it correct that PFS is located in the northeastern edge of the Basin and Range Province?

DR. STAMATAKOS: I believe that's correct, yes.

Q. And does Basin and Range -- seismicity in the Basin and Range include significant

historical earthquakes of 1950 and a magnitude 7.58; '54, another 7.5; also in '83. Is that correct?

DR. STAMATAKOS: Yeah. Except that to be absolutely correct, note that what was denoted there and what I took from the record that those are surface wave magnitudes, not moment magnitudes. So that's a moment magnitudes that correspond with earthquakes I would expect to be smaller than the surface wave magnitudes.

Q. On page 10 you state that the east, west and -- you state that the probability of activity is -- that Geomatrix basically ranked certain faults within -- near PFS and gave a 1 to the east, west, and Stansbury fault. Is that correct, at the bottom of --

DR. STAMATAKOS: You're talking about a parameter that goes into the probabilistic seismic hazard assessment?

Q. Right.

DR. STAMATAKOS: You can assign a probability of faulting occurrence on specific faults, and this goes back even to a question that Judge Farrar had about faults, definitions of capability. And see, what Geomatrix did, if I

remember correctly, is that for any fault surface that indicated evidence in the lake quaternary less 780,000 years, they gave a probability weight of 1 to that fault; and for faults that had suspected activity within the last two million years, I think, if I remember this correctly, they gave a probability activity of .8 or .7 weight probability for the East Cedar Mountain faults. And a .7 for -- .7 for the East Cedar Mountain fault and a .8 for the Springline fault. And the .7 activity on the East Cedar Mountain fault was assigned even though there was no direct evidence presented, I believe that there was quaternary displacement, just suspected quaternary displacement on that particular fault.

MR. GAUKLER: Your Honor, I just want to raise a concern that we're getting again to the issues that were part of the second investigation which really aren't at issue here any more. I understand this report isn't stuff that Mr. Stamatakos has, and there's testimony of this for background for the curves that appear on Staff Exhibit R. And I don't mind some probing in that context, but I do not want to go beyond and to raise the issues that should not be raised, that

the parties agreed were not to be raised in this proceedings.

JUDGE FARRAR: So far I think we're just, as you said, probing into some background without going too deeply into it. We'll bear that in mind, Mr. Gaukler.

Q. (By Ms. Chancellor) And on page 2-14 you state -- before Section 2.5-2 you state, "Especially critical are the possibilities that the West fault is an active, independent source and that the East and Springline faults are linked to form a single fault source." Correct?

MR. TURK: May I ask where you're reading from, where on that page?

MS. CHANCELLOR: 2-14 directly above section 2.1.5.2. See "Stansbury Fault," sentence immediately above that.

DR. STAMATAKOS: That's correct.

Q. (By Ms. Chancellor) Is it fair to say that the PFS site is a seismically active site?

DR. STAMATAKOS: In relative terms, yes.

Q. And in the consolidated SER on page 241 you state that revisions to the -- revisions to the ground motion led to the development of a nine-layer shear wave soil velocity profile and

that this model led to a significant increase in estimated ground motions.

MR. TURK: I'm sorry. May we have a moment to find the document?

MS. CHANCELLOR: Sure. Consolidated SER at page 241.

MR. TURK: Give us a moment to get the document out.

JUDGE FARRAR: Is that an exhibit?

MS. CHANCELLOR: Yes. It's Staff Exhibit C.

JUDGE FARRAR: The great, big --

MR. TURK: It's been submitted with aircraft.

MS. CHANCELLOR: Consolidated SER. Page --

MR. TURK: I'm sorry. Could you re-ask the question?

MS. CHANCELLOR: Right.

Q. (By Ms. Chancellor) Do you see the top sentence?

DR. STAMATAKOS: Yes.

Q. At the beginning of 241. And the revisions that are referred to on page 241 come from the revisions of PFS's re-evaluation of its

seismic analysis?

DR. STAMATAKOS: The component of the seismic analysis that has to do with how the energy is propagated in the upper part of the soil column, upper 30 feet I believe is one of the primary issues that they developed a different model for the site response.

Q. And is this because there was a conflict between the CPT data and the seismic lines?

DR. STAMATAKOS: I thought that it was also because of additional borehole geophysical data that they'd acquired.

MR. TURK: Sorry. Could I ask the witness to bring the microphone a little closer and perhaps to speak a little more slowly for the reporter's sake?

MS. CHANCELLOR: Did you say hostility, speak with a little more hostility?

MR. TURK: Speak a little more slowly. But words, like anything else, are in the ears of the beholder.

MS. CHANCELLOR: That's true.

Q. (By Ms. Chancellor) And the change that is referred to here in this shear wave model profile, this led Geomatrix to conclude that there

was a 35 percent increase in ground motions of the PFS site; that is correct?

DR. STAMATAKOS: No, it's not exactly correct. The revisions led to a large increase in the peak ground accelerations, but if you look at the entire set of the spectral velocities -- or spectral accelerations, excuse me, the changes as you go towards other frequencies in that spectrum are much smaller.

Q. But there was a 35 percent increase in peak ground acceleration from the .53 g in the earlier analysis to the approximately .7 g in the new analysis?

DR. STAMATAKOS: That's correct. There was a large increase in peak ground acceleration.

Q. So site response is important with respect to the analyzing the seismicity at the site?

DR. STAMATAKOS: Site response can be important, that's correct.

Q. I'd like to hand out but not have marked a copy from your notebook.

I don't want it marked at this stage, your Honor.

MR. TURK: May I note, in light of the

questioning on Friday, I've now copied off the entire notebook and I intend to introduce it as a Staff exhibit.

MS. CHANCELLOR: Well, I beat you to it.

MR. TURK: Well, looks like you're proposing the first six pages. I intend to introduce all 12 pages.

MS. CHANCELLOR: Well, at the moment all we have before us are the first -- before us is the cover page of Dr. Stamatakos's notebook, scientific notebook 353, initial entry John Stamatakos, August 1, 2000. Pages 1, 2, 3, 4, 5, and 6 -- six pages. Do you have that, Dr. Stamatakos?

DR. STAMATAKOS: I do.

MR. TURK: May I note also this is the document, part of the document that Dr. Stamatakos referred to today and on Saturday in terms of a document in his analysis, and this was turned over to you in discovery.

MS. CHANCELLOR: Yes, I retrieved this from our discovery responses, as I stated at the end of the testimony on Saturday, that I would review this.

Q. (By Ms. Chancellor) Dr. Stamatakos, on page 2 of your notebook, data and procedure, the

next to last sentence, it says, a set of seven hazard curves were provided to me by Dr. M. McCann -- I guess that should be "on" September 30, 2001. Dr. McCann indicated that the data were from 1993. Is that correct?

DR. STAMATAKOS: That's what the document states.

Q. And did you use this data from Dr. McCann to derive the plot, State's Exhibit S? Beg your pardon, Staff's Exhibit R?

DR. STAMATAKOS: Some of the data on Staff's Exhibit R were derived from that data, yes.

