

1 CHAIRMAN FARRAR: I commend the parties
2 for finishing a half hour early. Can -- do we gain
3 anything by putting Dr. Stamatakos on the stand and
4 getting his testimony subscribed to and so forth, or
5 does he have exhibits that he -- does he have to
6 explain the exhibits which we would want Dr. Arabasz
7 to hear?

8 MR. TURK: We will just conduct a few
9 questions to explain the exhibits. The exhibits have
10 been pre-filed with the State, so they have them
11 already.

12 CHAIRMAN FARRAR: Right.

13 MR. TURK: I leave it up to Ms.
14 Chancellor. If she wants to wait for that, we can.

15 CHAIRMAN FARRAR: Then I would say we
16 wait.

17 MS. CHANCELLOR: Right. And do you have
18 any oral examination, other than explaining the
19 exhibits of Dr. Stamatakos?

20 MR. TURK: May I consult --

21 CHAIRMAN FARRAR: Off the record.

22 (Off the record 12:32:37 - 12:32:55 p.m.)

23 CHAIRMAN FARRAR: Ms. Chancellor, does Dr.
24 Arabasz have this document?

25 MR. TURK: The written rebuttal and the

1 explanation of the two exhibits.

2 CHAIRMAN FARRAR: It would probably be
3 better to have DR. Arabasz hear the explanation of the
4 exhibits.

5 MS. CHANCELLOR: I think so. I think the
6 map may not have been self-evident.

7 MR. TURK: I would ask since the reporter
8 is here, that I be allowed to hand the exhibits out at
9 this time. Why don't I at least identify on the
10 record what I'm distributing. We can take care of
11 that.

12 CHAIRMAN FARRAR: Right. Let's do that.

13 MS. CURRAN: Judge Farrar, while you're
14 waiting for that, I'd like to ask to be excused
15 because I've ended my part in this hearing.

16 CHAIRMAN FARRAR: Well, maybe we like
17 having you here, and we won't excuse you.

18 (Laughter.)

19 CHAIRMAN FARRAR: Ms. Curran, thank you
20 for your participation, limited though it was.

21 MS. CURRAN: Thank you for your
22 consideration.

23 CHAIRMAN FARRAR: And we look forward to
24 seeing you in other cases, and perhaps in the other
25 matter which you and I are involved.

1 MR. TURK: Your Honor, let me note for the
2 record that we're distributing two documents at this
3 time. First, we have a color map, which I would ask
4 to be marked as Staff Exhibit Number 62 for
5 identification.

6 CHAIRMAN FARRAR: All right.

7 MR. TURK: The map is entitled, "Historic
8 Seismicity and Nuclear Facilities in the United
9 States." And that would be Staff Exhibit 62 for
10 identification.

11 (Staff Exhibit 62 marked for identification.)

12 MR. TURK: The second document I would ask
13 to have marked as Staff Exhibit Number 63 for
14 identification. And that document is entitled,
15 "Technical Assessment of Structural Deformation in
16 Seismicity at Yucca Mountain, Nevada." It's dated
17 September, 2001. It consists of the cover page, one
18 page from the table of contents, and Section 3.2.5 of
19 the document on pages 3-10 to 3-13. And that section
20 is entitled, "Seismic Hazard of Bare Mountain Falls."

21 (Staff Exhibit 63 marked for identification.)

22 CHAIRMAN FARRAR: All right. And these
23 are the two documents that were attached to the pre-
24 filed written testimony of Dr. Stamatakos.

25 MR. TURK: Yes. We provided a courtesy

1 copy by email.

2 CHAIRMAN FARRAR: Right.

3 MR. TURK: And we distributed, I believe,
4 yesterday -- what we distributed yesterday was the
5 non-color reduced version of the map.

6 CHAIRMAN FARRAR: Right.

7 MR. TURK: Today we're producing the color
8 version in its full size.

9 CHAIRMAN FARRAR: Why don't we make a
10 little more progress, and just have Dr. Stamatakos --
11 Dr. Stamatakos, would you take the stand a moment
12 briefly here, and we'll just have him adopt the
13 testimony, and then we can get right into the
14 explanation of the exhibits when we come back at 2:00.

15 MR. TURK: Okay. Let me then distribute
16 the pre-filed testimony.

17 CHAIRMAN FARRAR: Right. And this is
18 identical to what you gave us a couple of days ago?

19 MR. TURK: Yes, it is.

20 CHAIRMAN FARRAR: Okay. Dr. Stamatakos,
21 you've previously been sworn in the case, so please
22 consider yourself still under oath.

23 DR. STAMATAKOS: I will.

24 CHAIRMAN FARRAR: But we will not invoke
25 that regulation, and allow you to examine yourself, as

1 you did with other witnesses on a prior occasion. Go
2 ahead, Mr. Turk.

3 MR. TURK: Thank you, Your Honor. Good
4 afternoon, Dr. Stamatakos.

5 DR. STAMATAKOS: Good afternoon.

6 DIRECT EXAMINATION

7 MR. TURK: I've placed in front of you a
8 document entitled, "NRC Staff Rebuttal Testimony of
9 Dr. John A. Stamatakos, concerning Unified Contention
10 Utah L/QQ Part E (Seismic Exemption)", dated June 21,
11 2002. Do you have that document?

12 DR. STAMATAKOS: Yes, I do.

13 MR. TURK: And is this testimony that you
14 prepared for filing in this proceeding?

15 DR. STAMATAKOS: Yes, it is.

16 MR. TURK: You're previously prepared a
17 Statement of Professional Qualifications that's
18 attached to your earlier testimony in the proceeding,
19 as I recall.

20 DR. STAMATAKOS: That's correct.

21 MR. TURK: Do you have any revisions that
22 you wish to make to this document, the pre-filed
23 rebuttal testimony that we've just identified?

24 DR. STAMATAKOS: Only, now that the
25 numbers have been identified with the exhibits, that

1 we could fill those in in the various places within
2 that testimony.

3 MR. TURK: Okay. I believe the first such
4 place appears on page 5, if I'm not mistaken.

5 DR. STAMATAKOS: That's correct.

6 MR. TURK: And there, there's a reference
7 to the map that we distributed. Is that correct?

8 DR. STAMATAKOS: That's correct.

9 MR. TURK: And that's in the second
10 paragraph of page 5. Should we now insert where it
11 says "Staff Exhibit blank", make that Staff Exhibit
12 62?

13 DR. STAMATAKOS: If that's the number of
14 the map, yes.

15 MR. TURK: Okay. And then again, there's
16 a reference to the other exhibit on page 7. Do you
17 see that, about the middle of the page, there's
18 reference to a document entitled, "Technical
19 Assessment of Structural Deformation and Seismicity at
20 Yucca Mountain, Nevada"?

21 DR. STAMATAKOS: That's correct.

22 MR. TURK: And where it says, "Staff
23 Exhibit Blank", should they now say Staff Exhibit 63?

24 DR. STAMATAKOS: I believe that's correct.

25 MR. TURK: Okay. With the exception of

1 those two modifications, do you have any other
2 revisions or corrections to your testimony to make?

3 DR. STAMATAKOS: No.

4 MR. TURK: And is your testimony true and
5 correct to the best of your knowledge, information,
6 and belief?

7 DR. STAMATAKOS: Yes.

8 DR. RESNIKOFF: Yes.

9 MR. TURK: And do you wish to adopt it as
10 your sworn testimony in this proceeding?

11 DR. STAMATAKOS: Yes.

12 MR. TURK: Your Honor, at this point, I
13 would ask that the NRC Staff's Rebuttal Testimony for
14 Dr. Stamatakos be admitted and bound into the record
15 as if read.

16 CHAIRMAN FARRAR: Any objection?

17 MS. CHANCELLOR: No objection, Your Honor.

18 MR. TURK: With respect to the two
19 exhibits --

20 MR. GAUKLER: No objection, Your Honor.

21 CHAIRMAN FARRAR: Then the reporter will
22 bind the testimony into the record at this point, as
23 if read.

24 (Insert pre-filed testimony of Dr. Stamatakos.)

25

June 21, 2002

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PRIVATE FUEL STORAGE, L.L.C.)	Docket No. 72-22-ISFSI
)	
(Independent Spent)	
Fuel Storage Installation))	

NRC STAFF REBUTTAL TESTIMONY OF
DR. JOHN A. STAMATAKOS CONCERNING UNIFIED
CONTENTION UTAH L/QQ, PART E (SEISMIC EXEMPTION)

A. CIRCULAR REASONING

Q1. Dr. Arabasz stated that he observed no problems with the PFS exemption request until the Staff issued its Preliminary SER in December 1999, at which time he determined that the Staff's reasoning was "circular." Do you believe that Dr. Arabasz' stated concern is justified?

A1. No. Dr. Arabasz appears to misunderstand the origin of the arguments stated in the Staff's Preliminary SER of December 1999. In this regard, the 2,000 year return period ground motion was first proposed in the Geomatrix Consultants Inc. report of February 1999. The Staff's Preliminary SER, issued in December 1999, contains statements which are similar to the Geomatrix statements, and in essence pointed out that the Applicant's consultant had advanced arguments in favor of a 2,000-year return period.

The Staff ultimately determined to approve the PFS seismic exemption request based, in part, upon some of the considerations that were included in the Geomatrix rationale (for example, the Staff did not rely upon arguments that include lifetime of the facility or comparisons to building codes and other standards). The rationale for the Staff's determination to approve the PFS exemption request is reflected in the Staff's SER (September 2000) and SER Supplement No. 2 (December 2001), both of which are incorporated in the Consolidated SER (Staff Exhibit C).

B. DOE-STD-1020 AND CONSIDERATION OF RISK

Q2. Dr. Arabasz has criticized the Staff (*e.g.*, *May 17, Tr. 9114, 9160*) for using “*ad hoc*” and “flawed” reasoning in its determination to approve the PFS seismic exemption request. In particular, the State claims that the Staff did not link the selection of the 2,000 year design-basis ground motion to a target seismic performance goal, as DOE had done in DOE-STD-1020-2002 (*May 17, Tr. 9160, 9179*). Do you agree with the State’s criticism?

A2. No. As Drs. McCann, Chen and I stated in our direct testimony, we used the DOE Standard as a reference point in considering what is an acceptable exceedance probability for design. Within that context, DOE Standard 1020 provides insights for risk-based decision-making with respect to establishing seismic design basis ground motions. The DOE standard develops technical bases for establishment of a target performance goal and a seismic hazard exceedance probability for PC-3 facilities in general. While we considered that rationale, we also considered the more important issue with respect to the PFS site-specific exemption request -- *i.e.*, identification and evaluation of the potential radiological risks that may be posed by the proposed PFS facility.

In DOE-STD-1020, DOE considered radiological risk in establishing the appropriate MAPE for PC-3 and PC-4 facilities. At various DOE PC-3 facilities, many systems, structures, and components important to safety involve the storage or handling of large quantities of hazardous radioactive materials, such as liquid and powdered waste. This includes the high-level liquid waste stored in underground tanks. In contrast, the PFS facility proposes to store solid spent fuel contained in rugged casks and canisters. As such, the PFS facility fits well within (but is potentially less hazardous) than many of the types of facilities that DOE would assign to the PC-3 category.

In this regard, it must be observed that the establishment of an appropriate return period ground motion for a facility such as the proposed PFS ISFSI cannot be divorced from consideration

of the radiological risk associated with the facility. The Staff's acceptance of a 2,000-year return period included consideration of radiological risk as set forth in the Staff's Consolidated SER, and radiological risk considerations were an integral part of our reasoning. As stated in section 2.1.6.2 of the SER, we followed the Commission's guidance (as set forth in the 1980 "Statement of Consideration" accompanying the Commission's adoption of 10 C.F.R. Part 72, and subsequent SECY papers cited in our direct testimony), that dry cask storage facilities, like the one proposed for PFS site, are inherently less risky than nuclear power plants. For this reason, as the Commission has stated, cask and canister storage facilities need not meet the same design standards as nuclear power plants. The Staff's SER addresses the design and safety of the PFS facility, and in this regard, we rely upon the Staff's evaluation of these matters as set forth in other sections of the Consolidated SER.