Q. Okay, I'd like to go through this piece by piece. On page 3 of your notebook there looks like a spreadsheet with peak ground accelerations of seven western U.S. sites.

DR. STAMATAKOS: That's correct.

Q. Is this the seven plots of data that you received from Dr. McCann?

DR. STAMATAKOS: Yes.

Q. And you state on page 3 that Dr. McCann told you that the data were from 1993. If you'd look at the Diablo Canyon reference, it states that that's dated July 1988.

DR. STAMATAKOS: That -- okay.

Q. Have you reconciled the fact that Dr. McCann says that the data are from 1993 yet your reference to Diablo Canyon is for July of 1988?

DR. McCANN: Maybe I can --

Q. No, I'd like to ask Dr. Stamatakos this.

DR. STAMATAKOS: Okay. I would ask -- I would ask the same question of Dr. McCann. I presume that the Diablo Canyon report comes from a very long and rigorous study that was performed at the Diablo Canyon called the long-term seismic program, and perhaps, if I remember correctly, 1993 was when he might have assimilated all that data together into that spreadsheet which he provided me. But I would ask him to elaborate.

Q. First of all, I want to establish what you relied on in producing Staff's Exhibit R. And I'd be happy to follow up later with Dr. McCann, but let's first establish where you got your information from.

DR. STAMATAKOS: Okay.

Q. The list of references, the San Francisco Bay Bridge, Geomatrix -- first of all, the seven references here, are these the seven references -- on page 3, are these the seven

references you relied upon to develop the plots in Staff's Exhibit R?

DR. STAMATAKOS: Well, certainly not wholly. These are the references for the curves as they're titled. I added to that plot the Geomatrix data from PFS which was provided to us by PFS in the whole review process. I added the Yucca Mountain data which is published in the Yucca Mountain studies and also published in a paper that came out on earthquake spectra.

Q. Let's just stick with the San Francisco Bay Bridge, Diablo Canyon, Los Alamos site 1, Hanford site A, INEEL 1, INEEL 2, and Palos Verde. These seven references are part of the curves that you derived on Staff's Exhibit R, correct?

DR. STAMATAKOS: That's correct.

Q. These seven -- are these the seven references that you rely upon for developing the seven curves that relate to those sites on Staff's Exhibit R?

DR. STAMATAKOS: Yes, as given to me by Dr. McCann.

Q. Okay. San Francisco Bay Bridge, Geomatrix prepared by California Department of Transportation. Is there a date on this?

DR. STAMATAKOS: Well, I would again defer the specific questions about references to Dr. McCann. He supplied the hazard curves as he put them together from his extensive experience in doing seismic hazard analysis.

Q. And San Francisco Bay Bridge, that's not in the Basin and Range province, correct?

DR. STAMATAKOS: That's correct. It's in California.

Q. And do you know whether that's -- what the soil conditions, how would you characterize the San Francisco Bay site?

DR. STAMATAKOS: That's a rock site, I believe.

Q. And what is the distance to soils of controlling earthquakes at the San Francisco Bay bridge?

DR. STAMATAKOS: I don't know the particulars.

Q. And --

DR. STAMATAKOS: But I would imagine that they're quite close, given the San Andreas fault and the other faults in San Francisco.

Q. What is the site response of the San Francisco Bay bridge site to earthquakes?

DR. STAMATAKOS: I don't know the particulars. Again, I'm using a reference, hazard curve from another study. And I think what's important is to understand the impetus for the curves. We didn't rely on this analysis for site-specific hazard. What we did was just to prepare a comparison for a sort of first order understanding of how the PFS hazard curves fit into a set of other established hazard curves, including, you know, ones derived by the USGS, by DOE, by Geomatrix at other sites, other nuclear facilities.

Q. Isn't it correct that the curves that you display on Staff's Exhibit R are only as good as the studies from which they come?

DR. STAMATAKOS: That's correct.

Q. As a scientist, there is -- nobody could reproduce these results if there isn't a correct -- if there isn't a full and accurate reference to where the data came from. Is that correct?

DR. STAMATAKOS: Well, I would agree with that, but I would point to Dr. McCann, and he can provide the complete references if you so desire.

Q. But you relied totally on Dr. McCann to

develop these curves, correct?

DR. STAMATAKOS: I relied on the data that he supplied me, yes, and his extensive experience in performing seismic hazard sets at many nuclear facilities over many years. So I assume that he's very familiar with the hazard studies that have been performed.

Q. Diablo Canyon, that's not in Basin and Range, is it?

DR. STAMATAKOS: No.

Q. Los Alamos site 1, is that in Basin and Range?

DR. STAMATAKOS: I would say no.

Q. Do you have any idea when the study was done? Again, it's got date on none.

DR. STAMATAKOS: No, I don't. I would again ask Dr. McCann to clarify.

Q. Hanford site is in Washington, right?

DR. STAMATAKOS: That's correct.

Q. That's not Basin and Range, is it?

DR. STAMATAKOS: No.

Q. You don't know the distance to the controlling faults, do you?

DR. STAMATAKOS: I don't know the particulars, no.

Q. You don't know the site response, correct?

DR. STAMATAKOS: That's correct.

Q. If you look on page 24 of Exhibit Q, your report.

JUDGE FARRAR: Ms. Chancellor, before we leave Staff Exhibit R --

MS. CHANCELLOR: Oh, we're still going on with that, your Honor, but go ahead.

JUDGE FARRAR: Why are Los Alamos and Palo Verde not displayed on the Exhibit R?

DR. STAMATAKOS: I guess I plotted, what I plotted was a subset of the information that was provided in the table. I thought perhaps I was running out of clarity of if we superimposed any more hazard curves on the plot, but I would argue that the most relevant information can be derived from looking at Skull Valley and Salt Lake City curves. Again, it was just for us to get a first order of sense of where the hazards fell with respect to these other facilities.

JUDGE FARRAR: Looking at this 7 on page 3 of your notebook, if you did plot Los Alamos and Palo Verde, would they fall somewhere between Yucca Mountain and everything below that? Would they

fall above Yucca Mountain?

DR. STAMATAKOS: Well, I think the Los Alamos would fall well below the Yucca Mountain. Palo Verde would as well.

JUDGE FARRAR: Okay.

MR. GAUKLER: I would ask counsel how much more they think they have left in terms of trying to make sure we can start aircraft crashes this afternoon.

MS. CHANCELLOR: I'm going as fast as I can, Mr. Gaukler. It depends how on far we get on this.

JUDGE FARRAR: When is Col. Horstman due in town?

MS. NAKAHARA: He's here now, your Honor.

JUDGE FARRAR: And he leaves when?

MS. NAKAHARA: Wednesday around noon.

JUDGE FARRAR: Ms. Chancellor, I don't think Mr. Gaukler was accusing you of not going as fast as you can; he was looking for information, as we are.

MS. CHANCELLOR: I should be done -- I've just got this -- I've just got to go through, establish basis for Exhibit R and one other area

which will take a couple of questions.

JUDGE FARRAR: Okay, fine.