C. WESTERN U.S. NUCLEAR PLANT SITES AND HAZARD CURVE SLOPES

Q3. In his testimony, Dr. Arabasz is critical the staff's reliance on the analysis of western U.S. nuclear power plants, as described in the DOE Topical Report for Yucca Mountain (*e.g.*, May 17, Tr. 9138-9140; 9169). Specifically, he questions the validity of applying results of the DOE analysis, which establish a mean annual probability of exceeding the safe shutdown earthquake at the five western nuclear power plant sites of approximately 2×10^{-4} (equivalent to a 5,000-year return period ground motion). Please describe your understanding of his concerns.

A3. Dr. Arabasz states that he had an "epiphany" based on a footnote in DOE STD-1020-2002, Appendix C, Table C-3, in which DOE makes a distinction between sites on tectonic plate boundaries and those in the rest of the United States (Table C-3 provides two sets of values for the seismic hazard exceedance probability and the risk reduction ratio at PC-3 (and PC-4) facilities, and the footnote explains that the smaller exceedance probability is "for sites such as LLNL, SNL-Livermore, SLAC, LBNL, and ETEC which are near tectonic plate boundaries").

According to Dr. Arabasz, the sites near tectonic plate boundaries can be designed to higher probabilities (shorter return periods), than those in the rest of the country, with the provision that all sites must meet the same target seismic performance goals. Dr. Arabasz explains this in terms of the slope of the seismic hazard curves, and focuses upon the "importance of steep hazard curves along the plate boundary versus shallower hazard curves elsewhere." (*May 17, Tr. 9166*). He further looks at Table C-2 in Yucca Mountain Topical Report YMP/TR-003-NP, and states that four of the five western U.S. nuclear plant sites listed there are tectonic plate boundary sites, which have a lower return period than non-tectonic plate sites; which he believes supports his view that only tectonic plate nuclear power plant sites may have a shorter return period than the 10,000-year return period ($MAPE = 1 \times 10^{-4}$) that exists more commonly at other nuclear power plant sites.

Q4. Do you agree with Dr. Arabasz in this regard?

A4. No. First, of the five sites listed in Table C-2 of the Yucca Mountain topical report, only two of those sites (Diablo Canyon, San Onofre) are situated close to a tectonic plate boundary. The third site (Washington Nuclear 3) is relatively farther away from the tectonic plate boundary. Its seismic hazard curve is dominated by earthquakes resulting from subduction of the Juan de Fuca plate beneath the North American plate. This subduction zone seismicity is modeled much like the large areal sources used to model seismicity in the eastern United States; in comparison, earthquakes at tectonic plate margins or in the vicinity of the PFS site are modeled as specific fault sources. The fourth and fifth sites (Palo Verde and Washington Nuclear 2) represent inland sites that are not situated at a plate boundary and whose seismic hazard curves are directly controlled by earthquakes generated by local crustal faults. Thus, the Sample Mean of a MAPE of 2×10^{-4} , set forth in Table C-2 of the DOE topical report does not represent a value that should be limited to sites near tectonic plate boundaries or a subduction zone. Rather, it is applicable to the entire Western United States.

Second, there is not a clear difference between the shapes or slopes of most hazard curves in the intermountain west (including the PFS site), and sites that are near tectonic plate boundaries. In my view, the simple geographic location of a site relative to a tectonic plate boundary does not provide a sufficient justification to make a distinction between sites along tectonic plate boundaries and those in the rest of the intermountain United States.

In this regard, I have prepared a figure entitled "Historic Seismicity and Nuclear Facilities in the United States" (Staff Exhibit ___). The figure shows two maps: (1) a map of the United States, and (2) a map of the central Rocky Mountains and eastern Basin and Range. On both maps, the location of many of the nuclear facilities we have discussed are shown relative to the location of the tectonic plate boundaries. The maps also show the frequency and magnitude of historic earthquakes in the Western United States as compared to the Central and Eastern United States. Details concerning the source of the data are provided in the key at the lower right hand corner of the figure.

Further analysis supports my conclusion that the hazard curves for western U.S. nuclear power plant sites may not be distinguished based upon the proximity of the site to a tectonic plate boundary or subduction zone. First, in DOE-1020-2002, page C-9, DOE provides a clear definition of high hazard sites that fall in the "near tectonic plate boundary" classification. In that definition, there are three important factors: (1) proximity to active faults, (2) high recurrence rates, (3) and areas with high seismicity. In my view, the seismic hazard at the PFS site, as determined by Geomatrix Consultants Inc. (1999), fits this definition. The PFS site is near active faults, as Dr. Arabasz has agreed (*June 6, Tr. 10,226*). In addition, the PFS seismic hazard results meet the other parts of this definition: There are nearby faults with high recurrence rates; and according to the Geomatrix hazard results, the PFS site appears to be in an area of high seismicity. In my view, the high ground motions predicted by the Geomatrix PSHA, which are similar to those at very high

seismic sites like Diablo Canyon, imply that the PFS site has high seismicity. This is contrary to the view expressed by Dr. Arabasz, who stated he does not consider the PFS site to be a high seismicity site (*June 6, Tr. 10,226-227*).

Q5. During Dr. Arabasz' testimony, there was considerable discussion of the A_R value, which he used to differentiate sites located on the tectonic plate boundary from sites located throughout the rest of the United States. Do you agree that the A_R value can be used in this manner?

A5. No. During cross-examination of Dr. Arabasz, it became apparent that the slopes of many of the hazard curves do not necessarily match the implied expectation — *i.e.*, that sites on the tectonic plate boundary should have steeper slopes (smaller A_R values) than the shallow slopes (larger A_R values) for sites in the intermountain west (*e.g.*, *June 6, Tr. 10,230-231*). In contrast to this implied expectation, the slopes of many seismic hazard curves in the intermountain west are similar to those of sites located on a tectonic plate boundary. For example, A_R values for the PFS PSHA curves are approximately 2.20 to 2.25, which are within the upper range of A_R values cited in Appendix C of DOE Standard 1020 for sites near tectonic plate boundaries.