MS. CHANCELLOR: So I think I'm pretty much on track.

JUDGE FARRAR: Thank you.

Q. (By Ms. Chancellor) On Figure 2-2 on Page 2-4 of your report, Staff's Exhibit Q, there's a historical earthquake map. And INEEL would be in the Snake River plain, correct?

DR. STAMATAKOS: That's correct.

Q. And that's a fairly aseismic area, isn't it?

DR. STAMATAKOS: That's correct.

Q. There doesn't appear to be a reference for the Yucca Mountain hazard curve. Where was that obtained from?

DR. STAMATAKOS: That was obtained from the DOE document that documented the probabilistic seismic hazard assessment, and it's also provided in a paper by Carl Steppe and many co-authors including Dr. Arabasz that was published in 2001, I believe, in earthquake spectra. I don't know the details, but that comes from our data that was provided to us by DOE in their Yucca Mountain hazard study. And to try to anticipate questions,

that was for a generic hard rock site and no soil considerations were yet added into that Yucca Mountain curve. It's a rock site.

Q. Appreciate that. Thank you. With respect to the Salt Lake City curves on this map, you went to a USGS web site and found some data there; is that correct?

DR. STAMATAKOS: I found a paper that was published on a web site by the USGS, that's correct.

Q. And this paper published by the USGS doesn't specify where in Salt Lake City these ground motions --

DR. STAMATAKOS: No. If you'll allow me, I have a copy of a paper that could refresh my memory on the specifics of, some of the specifics, questions you may ask.

Q. Sure, that's fine.

JUDGE FARRAR: While he's doing that, let's go off the record to find out about the sound system.

(Discussion off the record.)

MS. CHANCELLOR: Okay, Dr. Stamatakos, do you have that paper?

DR. STAMATAKOS: Yes, I do. And they

don't give a specific location for this particular hazard curve, only to say that the site spacings for these were in approximately 1 degree latitude -- 10th of a degree latitude, excuse me, and a 10th of a degree longitude, and that would correspond to roughly an area about 11 kilometers by 11 kilometers.

Q. And it doesn't state the distance to the Wasatch Fault or the West Valley fault; is that correct?

DR. STAMATAKOS: It doesn't state the exact distance to the Wasatch Fault, but I would assume that Wasatch Fault is quite close to Salt Lake City.

Q. Five kilometers?

DR. STAMATAKOS: Okay.

Q. No, is it five kilometers?

DR. STAMATAKOS: I don't know.

MR. TURK: And also, what point in Salt Lake City are you measuring from? The center of the city? Edge of the city?

MS. CHANCELLOR: I don't know, because that's precisely the point, Mr. Turk. There's nowhere in the USGS document that states where it is.

Q. (By Ms. Chancellor) In earlier testimony you stated that the rock site hazard curve for the Skull Valley site on Exhibit R was -- did you say that was from Geomatrix?

DR. STAMATAKOS: That's correct.

Q. Is that before or after the ground motions increased, the rock site?

DR. STAMATAKOS: I believe it's after.

Q. Is there anything in the SAR that references a rock site?

DR. STAMATAKOS: The SAR?

Q. SAR?

DR. STAMATAKOS: Safety Analysis Report.

Q. Safety Analysis Report.

DR. STAMATAKOS: I can't recall what's in the SAR. I just recall what was provided -- these data were actually provided to us in April, was it a year ago, when we -- 2001, April 2001 when we met with the Applicant and asked them for some additional requests for information when they presented the new results. And in that package of information they provided us digital hazard curves, including the Skull Valley rock and Skull Valley soil curves for a range of frequencies, PGA included, and that's where I derived this data

from.

Q. Now, I think we established the hazard curves depend on the location of the site relative to the sources such as active faults, right?

DR. STAMATAKOS: That's one consideration.

Q. And do hazard curves depend on the thickness and type of material underlying the site?

DR. STAMATAKOS: It depends whether the hazard curves are incorporating effects of soil or whether they're derived for rock sites. Many of the hazard curves that are presented here, the Yucca Mountain site and the Salt Lake City site, are for sites assuming rock conditions. So there's no additional information about how the hazard might change if there were additional factors such as the soil on top of the rock and what would happen to the seismic energy as it propagates through that soil. So comparisons can be made between the Skull Valley rock and the Salt Lake City rock in this case.

Q. You say there can be?

DR. STAMATAKOS: Well, the comparison that I made in my discussion was between the hazard curve for Salt Lake City, assuming rock conditions,

and the hazard curve for Skull Valley assuming rock conditions.

Q. But you don't know where the Salt Lake City data came from. You don't know a site-specific location where the Salt Lake City --

DR. STAMATAKOS: No, but it does say in the paper that the reference conditions were for a firm rock site with an average shear wave velocity of 760 meters per second.

THE REPORTER: Of what?

DR. STAMATAKOS: The reference site conditions for the Salt Lake City hazard curve that were presented by the USGS --

JUDGE FARRAR: Wait, wait. All she needs is what were your last few words.

DR. STAMATAKOS: 760 meters per second.

Q. (By Ms. Chancellor) Aren't near-surface site materials different for older sites on the hazard curve with the exception of the two Skull Valley curves?

DR. STAMATAKOS: I'm sorry. I didn't understand your question. Could you repeat it?

Q. Aren't the near-surface site materials for all of the sites listed on Staff's Exhibit R, aren't they all different with the exception of the

two Salt Lake valley sites -- or Skull Valley sites?

DR. STAMATAKOS: Well, there may be some differences especially for those curves that include a soil component, but for the hard rock curves I would anticipate that the differences are somewhat smaller. So again, that's why in the comparison I looked at a hazard curve derived for hard rock compared to Skull Valley hard rock curve.

Q. And location to soils is going to -- site distance to soil, earthquake soils is going to be different?

DR. STAMATAKOS: That's one factor. Magnitude frequency of how often those large earthquakes occur is also a very critical factor, maybe in this case slightly more critical.

Q. On page 69 of your notebook you say, the results showed the conservative nature of the applicant's soil characterization and PSHA results presented in the SAR. Do you see that? That's on the top of page 6.

DR. STAMATAKOS: Yes. We've concluded and stated in many of our documents that --

Q. There's no question.

DR. STAMATAKOS: -- that the Applicant's

PSHA is conservative.

DR. McCANN: Can I --

Q. If all of the hazard curves for the sites are a different location with different surface materials, different site to soil locations, how can you draw any conclusions at all from them about the level of conservatism in the Skull Valley hazard curves?

DR. STAMATAKOS: Because you can still look at the general amounts of ground motion that are predicted for Skull Valley, and if we assume for a moment there are no soil effects and just look at the Skull Valley rock curve, it predicts very high ground motions, given the conditions at the site when you consider the fact that there are faults there that are considerably less active and produce smaller magnitude earthquakes than many of the other hazard curves that are here.