In my view, the slope (or A_R value) of a seismic hazard curve, although potentially important for engineering considerations, is not an appropriate tool to differentiate between sites along the tectonic plate boundary and other sites in the intermountain west. Factors that control the slopes or A_R values of seismic hazard curves are complex and do not neatly relate to site conditions indicative of a tectonic plate boundary. For example, it became apparent during the cross-examination of Dr. Arabasz that increased knowledge about a site (*e.g.*, a different representation of uncertainties) can lead to a substantial change in the hazard curve slope or A_R value. For the Los Alamos site, modifications or updates to the seismic hazard assessment were seen to have a significant effect on the A_R values: In that example, the A_R value changed by 30% (from 2.14 to

2.80) with the 1995 update to the Los Alamos seismic hazard assessment (*June 6, Tr. 10,218-10,220*). This example illustrates that the A_R value or hazard curve slope is more sensitive to uncertainties in modeling specific site conditions and details of the PSHA study than they are to the location of a site (i.e., whether it is or is not located along a plate tectonic boundary).

One factor that does not control the slope of a seismic hazard curve is recurrence rate -- contrary to Dr. Arabasz's view that this parameter probably controls the slope of that curve (*June 6, Tr. 10,216*). For example, as part of my work at the CNWRA related to our evaluation of the DOE PSHA for Yucca Mountain, we examined recurrence rates, among other factors. One of the analyses we completed was a simple sensitivity study of the effects of fault length, fault shape, and recurrence rate (or "slip rate") on the predicted ground motions for the Bare Mountain fault in Nevada. See "Technical Assessment of Structural Deformation and Seismicity at Yucca Mountain, Nevada," CNWRA Report, 2001 (Staff Exhibit ___). In that study, we minimized many of the factors that are part of a PSHA, because we used a single attenuation model (Abraham and Silva, 1997), a single model for recurrence (characteristic), and a single empirical model to scale fault dimension to magnitude (Wells and Coppersmith, 1994). The only parameters we varied were fault length, fault shape (planar or listric), and recurrence rate (slip rate). Details of the cases are summarized in Table 3-1 of that report, "Sensitivity of fault geometry and Fault Slip rate on the Seismic Hazard of the Bare Mountain Fault." Seismic hazard results are summarized in Figure 3-2 of that report, "Seismic Hazard Results for the Bare Mountain Fault Based on Alternative Assumptions of fault geometry and Fault Activity." Those results show that differences in recurrence rate (slip rate) simply scale the hazard curves without affecting their slopes. Therefore, the recurrence rate (slip rate) does not influence the slope of the hazard curves. Because the recurrence rate (slip rate) is not important in defining the hazard curve, I see little difference in the underlying geological factors that would distinguish sites located near the tectonic plate boundary and other sites located in the

intermountain west, in defining the hazard curve or its A_R value. In this regard, it should be noted that the San Andreas fault system is an active strike-slip fault that happens to form the plate boundary -- but in terms of seismicity, it is like any other large strike-slip fault, whether that strike-slip fault is a plate boundary or not.

Finally, other factors which are not site-specific can influence a hazard curve slope. For example, in the case of Diablo Canyon, the slope of the hazard curve is steeper than is typical for coastal California hazard curves. This is because efforts were taken in the Diablo Canyon seismic probabilistic risk assessment to develop a site-specific model for variability in ground motion attenuation; that site-specific model of variability made the Diablo Canyon seismic hazard curve steeper than if more typical models of variability for western U.S. sites had been used.

For these reasons, the DOE analyses of the mean annual probability of exceedance at western nuclear power plant sites reflected in DOE Topical Report YMP/TR-003-NP -- resulting in a reference exceedance probability for nuclear power plants in the western United States of 2×10^{-4} (5,000 yr return period) -- is applicable to the PFS site and provides a valid reference point in considering the appropriate return period ground motion for the PFS facility design earthquake.

D. APPLICABILITY OF NUREG/CR-6728

Q6. In his testimony, Dr. Arabasz referred to NUREG/CR-6728, and in particular to the methodology in chapter 7 of that report as appropriate for developing risk-consistent guidelines in "regulatory decision making" (*June 6, Tr. 10,154*). Do you agree with that view?

A6. No. NUREG/CR-6728 has not yet been reviewed or accepted by the Staff or the Commission. Further, that document was published in October 2001, well after the Applicant's work was completed, and just a short time before issuance of SER Supplement No. 2. Accordingly, that document does not provide an appropriate or approved basis upon which to consider the PFS seismic exemption request.

1 MR. TURK: Thank you. With respect to the
2 two exhibits that we just discussed briefly, first of
3 all, with respect to the map --

4 CHAIRMAN FARRAR: Wait, wait, wait. We're
5 not -- we want Dr. Arabasz to hear this.

6 MR. TURK: Oh, I thought you wanted him to
7 adopt the exhibits.

8 CHAIRMAN FARRAR: Oh, okay. Right.

9 MR. TURK: Do you want me to wait for him?

10 CHAIRMAN FARRAR: No, no.

11 MS. CHANCELLOR: Is there going to be an
12 explanation of the map?

13 MR. TURK: I would simply ask whether he
14 prepared these documents, whether he's familiar with
15 and prepared the documents. If he is, I would ask for
16 them to be admitted.

17 MS. CHANCELLOR: Oh, that's fine. We can
18 do that now.

19 CHAIRMAN FARRAR: Okay.

20 MR. TURK: Dr. Stamatakos --

21 MS. CHANCELLOR: I'll stipulate --

22 CHAIRMAN FARRAR: Yeah.

23 MR. TURK: Well, for the record, Dr.
24 Stamatakos, Staff Exhibit 62, the map showing Historic
25 Seismicity in Nuclear Facilities.

1 DR. STAMATAKOS: Yes.

2 MR. TURK: Did you prepare that map?

3 DR. STAMATAKOS: Yes, in conjunction with
4 one of the technical people that works with us at the
5 center by the name of Debbie Waiting.

6 MR. TURK: You're satisfied that this map
7 is an accurate depiction of seismicity in nuclear
8 facilities in the United States, historic seismicity?

9 DR. STAMATAKOS: As I've characterized it
10 in the written part, which is in the key in the lower
11 right-hand corner, yes.

12 MR. TURK: It's the key in the lower
13 right-hand corner of the map.

14 DR. STAMATAKOS: That's correct.

15 MR. TURK: Also, with respect to Staff
16 Exhibit 63 for identification, which is the Technical
17 Assessment of Structural Deformation in Seismicity at
18 Yucca Mountain, Nevada, Section 3.2.5. Are you
19 familiar with this document?

20 DR. STAMATAKOS: Yes.

21 MR. TURK: And are you one of the co-
22 authors of this document?

23 DR. STAMATAKOS: Yes.

24 MR. TURK: Your Honor, I would ask that
25 these two exhibits be admitted at this time.

1 CHAIRMAN FARRAR: Any objection?

2 MS. CHANCELLOR: No objection, Your Honor.

3 MR. GAUKLER: No objection.

4 CHAIRMAN FARRAR: All right. Then Exhibit
5 62 and 63 will be admitted. Then when we return from
6 lunch, we'll have Dr. Arabasz on the phone. Mr. Turk,
7 you'll want to ask Dr. Stamatakos to explain the map.

8 (Staff Exhibits 62 and 63 admitted in evidence.)

9 MR. TURK: I will ask him to explain the
10 map. Yes, sir.

11 CHAIRMAN FARRAR: Okay. Which Dr. Arabasz
12 will be able to hear, and you'll have no other
13 questions?

14 MR. TURK: Nothing that I can think of.

15 CHAIRMAN FARRAR: Okay. Then we'd be
16 ready at that time. Will the Applicant have any
17 examination?

18 MR. GAUKLER: No, Your Honor.

19 CHAIRMAN FARRAR: Okay. So, Ms.
20 Chancellor, we'll start right with you shortly after
21 2. How long are you anticipating?

22 MS. CHANCELLOR: It depends whether Dr.
23 Stamatakos answers yes or no. Dr. Arabasz has given
24 me a whole bunch of questions, so it could be a few
25 hours, or it could be less.

1 CHAIRMAN FARRAR: We'll finish today then.

2 MS. CHANCELLOR: We'll finish today.

3 CHAIRMAN FARRAR: All right.

4 MR. TURK: I think Dr. Stamatakos is very
5 willing witness. He may have to explain answers at
6 times, but my own impression is that he's always been
7 candid and fairly quick with his answers.

8 MS. CHANCELLOR: I'm just not sure he's
9 going to answer yes to --

10 (Laughter.)

11 CHAIRMAN FARRAR: Then we will then be on
12 target to start tomorrow morning with Dr. Bartlett.

13 MS. CHANCELLOR: Direct testimony on the
14 DOE portion, or DOE Standard 1020 as it relates to the
15 seismic exemption.

16 CHAIRMAN FARRAR: Did we ever -- did we
17 get that admitted?

18 MR. GAUKLER: No, we did not start.

19 MS. CHANCELLOR: No.

20 CHAIRMAN FARRAR: We didn't start with
21 him, and then reserve cross.

22 MS. CHANCELLOR: Haven't started.

23 CHAIRMAN FARRAR: Right. Okay. Good. I
24 couldn't remember that we had done that, but --

25 MR. GAUKLER: The testimony that we'll be

1 doing will be Dr. Bartlett on design conservatism with
2 respect to Section E of the Unified Contention.

3 CHAIRMAN FARRAR: Now is this the
4 testimony that was originally with Ostadan?

5 MS. CHANCELLOR: That's correct, and it
6 was amended to just have DR. Bartlett as the one
7 witness.

8 CHAIRMAN FARRAR: Did you hand that out to
9 us?

10 MS. CHANCELLOR: Long time ago.

11 CHAIRMAN FARRAR: In Salt Lake City?

12 MS. CHANCELLOR: Yes.

13 CHAIRMAN FARRAR: Will there be new
14 copies?

15 MS. CHANCELLOR: I hadn't planned to, but
16 if you --

17 CHAIRMAN FARRAR: Were there any changes
18 other than deleting?

19 MS. CHANCELLOR: There was a slight re-
20 write of one question.

21 CHAIRMAN FARRAR: But basically --

22 MS. CHANCELLOR: It's basically the same.

23 CHAIRMAN FARRAR: If we can't find that
24 copy, we can --

25 MS. CHANCELLOR: We have a copy to

1 introduce into evidence, so we can make you additional
2 copies if you can't find the copy that we distributed
3 earlier.

4 CHAIRMAN FARRAR: Right. But if we can't
5 find that, we can follow along from the original
6 pretty well, the one that you gave us months ago.

7 MS. CHANCELLOR: Yes.

8 CHAIRMAN FARRAR: Okay.

9 JUDGE LAM: It's entitled, "Lack of Design
10 Conservatism", Ms. Chancellor?

11 MS. CHANCELLOR: I believe that's what
12 it's called. It says, "Section E, Dr. Bartlett and
13 Ostadan."

14 JUDGE LAM: Right.

15 MS. CHANCELLOR: Yes.

16 JUDGE LAM: I have a copy.

17 CHAIRMAN FARRAR: Okay.

18 MS. CHANCELLOR: Of the new one, Judge
19 Lam?

20 JUDGE LAM: No, the one that you filed on
21 April 1st.

22 CHAIRMAN FARRAR: Don't worry about it.

23 MS. CHANCELLOR: Okay.

24 CHAIRMAN FARRAR: We'll deal with it. All
25 right. Then --

1 MR. TURK: For clarification, I'm not
2 aware of any testimony in which -- which has been
3 submitted only by Dr. Bartlett. There's a strike-out
4 version of the earlier testimony. That's the one that
5 I have, and that's the one --

6 MS. CHANCELLOR: But that strikes out
7 everything relating to Dr. Ostadan, including the
8 title of the testimony which says, "Testimony By Dr.
9 Steven Bartlett."

10 MR. TURK: My only question is, is there
11 some later version in which the strike-outs don't
12 appear, or --

13 MS. CHANCELLOR: No, no, no, no. In
14 accordance with the Board's direction, I've just
15 stricken out the irrelevant portions.

16 CHAIRMAN FARRAR: So if we put our hands
17 on the strike-out version, that's current.

18 MS. CHANCELLOR: You got it. Right.

19 CHAIRMAN FARRAR: Okay.

20 MR. TURK: I would note also, Your Honor,
21 I handed you a cross examination plan back in Salt
22 Lake City for that testimony. Perhaps I should bring
23 extra copies?

24 CHAIRMAN FARRAR: Yes, why don't you.

25 MR. TURK: Okay.

1 MR. GAUKLER: I did too, so I'll try to
2 find it.

3 CHAIRMAN FARRAR: Yeah. All right. Then
4 let's -- you've earned yourself an extra lunch break.
5 We'll be back at 2:00 as planned, with an extra
6 quarter hour here. Thank you.