The Hosgri fault for the Diablo Canyon site is a larger fault that produces a larger magnitude, maximum magnitude earthquake. The Wasatch fault certainly is a larger fault, and in fact it's stated so in one of your witnesses' testimony that it's probably one of the biggest and most active normal faults known in the world. It

has a slip rate that's up to five to ten times larger than slip rates that are predicted by Geomatrix in their analysis of the Stansbury and East fault.

And so as a first order comparison, to us it seems that the PSHA performed by Geomatrix results in a conservative hazard curve given those first order observations.

And then what we did is some specific calculations that supported that. We looked at, for example, in the '99 report we looked at the West fault and the interpretation of whether or not that was an active source. We did a sensitivity study and we did a re-evaluation, an independent evaluation of geophysical data that was provided in the 1999 report, and we concluded that the West fault was not a fault that was capable of producing earthquakes, and therefore that was just one example of the source characterization that we deemed to be conservative.

Q. Staff's Exhibit R shows how seismically active the PFS site is vis-a-vis other sites. Isn't that true?

MR. TURK: Objection. That's not what it's represented to be.

MS. CHANCELLOR: Precisely. That's what I'm getting at.

Q. (By Ms. Chancellor) Doesn't this show --

JUDGE FARRAR: Overruled. You may answer.

DR. McCANN: Your question refers to -- I mean, your question used the word "seismicity," which of course is only one element of the hazard analysis. And by that I mean seismicity is, as we refer to it, generally is restricted to the seismic sources and the rate of occurrence of earthquakes. The seismic hazard curve includes ground motion, site response, etc. So seismicity is one part.

Your reference to the hazard curve and some of the details of differences that might exist between, say, PFS, a Salt Lake City site, certainly it is a fair statement to say that a site in Salt Lake City at whatever street corner one would like to choose is not precisely the same in every minute detail as PFS. But there are things one can notice from the hazard curves that are displayed on the figure, and let's just stick to Salt Lake City and PFS in particular.

The first is, we can remove a number of

the effects, distance, for example, if we recognize that a site in Salt Lake City nominally is quite close to the Wasatch. For discussion, let's say less than 10 kilometers. The majority of ground motion attenuation relationships saturated those distances, and so the difference in distance between one, two, three, four, five, six up to ten don't really make as much difference as they would if we were talking, say, 10 versus 50.

Secondly, as you go to very low ground motions in the hazard curve, one of the things that you notice on the figure is that for the Skull Valley curves, both the rock and the soil, is that they have the same rate of occurrence of very low ground motions. And what that means is, is that given the occurrence of an earthquake of magnitude 5 or greater on any one of the seismic sources in the vicinity of the particular site of interest, the likelihood of exceeding those low ground motions, and let's call them numbers slightly greater than zero just for discussion, that removes all effects of distance, it removes all effects of attenuation models, and it removes essentially all effects of site response.

So here we have a case where, for all

practical purposes, the Skull Valley site, the Salt Lake City site have the same rate of occurrence of exceeding this very low ground motion.

What that's saying is that the rate of occurrence of earthquakes in the vicinity, in the general vicinity of Skull Valley and Salt Lake, are essentially the same, even though Skull Valley is considerably removed from Salt Lake City and the very active Wasatch Front -- Wasatch Fault. By the same token, it also comes very close to the rate of occurrence of exceeding those low ground motions for the San Francisco Bay Bridge, which has many, many active faults on both sides of the east and the west.

So this curve tells us that the Skull Valley site appears to be challenging some of the more seismically active areas in the country which the seismic source characterization by itself doesn't necessarily support, and thus appears to be conservative.

MS. CHANCELLOR: I'd like to have marked State's Exhibit 185, Final Report, Volume I of III, Fault Evaluation Study and Seismic Hazard Assessment, Revision 1, prepared by Geomatrix consisting of Figure 6-12, Table 6-2, which

continues on for approximately five pages, and then Figure 6-6 continues on for three pages.

JUDGE FARRAR: Do you want this marked as --

MS. CHANCELLOR: State's Exhibit 185, please, your Honor.

JUDGE FARRAR: Then we'll pause and let the reporter do that.

(STATE'S EXHIBIT-185 MARKED.)

Q. (By Ms. Chancellor) Let's try and get at this conservatism in the Staff's exhibit. Dr. McCann, would you please look at the second page, Figure 6-12 in the Geomatrix report showing contributions of individual sources to total mean hazard for horizontal motion at the CTB site.

DR. McCANN: Yes.

Q. Please review the bottom left which shows hazard curves for peak horizontal ground acceleration. Let me ask the question, then you may need some time to review. For peak accelerations greater than 0.1 g, which fault is the larger contributor to the seismic hazard at the PFS site?

DR. McCANN: Did you say 0.1?

Q. 0.1 g. Which fault is the largest

contributor? I'll give you a hint. Is it Stansbury fault?

DR. McCANN: No, it doesn't appear to be.

Q. It's maybe a little confusing, because Stansbury fault is that dash-dot pattern that if you look on the Y axis, it's the second line from the top.

DR. McCANN: It's a little confusing to me. The legend appears to be a line and two dots, and the line on the figure appears to be -- or the curve on the figure appears to be a line and one dot.

JUDGE FARRAR: And there's another curve that's a line and one dot.

MS. CHANCELLOR: I believe there's a dot before every name on the legend.

DR. McCANN: Oh, I see. Okay. So yes, it looks like it's the Stansbury.

Q. (By Ms. Chancellor) And which fault is the second largest contributor? Is that the East fault/Springline?

JUDGE FARRAR: Wait a minute. Starting at the one that intersects the top horizontal line of the margin of the graph. If I come down one

from that solid line which represents total, I have a line and a dark dot. Then if I come down two more, I have a line and a not dark dot. Which is which? The second one is Wasatch?

MS. CHANCELLOR: The second one is the Stansbury.

JUDGE FARRAR: Well, I don't know that.

DR. McCANN: The question referred to, Judge, at .1 g?

JUDGE FARRAR: No, I'm just trying to read the graph right now.

DR. McCANN: Okay. I'm sorry.

JUDGE FARRAR: I have -- my first -- of the first four lines on that graph, kind of heading in a southwesterly direction from the top of the map, from the top of the graph, the second line, is that Stansbury or is that Wasatch?

MS. CHANCELLOR: It may be easier to look if you go to .1 g and go up to the top and --

JUDGE FARRAR: No, I'm just trying to read it. I'm not trying to get a reading, I'm trying to figure out which line represents which graph according to your -- which line represents --

MR. TURK: Could I possibly help?

JUDGE FARRAR: Which thing in the

legend? Well, if they can't help me --

MR. TURK: No, if the witnesses have the original rather than a copy of the chart -- do you have the original Geomatrix revision?

DR. STAMATAKOS: No.

MR. TURK: I think it may be a reproduction diffusion of the symbol that's the problem, photocopying problem.

JUDGE FARRAR: Right. But if it is, then they need to interpret this for us in light of Ms. Chancellor's questions.

MS. CHANCELLOR: If you start from the right-hand edge and come over to the left, the lines of interest are easier to distinguish where you have a solid line as the total, and then the next one over going from right to left is the Stansbury.

JUDGE FARRAR: I don't know that.

MS. CHANCELLOR: Okay, that's fine.

JUDGE FARRAR: That's what I'm asking. I have the legend that has two different ways of relying on a dot. One's a dark dot and one's a light dot, and I just want to make sure the quality of the reproduction, we know which is which on the picture.

MR. SILBERG: Are we looking at the left chart or the right chart?

MS. CHANCELLOR: The left.

DR. McCANN: The left one.

JUDGE FARRAR: Oh, I was looking at the right one. Thank you.

MR. TURK: But aside from that, the problem is in the legend.

JUDGE FARRAR: Right, but --

DR. STAMATAKOS: I believe that Wasatch is a line with what's supposed to be a blackened star.

JUDGE FARRAR: It looks like a big black dot on the reproduction.

DR. STAMATAKOS: Yeah. It's supposed to be a blackened star, and Stansbury is the line with the small dot. So I think Ms. Chancellor is correct. If you go to the left, then the first one there is the Stansbury.

Q. (By Ms. Chancellor) So we've established that the Wasatch -- that the Stansbury is the largest contributor to accelerations greater than .1 g, correct?

MR. TURK: The Stansbury.

MS. CHANCELLOR: Stansbury. And is the

East fault/Springline fault the second largest contributor?

DR. McCANN: Can we make a clarification on your prior statement? When you say largest contributor, just to put it in context, as I read it, at .1 g we roughly have a 10-2 probability of exceedance for the total; and for the Stansbury, which is the next curve down, we have a -- approximately, just to make it easy, 3 x 10-3 probability of exceedance. So that would mean that the Stansbury contributes about 30 percent to the total.

Q. Okay. And how much does -- and the East fault/Springline, would that be the next largest contributor?

DR. McCANN: Yes. And roughly I would read that as, just for this discussion, 2 x 10-3, and therefore contributing about 20 percent to the total.

Q. And the East fault is about what, .9 kilometers from the canister transfer building? Don't recall?

DR. McCANN: It's fairly close. I don't remember the exact number.

Q. And would you agree that the East fault

is a major contributor to the seismic hazard at the PFS site?

DR. McCANN: Yes.

Q. Could the hazard from the East fault be in part responsible for the apparently higher ground shaking at the PFS site compared to that of the unspecified site in Salt Lake City for which Frankel computed the hazard curve, the USGS hazard curve?

DR. McCANN: Could you restate your question?

Q. Could the hazard from the East fault be in part responsible for the apparently higher ground shaking hazard at the PFS site compared to the unspecified site in Salt Lake City from the Frankel figure, USGS?

DR. McCANN: The East fault, yes, is a significant or important contributor to the seismic hazard at the PFS site and would not, I would not expect have an important contribution to ground motions in Salt Lake City.

MR. TURK: I don't know if the witness understood the question.

MS. CHANCELLOR: Well, that's for the witness to tell me.

MR. TURK: Well, his answer didn't match the question. We'll do it with redirect.

MS. CHANCELLOR: Fine.

Q. (By Ms. Chancellor) On page 17 of your testimony you state, it should also be noted that the ground motions estimated by the Applicant in Skull Valley are higher than those estimated for the I-15 corridor, despite the close proximity of Salt Lake City to the Wasatch fault which has a slip rate nearly ten times greater than the Stansbury or East fault, citing Martinez, etc., and is capable of producing significantly larger magnitude earthquakes than the faults near the proposed PFS facility site in Skull Valley, citing several references. Do you see that, page 17?

DR. STAMATAKOS: Yes.

Q. Would you please look at Table 6-2 at page 2, Table 6-2 at page 2. Under the column Fault, and it's listed Stansbury, and also look at the slip rate. What is the range of slip rates given for the Stansbury fault?

DR. STAMATAKOS: The range is --

MR. TURK: I'm sorry. We're looking for the document.

MS. CHANCELLOR: It's the exhibit we

handed out, State's Exhibit 185.

MR. TURK: Table 6-2?

MS. CHANCELLOR: Table 6-2.

MR. TURK: Which page?

MS. CHANCELLOR: Page 2.

MR. TURK: Labeled 2 of 5, okay. Page 2 of 5. Now, I'm sorry .

Q. (By Ms. Chancellor) What is the range of slip rates given for the Stansbury fault?

DR. STAMATAKOS: 0.3 millimeters per year to 0.5 millimeters per year with the highest weight given to a value of 0.4 millimeters per year.

Q. Now, if you look at pages 4 and 5 of this exhibit on the Wasatch fault, is it correct that there are no slip rates given for Salt Lake City, but there are slip rate distributions given for the unsegmented model of the Wasatch fault? Is that right?

DR. STAMATAKOS: That's correct.

Q. Can you tell me what the range of slip rate is?

DR. STAMATAKOS: For an unsegmented amount it looks like it goes between 0.1 millimeter a year to 0.05 millimeters per year.

Q. And the highest weight?

DR. STAMATAKOS: I'm sorry. It goes from 0.7 millimeters a year to 1.8 millimeters. Highest weight given to 1.1 millimeters per year.

Q. So does this -- have you reviewed this Geomatrix report before, Dr. Stamatakos?

DR. STAMATAKOS: Yes.

Q. And you've presumably signed off on it or done --

DR. STAMATAKOS: Presumably signed off on it? It's -- certainly looked at this data. This hasn't -- this data hasn't changed from the data that was provided in their -- much of this data hasn't changed since it was originally provided in 1999.

Q. Does the data on the two tables we looked at in the Geomatrix report support your statement that the slip rate on the Wasatch fault is ten times greater than the slip rate on the Stansbury fault?

DR. STAMATAKOS: As quoted in your answer on page 17?

DR. STAMATAKOS: My -- to be precise, my answer said early ten times. And the --

Q. How near are you?

MR. TURK: Could the witness be allowed to answer the question without interruption?

DR. STAMATAKOS: Well, if you're going to make -- based on this comparison, I would say it's a factor of three, 1.1 to 0.4, whatever that distribution. So roughly a factor of three. What I was alluding to here was slip rates estimated based on other published information on slip rates on the Wasatch fault. For example --

Q. The publication by Martinez?

DR. STAMATAKOS: Martinez, which I think that's based on GPS data, global positioning satellite data gives slip rates up to five millimeters per year, if memory serves me correctly.

Q. Is the slip rate estimated on GPS data available for the Stansbury fault near the PFS site?

DR. STAMATAKOS: Not in specific, but I would add that if you look at the entire Basin and Range in terms of GPS models, models of the slip rates for the GPS data that's available, and that would cover the total amount of extension that's occurring in the Basin and Range from the Wasatch Front all the way to California, that in those

models the large percentage, perhaps I think 80 percent of that strain is accommodated by the Wasatch Front and by faults in California, and the remaining strain is absorbed by faults, all of the other faults that lie between the Basin and Range. And if memory serves me correctly, that conclusion was in a paper by Thacker and others that was published in Science, I believe. And I can provide you that reference. I could look up that reference if you want to see it.