7 (Whereupon, the proceedings went off the
8 record at 12:56 p.m. and resumed at 2:01 p.m.)

9 CHAIRMAN FARRAR: On the record. Good
10 afternoon everyone. Dr. Arabasz, it's Judge Farrar.
11 Can you hear me all right?

12 DR. ARABASZ: Yes I can, Judge Farrar.

13 CHAIRMAN FARRAR: All right. Let me tell
14 you where we stand. Before the lunch break, we swore
15 in Dr. Stamatakos. We had him adopt his prepared
16 rebuttal testimony dated June 21st which I believe you
17 have in front of you.

18 DR. ARABASZ: Correct.

19 CHAIRMAN FARRAR: And accepted the two
20 exhibits that we attached. One is the map which has
21 been labeled Staff Exhibit 62, and then the Yucca
22 Mountain assessment which is Staff Exhibit 63. Those
23 have been admitted into the record. I believe you
24 have copies of those also.

25 DR. ARABASZ: Yes I do.

1 CHAIRMAN FARRAR: We will begin this
2 afternoon with Mr. Turk, Staff Counsel asking Dr.
3 Stamatakos to explain those two exhibits. Then the
4 companies indicated they will have no examination of
5 Dr. Stamatakos. Then Ms. Chancellor will cross
6 examine him for the State. You can just listen in.
7 I think what we'll do is if at any point Ms.
8 Chancellor wants to talk to you privately, she'll call
9 you on a cell phone. Do you have another line there
10 that she can call?

11 DR. ARABASZ: Yes I do.

12 CHAIRMAN FARRAR: Okay. I should indicate
13 for the benefit of anyone who's reading this
14 transcript in the future that Dr. Arabasz that I'm
15 talking to is at the University of Utah and is
16 appearing today by speaker-phone and is participating
17 in assistance of the State of Utah. So with no
18 further adieu, Mr. Turk, you may proceed.

19 MR. TURK: Thank you, Your Honor. Just as
20 one preliminary matter, let me note that I e-mailed
21 the two exhibits to Counsel for the State. When I did
22 that, I was e-mailing the color version of this map.
23 So Dr. Arabasz, I don't know if you were able to print
24 out the color version, but you should have received an
25 e-mail of the color version.

1 MS. CHANCELLOR: Dr. Stamatakos Fed-Exed
2 a copy of the color map.

3 MR. TURK: Did he?

4 MS. CHANCELLOR: Yes.

5 MR. TURK: Okay.

6 MS. CHANCELLOR: Thank you, Dr.
7 Stamatakos. I forwarded that to Dr. Arabasz.

8 MR. TURK: Thank you. And thank you Dr.
9 Stamatakos.

10 DIRECT EXAMINATION

11 BY MR. TURK:

12 Q Dr. Stamatakos, could you please explain
13 how you prepared Staff Exhibit 62 and what it
14 represents? I would ask you just to speak slowly so
15 that when the voice transmits by telephone to Dr.
16 Arabasz he won't have any confusion in understanding
17 you.

18 A Okay. The exhibit is two maps that we put
19 together to try to just point out in a large scale
20 context where earthquakes have occurred in the past
21 relative to the different definitions of tectonic
22 plates and tectonic plate boundaries which I've
23 labeled on the larger map. Then again the third
24 component are the yellow stars which indicate sites of
25 nuclear facilities.

1 I put together this map because in
2 previous testimony we had lots of discussion about
3 where certain nuclear facilities were relative to
4 different tectonic features or different geographic
5 features. I thought it would be useful to help frame
6 the discussions if you had a visual aide to see where
7 those facilities are located to a lot of the features
8 and the earthquakes that we've been talking about in
9 past testimony.

10 Both images were put together using a
11 software called Art View which is an off the shelf PC
12 available software that allows you to integrate
13 geographic information. I've tried to list as
14 complete as I can where the sources of the information
15 used in constructing the maps came from. The
16 topography, both base maps come from a USGS source
17 that you can access and download topographic images of
18 the United States.

19 The earthquakes come from two separate
20 sources. For the large map, the full map of the U.S.,
21 I simply downloaded a section of a catalog from the
22 Berkeley site and plotted those. The inside map on
23 the right was just highlights the portion of the
24 InterMountain West. Those earthquakes I downloaded
25 from a University of Utah site. As I said in here, I

1 didn't correct or modify the catalogs at all. I just
2 plotted the data as they are presented on those web-
3 sites.

4 The nuclear facility locations were
5 downloaded from an NRC web-page site. I've labeled
6 some of the ones in the Western U.S. I didn't label
7 all of them in the Central and Eastern United States.
8 Then I used a third source I got from another web-site
9 publication. I believe it's a paper by Swanson et al
10 in 1989, but there were many other sources you could
11 use to pick out the location of the relative features
12 along the Western United States that define the
13 tectonic plate boundary. Namely the San Andreas Fault
14 and the Subduction Zone where the Juan de Fuca plate
15 is subducting underneath parts of Oregon and
16 Washington.

17 As I said at the beginning of this answer,
18 the main purpose of this map was just to provide a
19 framework. When we were talking about the various
20 facilities, we get a sense of where they are located
21 geographically. We get a sense of where they are
22 located relative to earthquakes.

23 Q You could use the term "historic
24 seismicity." In this document, how do you use that
25 term?

1 A The historic seismicity I'm using to just
2 refer to earthquakes that have been measured in the
3 United States either by instrument or other means. As
4 I say the sequence of earthquakes that I'm using
5 covers 100 year span from 1900 to 2000.

6 Q As other people or as you yourself use the
7 term "historic seismicity" in other contexts, that
8 phrase may be used to demarcate a longer time period.

9 A It can demarcate a longer time period. My
10 understanding of that phrase is that it commonly
11 refers to earthquakes that have occurred and have been
12 recorded in the historical sense as opposed to
13 earthquakes that may have occurred a long time ago.
14 There may be geologic evidence for those earthquakes,
15 but there isn't a direct measurement of that
16 particular event.

17 Q When the term is used in that context as
18 opposed to how it's used here, that would include
19 periods such as going back to the first European
20 settlement of the North American continent.

21 A That's correct. You can go back in time
22 and dig up records of earthquakes back to when
23 recorded human activity occurred in the United States.
24 But as you go further back in time, the records get
25 more and more sketchy because smaller earthquakes are

1 missed, locating exact epicenter of many of
2 earthquakes is difficult to do.