Q. Is it legitimate to compare a GPS derived slip rate to the slip rate determined by Geomatrix for the Stansbury fault? Are we comparing apples and oranges, or, as Mr. Travieso-Diaz says, apples and bananas, I think?

DR. STAMATAKOS: Well, certainly there is some controversy in the scientific community about how you actually interpret the GPS slip rates. But they are making their way into seismic hazard assessments and I believe they were a component of what was evaluated by the experts for Yucca Mountain. I don't know whether they were displaced or not. They're a proponent of what was used for some recent analysis, for example, like

Paducah, Kentucky.

Q. If you would turn to State's Exhibit 185 to Figure 6-6, third to last page in the exhibit. The figure shows maximum magnitude distributions for fault sources.

DR. STAMATAKOS: That's correct.

Q. Would you please look at the plot for the Stansbury fault on the first page on the top left?

DR. STAMATAKOS: Okay.

Q. What is the largest maximum magnitude in the distribution?

DR. STAMATAKOS: Well, looks like there's one little low probability node at 7.5, but the distribution seems to be centered around magnitude 7.

Q. So the magnitude 7 would be the mean distribution, right?

DR. STAMATAKOS: I believe that's correct.

Q. If you would turn to the last page and look at the plot for the Wasatch fault on the top left.

DR. STAMATAKOS: Okay.

Q. What is the largest magnitude in the

distribution?

DR. STAMATAKOS: It's magnitude 7.4. Although doesn't Dr. Solomon's testimony indicate magnitudes larger than 7.5?

MR. TURK: I'm sorry. You're asking about the first chart on page --

DR. STAMATAKOS: Three of three.

MS. CHANCELLOR: The last, top left.

MR. TURK: You're only asking about the Wasatch, not about all the different extensions?

MS. CHANCELLOR: Just talking about the Wasatch, top left.

MR. TURK: I think that might be a little confusing. Aren't the other segments part of the Wasatch as well?

DR. PECHMANN: We'll get to that.

MR. TURK: As long as we're clear, we're only talking about the first box.

JUDGE FARRAR: If I might remind you, you told me the other day you didn't want to make it into the witness box. So be careful.

MR. TURK: And know that I know Dr. Pechmann's name, I look forward to hearing from him.

MR. SILBERG: My only question is will

we get to it before lunch or after lunch.

MS. CHANCELLOR: Depends how many interruptions I get, Mr. Silberg.

Q. (By Ms. Chancellor) So the largest magnitude and its distribution is 7.4?

DR. STAMATAKOS: 7.4, okay.

Q. And the mean distribution?

DR. STAMATAKOS: Centered again around 7 or slightly above 7.

Q. Okay. Please look at the Salt Lake City segment of the Wasatch fault, the third panel.

MR. TURK: And could I ask Mr. -- ask him to eyeball these charts, give him a moment to do whatever measurement he needs to do.

MS. CHANCELLOR: Certainly what is the maximum magnitude of distribution?

DR. STAMATAKOS: Magnitude 7.

Q. What is the approximate mean of the distribution?

DR. STAMATAKOS: It would have to be less than magnitude 7. These are pretty small plots, so I wouldn't know exactly, but it would be less than magnitude 7.

Q. Does Figure 6.6 of the Geomatrix report that we have gone through support your statement

that the Wasatch Fault is capable of producing significantly larger magnitude earthquakes than the faults near the proposed PFS facility?

DR. STAMATAKOS: Certain segments of the fault do. And if you look at their assessment, again I would say that yes, the magnitudes that are summarized in the table, the magnitudes for the Salt Lake City fault are larger, and then the point of reference, I would point to your own witness's testimony which again suggests that the magnitudes on the Wasatch Fault may be as large as magnitude 7.5. And that's given in testimony that I think everybody has agreed is going to be accepted.

Q. I don't think we've reached that agreement, Dr. Stamatakos.

Could you explain what you mean by saying that the Salt Lake City segment of the Wasatch Fault is larger than the Skull Valley, that the magnitudes for the Salt Lake City segment are larger than the magnitudes for the Stansbury?

DR. STAMATAKOS: Well, I don't believe I said the Salt Lake City, I said for other segments. So if you look at, for example, if you look at, for example, the distribution on the -- I would make comparison to the Lavon segment which has a very

high distribution. Its mean would be higher than what's offered for the Stansbury. I would have to go back and look at this data to understand where the mean values are.

And in addition to that, these are magnitudes offered for specific ruptures for single segments. Ruptures would also be larger perhaps if multiple segments of the Wasatch Fault were to rupture simultaneously. And there aren't models for maximum magnitude here presented for that possibility along the Wasatch Fault.

Q. Aren't we comparing apples to bananas here between the Stansbury and the Wasatch with respect to the PFS site and how there is, quote, conservatism as you claim in PFS's analyses?

DR. STAMATAKOS: I don't think this is a comparison of apples and bananas. As I've stated in the first order, what the curves that we plotted demonstrate is that the calculated hazard for the PFS site is quite large compared to other published hazard curves for the western United States, including the ones in California where we know activity rates are quite high.

And although there may be some differences in details, it's clear that, and I

don't think anybody would argue the fact that the Wasatch fault is a much larger, much more active fault than the Stansbury fault in that the comparisons show that despite that observation, the hazard at Skull Valley is plotted as something that's larger. Even if you make the conclusion that the Stansbury is like the Wasatch fault, which I don't think anybody would make, the hazard still is larger for Skull Valley than it is for hazard curves that are plotted either by the USGS or Salt Lake City or the analysis that was performed for the I-15 project which also showed plot hazard results for specific sites along the Wasatch Front.

MR. TURK: Could I get a clarification before -- you said the hazard in Skull Valley is larger. You mean --

DR. STAMATAKOS: The amount of ground motion.

MR. TURK: That Geomatrix --

DR. STAMATAKOS: That's a Geomatrix estimate, yeah.

Q. (By Ms. Chancellor) So you're saying that this chart shows that the ground motions at the PFS site are estimated to be greater than those estimated in Salt Lake City?

DR. STAMATAKOS: That's correct.

Q. If you were -- that's only what Exhibit R shows, correct? It doesn't show that the Applicant's estimates of the ground motion are conservative, it just shows that these are the ground motions --

DR. STAMATAKOS: All the curve shows is that these are the ground, what under line that is meant to go and I'd have to do a first order, if you will, part of the expression smell test to say, okay, well, why is that? Why is the hazard so high at a site out in the middle of the Basin and Range away from the Wasatch Front compared to other hazards in the western United States, including southern California, including Salt Lake City, whereas your witnesses put in their testimony, one of the largest and most active normal faults exist. Certainly we've heard some testimony and people are familiar with the levels of hazards related to faults like the Hosgri fault and the San Andreas fault in California that could produce large magnitudes and can produce those earthquakes more frequently than is estimated for Skull Valley.

So our conclusion based on a comparison of these curves with that basic explanation plus

some specific analyses that we did, we reached the conclusion that -- our conclusion that we feel that the hazard curves presented by PFS for this facility are conservative.

Q. Isn't the maximum magnitude on the Salt Lake City segment of the Wasatch Front the most relevant reference for the Salt Lake City curve on your nap?

DR. STAMATAKOS: I'd have to look at -- I can't remember from memory the various segments of the Wasatch Fault without looking at a map. But I'm sure that other segments -- if that's true, the Salt Lake City segment is the one that's closest to Salt Lake City, would be very important.

But other segments would also come to play, because I'm sure that their site-to-source distances for some of the other segments are within the range that are important in the ground motion. So my conclusion is that this Salt Lake City curve, although it may depend largely on the Salt Lake City segment if that's the closest large segment to downtown Salt Lake City, and other segments of the Salt Lake City -- of the Wasatch Fault, excuse me, would also contribute to the hazard at Salt Lake City.

Q. In going -- in looking at the Stansbury fault and the Salt Lake City portion of the Wasatch fault, didn't we establish that the maximum magnitude on the Stansbury fault would be greater than the maximum magnitude on the Salt Lake City segment of the Wasatch fault?

DR. STAMATAKOS: Too many pieces of paper. I believe that's correct. If the Salt Lake City fault had a lower mean maximum magnitude than the Stansbury fault.

MS. CHANCELLOR: Your Honor, I wish to --

MR. TURK: Could we ask the witness first to look at the paper and make sure that that's his answer?

DR. STAMATAKOS: The distributions are quite different, and I would add that the Stansbury distribution, although the mean is given at around magnitude 7 and there's a small possibility, probability of larger earthquakes, that the distribution that's put for the Stansbury fault is quite broad. It also includes many smaller magnitude earthquakes with another, for example, a fairly significant peak at about a magnitude 6.6.

Unlike the -- because of the excellent

work that's been done on the Wasatch fault, all of the Wasatch fault segments have very narrowly defined maximum magnitude ranges.

MS. CHANCELLOR: Your Honor, the State renews its objection to Staff's Exhibit R. If this exhibit were being offered solely for the purpose of showing what ground motions are at these very sites, notwithstanding that there is absolutely no reference on this exhibit, that's one thing. But the Staff is offering this exhibit to show that the ground motions estimated at the Skull Valley site are, quote, conservative. This exhibit does not stand for that proposition.

In addition, the exhibit doesn't even have the Y axis label. It has no reference whatsoever to where these data were derived from. And so I would say that this exhibit, Staff's Exhibit R, standing by itself will be totally misleading to the lay person who picks up this chart and looks at it for the purpose of the Staff's proposition that this shows that the ground motions at the Skull Valley site are, quote, conservative. What it does show is that the Skull Valley site is -- that the Skull Valley site is seismically hazardous.

JUDGE FARRAR: If it shows that it's seismically hazardous, why would you object to its admission?

MS. CHANCELLOR: Because that's not the reason that it is being put forth. It is being put forth by the Staff not to show that it's seismically hazardous but to show that PFS's numbers are conservative, and in fact they go so far as to say that they are 1.5 times more conservative than the estimates of ground motions in Salt Lake Valley. And that proposition is wrong based on this analysis.

JUDGE FARRAR: Mr. Turk?

MR. TURK: Your Honor, we intend to do redirect, and I would ask that the motion be tabled unless you would like me to do that now so you can rule on the motion.

JUDGE FARRAR: No, let's continue to withhold any action on it given the State's objection, and we'll deal with it after redirect.

MS. CHANCELLOR: I would request, your Honor, if there's any consideration given to entering this exhibit into the record that it be accompanied by Dr. Stamatakos's notebook pages 1 through 6, but I don't want to undermine my

argument that it shouldn't be entered into the record at all.

JUDGE FARRAR: Let's wait till we get to that point.

MS. CHANCELLOR: I have one final question. Where in the consolidated SE -- let me back up. You cite many regulations in your testimony. One regulation you don't cite is 72.7, specific exemptions. And those -- and that regulation reads, "The Commission may, upon application by any interested person, or upon its own initiative grant such exemptions from the requirements of the regulations in this part as it determines are authorized work by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

Where in the consolidated SER is there any consideration for public interest in granting PFS its seismic exemption request?

MR. TURK: That may be a question more properly directed to counsel.

JUDGE FARRAR: Maybe we'll do that too, but let's get the witness's answer.

DR. STAMATAKOS: We didn't address that directly. As stated clearly in our evaluations,

our task was to evaluate the technical merits of PFS seismic hazard curve in light of the exemption request. And our conclusions are, you misstated slightly how we applied those hazard curves as one example, but we'll get back to that. Our evaluation is that they did a thorough job, and that, based on our evaluations the results appear to us to be conservative. It's not just the comparison of the hazard curves that that conclusion was drawn from. That conclusion was drawn from our evaluation of seismic hazards result only back to 1999.

JUDGE FARRAR: But wait. Are you answering the question about public interest? In other words, that deals with what you think about the public health and safety, but you're saying, where did you consider the different factor of public interest?

DR. McCANN: I will address --

JUDGE FARRAR: And counsel will eventually argue about what public interest means, but where do you have it in there?

DR. McCANN: In the context of the probabilistic seismic hazard analysis, which was the technical focus of our review, and as we and

others have talked at length, these things are not independent of one another, and therefore one of our starting points as part of the consideration of the exemption and the probability of exceedance of the design basis, we started with the Commission's statement and the statement related ISFSIs to nuclear power plants. The Commission has also stated that existing nuclear power plants operating today are safe. And that statement --

JUDGE FARRAR: We're -- I don't think we're addressing her point. The point is not whether you think this is safe, it's -- okay, it's safe and there's a reason why for the public we want to head in this direction. Now, to me, implicit in her question is, that's counter-intuitive. The public interest would usually be having something as safe as possible, anything that pulls away from that you might intuit is not in the public interest. She's asking what reason is there that is in the public interest, not that it's safe from a seismic standpoint, but how has the public interest served.

Now, counsel may argue that this factor means something different than I'm suggesting here. But what is the public interest in granting this

exemption? How is the public served by granting the exemption? Not asking if your work is right, but is the public interest served by granting this exemption, and where is that reflected in the documents.

DR. McCANN: Our --

MR. TURK: Your Honor, I would simply note, if you're asking a question about an NRC Staff's regulatory position, these are not NRC Staff employees. I have no problem if they give their own opinions.

JUDGE FARRAR: Or he might say he has no idea, and then you'll have to make up the difference somewhere else. You know, given this understanding of the question, are you aware of anything in your documents that -- how this exemption promotes the public interest? Not the public safety, public interest.

DR. McCANN: Now I'm confused. Public interest being and public safety being?

JUDGE FARRAR: The regulation mentions it.

Q. (By Ms. Chancellor) Are you familiar with Section 72.7, which is the standard for granting an exemption?

DR. McCANN: No, I'm not.

Q. And you, Dr. Stamatakos?

DR. STAMATAKOS: I'm familiar with that part of the regulation insomuch as I've read it.