3 Q Magnitudes would be more difficult.

4 A Magnitudes are much more difficult to
5 determine. That's correct.

6 MR. TURK: Your Honor, that's the limited
7 direct examination on this exhibit. I really don't
8 intend to conduct any examination on Exhibit 63 except
9 perhaps maybe to ask a general question of Dr.
10 Stamatakos.

11 BY MR. TURK:

12 Q This Exhibit is the Section 3.2.5 of the
13 Yucca Mountain technical assessment of structural
14 deformation and seismicity. I would ask you simply to
15 explain the relevance of this exhibit to your
16 testimony.

17 A Well, this is part of a document that we
18 prepared in our work on the Yucca Mountain Project.
19 In the pre-licensing phase of that particular project,
20 we're asked to continually evaluate DOE's program
21 relative to the Yucca Mountain Project. So almost on
22 a yearly basis we provided some type of an assessment
23 in our particular area which is we're grouped in this
24 context of Yucca Mountain into a team who were
25 involved in evaluating what's called structural

1 deformation and seismicity.

2 So I've taken a section of that report
3 out. That section was just a simple sensitivity study
4 that we did looking at one of the important faults in
5 the Yucca Mountain region. It's called the Bare
6 Mountain Fault. In that study, we did a simple hazard
7 assessment. The aim of this particular study was
8 actually to assess some differences in the activity
9 rate or the slip rate as would be predicted by a
10 number of different methods for evaluating the
11 activity in the Yucca Mountain region.

12 We picked the Bare Mountain Fault. We
13 used some other simplified assumptions which I think
14 are detailed in the report. The purpose of the
15 report, bringing this report forward here is that in
16 our discussions in the past on the slopes of seismic
17 hazard curves, there was some discussion about whether
18 or not slip rate or activity rate might influence the
19 shape or slope of seismic hazard curves.

20 As this study points out, I don't think
21 that particular parameter has a large influence on
22 slope. This is going to be provided in context of
23 whether or not the tectonic plate region should be
24 considered distinctly different from the rest of the
25 InterMountain West in terms of slopes of seismic

1 hazard curves.

2 Q If you would, turn to page 3-12 of Staff
3 Exhibit 63. There do you see three sets of curves?

4 A Actually there are 16 curves I believe.
5 12 curves.

6 Q Okay. Grouped into three different sets.
7 Four per set.

8 A That's right.

9 Q Could you explain how those curves relate
10 to your testimony that slip rate does not have a
11 significant influence on the slope of a hazard curve?

12 A Well, the curves that are color coded and
13 coded with symbol refer back to the table which is on
14 page 3-11 which outlined the different sets of
15 parameters that we did in this particular sensitivity
16 study. The three sets of curves, four in each,
17 represent cases where within each group we varied
18 other parameters about this particular Bare Mountain
19 Fault and its length and its shape. But the three
20 groups of sets were based on varying slip rate or
21 activity rate in the seismic hazard program that we
22 used.

23 I think what they show is that as you
24 increase the slip rate or activity rate of the Bare
25 Mountain Fault from a hundredth of a millimeter a year

1 to a tenth of a millimeter a year to a millimeter a
2 year that you get large changes in the hazard, but
3 that the slopes of the curves don't change very much.
4 The activity rate or slip rate on the fault acts as a
5 scaler in hazard space, but it doesn't necessarily
6 affect the slope.

7 Q Just so the record is clear, looking at
8 that page 3-12, to the lower left corner of the graph
9 there is a set of curves for 0.01 millimeters per
10 year. Those set of four curves represent the slip
11 rate of 0.01 millimeter per year.

12 A That's correct. Then what's varied there
13 was the length of the fault which controlled how big
14 the maximum earthquake could be, the shape of the
15 fault whether or not it was of a plated (PH) shape, or
16 we tried to make a simplified assumption to make the
17 shape more listric (PH) as those other parameters are
18 explained in the test and in the table.

19 MS. CHANCELLOR: Excuse me, Your Honor.
20 My understanding was that we were going to get
21 directly into cross examination after Dr. Stamatakos
22 explained his map. I didn't understand that Mr. Turk
23 was going to be conducting direct examination.

24 MR. TURK: It's my understanding that the
25 Judges asked if I would do that. I'm responding to

1 what I believe was a request that he explain the
2 exhibits before we go further.

3 CHAIRMAN FARRAR: Okay. If you and the
4 witness can keep the explanation at this point to a
5 minimum.

6 BY MR. TURK:

7 Q Okay. One last question then. The middle
8 set of curves, that's 0.1 millimeter per year and
9 those four curves in the center represents curves with
10 a slip rate of 0.1 millimeters per year.

11 A Yes. 0.1 millimeters per year.

12 Q Then again finally the last set of curves
13 to the right, that's a slip rate of 1.0 millimeters
14 per year.

15 A That's correct.

16 MR. TURK: I have nothing further that I'd
17 like to inquire about.

18 BY MR. TURK:

19 Q Dr. Stamatakos, did you have anything else
20 that you'd like to bring to attention of the Board?

21 A No.

22 MR. TURK: With that, Your Honor, the
23 witness is available for Board questioning and cross
24 examination.

25 CHAIRMAN FARRAR: All right. Just a

1 moment, Ms. Chancellor. Dr. Stamatakos, on page seven
2 of your testimony you mention recurrence rate and then
3 you provide the parenthetical that that's what you
4 mean by slip rate. If I just understood page 3-12,
5 slip rate is in millimeters per year.

6 DR. STAMATAKOS: That's correct.

7 CHAIRMAN FARRAR: Okay. Then how does
8 slip rate equal recurrence rate?

9 DR. STAMATAKOS: Well, there are a number
10 of different ways that you can characterize how active
11 a fault might be. There's a lot that goes into that.
12 The slip rate one way of looking at it is the average
13 slip rate of the fault. So we don't imply by a slip
14 rate that as the fault moves an incremental amount
15 each year.