Q. Putting aside public safety and threat to property and security, is there anywhere in the consolidated SER or any other documents that address the public interest, to your knowledge?

DR. STAMATAKOS: Only insofar as that the exemption request takes advantage of significant advances in understanding of how best to quantify earthquake seismic hazard assessments, compare to an approach that, by all accounts, the deterministic approach has significant flaws.

So in that aspect, we can argue that by moving toward a probabilistic society we're moving toward a better understanding and evaluation of hazards without incorporating unrealistic effects into our seismic hazard assessment. And again, our analysis is based on technical evaluation of the application and the exemption requests. Larger issues were not part of our evaluation.

Q. Dr. Chen, in the INEEL exemption request was managing the damage core reactor fuel part of the contribution of granting INEEL an exemption?

MR. TURK: I'm sorry. It was managing the fuel? I don't understand it.

JUDGE FARRAR: Does the witness understand it?

DR. CHEN: No, I do not.

Q. (By Ms. Chancellor) Was the ability to have a place to store the damaged reactor fuel from Three Mile Island at the INEEL facility, was that a consideration in granting INEEL its exemption request? If you know.

DR. CHEN: I still don't quite understand the question.

JUDGE FARRAR: She's saying, was it in -- was the public interest served by the --

MS. CHANCELLOR: By having a place to put the INEEL damaged core reactor fuel.

JUDGE FARRAR: And to your knowledge, was that factor considered in your decision to grant an exemption?

MS. CHANCELLOR: The witness can answer to the best of her knowledge.

JUDGE FARRAR: And if you don't know the answer, we've told all witnesses it's fine if you don't know the answer.

DR. CHEN: I can only tell what I know.

It is true that the ISFSI for TMI to was constructed because DOE realized that their previous storage facility was not safe enough and there's not sufficient standards, sufficient DOE standards. So in that regard, it is.

MS. CHANCELLOR: I have no further questions, your Honor.

JUDGE FARRAR: Let me ask one quick --

MS. CHANCELLOR: Oh, I do one, your Honor. Could I move for entry of State's Exhibit 185, which is the exerts from the Geomatrix report?

JUDGE FARRAR: Any objection, Mr. Gaukler?

MR. GAUKLER: I guess, I think hinge on whether or not you admit Staff Exhibit R, and I believe we should consider the two together. And if we admit Staff Exhibit R, I have no objection to the state.

JUDGE FARRAR: Mr. Turk?

MR. TURK: I wasn't going to object to the introduction of this exhibit by itself, but the question is, what does it stand for. If it's -- if it has to do with the reliability of Staff Exhibit R, then the Applicant's statement and his records should be viewed together.

MS. CHANCELLOR: Your Honor, there's testimony that the Wasatch Fault is ten times --

JUDGE FARRAR: Is Mr. Gaukler right that we should hold this and do R and State 185 together?

MS. CHANCELLOR: No, your Honor. This goes to whether the testimony by the witnesses is correct, and it goes to whether the slip rate on the Wasatch segment of the Wasatch Fault is ten times more than the slip rate on the Stansbury fault. So it's specific to the Staff's testimony. If refutes that allegation that the slip rate on the Wasatch is ten times greater, more than on the Stansbury.

JUDGE FARRAR: Maybe there's some confusion here. The notebook was never marked for identification, and that certainly has a tie-in to Exhibit R. Mr. Gaukler, but you think 185 also has that tie-in?

MR. GAUKLER: That's what I understood from the cross-examination, that it did; and I would just say that you admit that Exhibit R, and I have no objection. If we don't, let's address the issue then.

JUDGE FARRAR: Given Mr. Gaukler's

position, let's hold off on 185 until we get to R, just for efficiency.

Let me ask the witnesses, you keep referring to the Wasatch Fault. If I got in the car and drove east from here, where is it in all these mountains that we see out the window?

DR. STAMATAKOS: It's somewhere near the base of the foothills as you start to gain elevation.

JUDGE FARRAR: This side?

DR. STAMATAKOS: This side.

JUDGE FARRAR: West?

DR. STAMATAKOS: West.

JUDGE FARRAR: Between us and the mountain that's on the west side -- the west face of the mountain?

DR. STAMATAKOS: That's correct.

JUDGE FARRAR: Judge Lam has some questions for you.

JUDGE LAM: Dr. McCann, Dr. Stamatakos --

MS. CHANCELLOR: I believe you have to go east to get to the Wasatch fault, not to the west. Which mountains are you --

MR. TURK: The witness is describing the

elevation --

JUDGE FARRAR: Going east from here I would come to the west face, and he says that's where the fault is.

MS. CHANCELLOR: Okay. I beg your pardon.

JUDGE LAM: Ms. Chancellor, I thought you were going to ask the questions for me.

MS. CHANCELLOR: No, your Honor.

JUDGE LAM: Good afternoon Dr. McCann, Dr. Stamatakos and Dr. Chen. I read in your prefiled testimony that the applicant two years ago, two, three years ago had determined a set of peak ground motions, and within two years we revise it upwards by 30 to 40 percent. Is that correct?

DR. STAMATAKOS. For the peak ground acceleration, that's correct, yes.

JUDGE LAM: Now, I assume in your business new information comes up from time to time. Is that correct?

DR. STAMATAKOS: That's correct.

JUDGE LAM: Then the question is, what confidence level do you have that these peak ground acceleration value would not be revised again and we open this source of characterization issue for

litigation?

DR. STAMATAKOS: Well, to some extent because that revision really involved soil characterization, in particular the upper 30 or 60 feet of soil, I would say that -- and then how that is modeled in the source part, it depends on the nature of the new information. And to some extent we would rely on soil experts to tell us about those specific site conditions that lead to that component of the seismic hazard.

So if there is not a revision in -- significant revision in the inputs that go into the soil modeling like shear wave velocity, my confidence would be fairly high that there would not be a better, substantial change. Do you want to add?

DR. McCANN: I guess the only thing I would add is two points. One is, in a probabilistic hazard analysis, as you know, the uncertainty is explicitly modeled. The negative side of having that uncertainty is an explicit admission of what it is we don't know, and some expectation that the answers could be higher or lower than what we're seeing based on the uncertainties that we have.

Secondly, I think it's also a fair statement both in a deterministic and a probabilistic analysis as new, detailed information becomes available for a site, it poses new issues, potentially, and that would be true here whether we're talking about a probabilistic seismic hazard, and in any licensing environment -- new discovery of a fault, new site soil information or whatever.

But the probabilistic hazard analysis presumably has addressed these uncertainties and quantified them and given as some measure that there is an expectation that the true answer lies somewhat higher or somewhat lower than the estimate we're working with today.

JUDGE LAM: Dr. Chen, do you have anything to add to that?

DR. CHEN: No, I agree with Dr. Stamatakos and Dr. McCann.

JUDGE LAM: Also, in two days of testimony we heard a great deal of statement from all three of you that the soils characterization is conservative. Would you collectively or individually describe to me, what are the most important contributor to your assessment of these conservatisms?