16 CHAIRMAN FARRAR: Right.

17 DR. STAMATAKOS: It's just an average rate
18 of activity of that particular fault.

19 CHAIRMAN FARRAR: That I understand.

20 DR. STAMATAKOS: Recurrence rate is really
21 the time between some significant event.

22 CHAIRMAN FARRAR: That's what I would have
23 thought that meant. Then how on page seven, are those
24 two --

25 DR. STAMATAKOS: In this case, they're

1 fairly synonymous in the sense that we chose a model
2 for how the earthquake recurs on this particular
3 fault. It's described as characteristic. In that
4 model, most of the slip that occurs on a fault is
5 taken up by the earthquake that's of maximum
6 magnitude. So that would be the earthquake that would
7 have the one that we'd be interested in, in how often
8 it recurred.

9 In this particular case, if for example we
10 picked a magnitude of 6.5 is the maximum magnitude
11 earthquake. That earthquake occurred at some interval
12 which we would call the recurrence interval, most of
13 the slip on the fault would occur only during those
14 large magnitude events, the 6.5 earthquake. In that
15 sense, you can link slip rate and recurrence rate.

16 CHAIRMAN FARRAR: But a recurrence rate
17 would be something happens every so many years and the
18 slip rate is in distance per year.

19 DR. STAMATAKOS: Yes. But if that large
20 earthquake is the controlling earthquake as in the
21 characteristic model and you had that earthquake each
22 time produced some measure of slip. If a magnitude
23 6.5 earthquake for example was the characteristic
24 earthquake in this case and the 6.5 earthquake
25 produced one meter of slip, and that characteristic

1 earthquake occurred every 1,000 years, then you would
2 get a meter of displacement every 1,000 years. You
3 could then calculate what the yearly millimeter per
4 year slip rate was.

5 CHAIRMAN FARRAR: I heard what you said.
6 Maybe I'll understand it better by the time that we
7 finish. Ms. Chancellor, go ahead.

8 MS. CHANCELLOR: Thank you, Your Honor.

9 CROSS EXAMINATION

10 BY MS. CHANCELLOR:

11 Q Good afternoon, Dr. Stamatakos.

12 A Good afternoon.

13 Q You were present for Dr. Arabasz's
14 testimony on June 5th and 6th in Salt Lake City. Is
15 that correct?

16 A That's correct.

17 Q Before we started today, I inquired and
18 you have a copy of the transcript of the hearings for
19 June 5th and 6th.

20 A That's right.

21 Q Dr. Arabasz also testified on May 17th.
22 You weren't present for that part of the hearing.

23 A I was not present, but --

24 Q You have a copy of that.

25 A I have a copy of the transcript.

1 Q I'll be referring at times to various
2 pages from those transcripts, so if you'd keep that
3 handy. Have you reviewed those transcripts?

4 A I have reviewed them. I've read through
5 them a couple of times in preparation of this
6 rebuttal, yes.

7 Q The title of your rebuttal is "NRC Staff
8 Rebuttal Testimony of Dr. John Stamatakos concerning
9 unified contention L/QQ Part E seismic exemption."
10 Right?

11 A That's correct.

12 Q You're a contractor for the NRC Staff.

13 A That's correct.

14 Q Was your rebuttal testimony reviewed by
15 the NRC Staff?

16 A The rebuttal testimony was prepared in
17 cooperation with NRC Counsel.

18 Q In Part B of your testimony, it addresses
19 DOE Standard 1020 and Consideration of Risk in Part C
20 Western U.S. Nuclear Power Plant Sites and Hazard
21 Curve Slopes. Correct?

22 A That's correct.

23 Q Are Parts B and C of your rebuttal
24 testimony intended to represent your views and
25 opinions, those of the NRC Staff, or a mixture of your

1 personal views as a contractor to the Staff as well as
2 the Staff?

3 A I would say that primarily the views
4 expressed in this rebuttal testimony are my own.

5 Q Your own personal views. Are there any
6 that you are aware of that we could attribute to the
7 NRC Staff as opposed to your own views as a
8 contractor?

9 MR. TURK: I would object, Your Honor.
10 The Staff is putting this gentleman forward as its
11 witness. In doing so, the Staff adheres to his views.
12 I think we're asking for a legal conclusion as to
13 whether the Staff takes the view more generically or
14 not. But the Staff is proposing that this testimony
15 be accepted as the Staff's testimony.

16 MS. CHANCELLOR: That's not my question,
17 Your Honor. The contractor Staff hat comes on and off
18 NRC Staff witnesses. I'm just trying to establish.
19 While I understand this is NRC Staff testimony, a lot
20 of this testimony goes to what is the reference
21 probability for a nuclear power plant in the Western
22 United States and is that an NRC Staff position or is
23 that Dr. Stamatakos's personal opinion as a contractor
24 to the NRC Staff.

25 CHAIRMAN FARRAR: Let me think aloud here.

1 As I understand the system, the Staff has employees
2 and they have contractors. The contractors do work
3 and submit it to some Staff employee who may or may
4 not be as expert as the contractor but who has I
5 assume some management responsibilities to decide what
6 positions are going to be taken. That's my simple-
7 minded understanding of the system.

8 I guess I don't want to speak for my
9 colleagues who have been doing this far longer than I
10 have. But I assume there's a presumption of
11 regularity that when Staff puts forward a witness
12 someone in Staff management has agreed that's going to
13 be their position. It may be right or wrong, but
14 that's their position. If I'm right, I'm
15 misunderstanding. I'm trying to figure out where
16 you're trying to go. I'm not ruling against you. I'm
17 trying to figure out how where you're trying to go
18 fits in with this.

19 MS. CHANCELLOR: Let me give you an
20 example. For example, NUREG/CR-2728. That NUREG has
21 come up in this proceeding, and the Staff has made the
22 point that this is not an NRC Staff document. This
23 was prepared by a contractor. So, if I discredit Dr.
24 Stamatakos's testimony, I don't want the Staff to come
25 back and say well he was just a contractor. He really

1 wasn't expressing Staff's position. So, I'm not sure
2 what I'm dealing with here. That's all I'm trying to
3 establish. Dr. Stamatakos said that by enlarge most
4 of his testimony relates to his own personal opinion
5 as a contractor to the Staff.

6 MR. TRAVIESO-DIAZ: Mr. Chairman?

7 CHAIRMAN FARRAR: Yes.

8 MR. TRAVIESO-DIAZ: The typical practice
9 that I'm aware of is that when a contractor is put
10 forward by a party whether it is Staff or a private
11 party, a preliminary question that is legitimate to
12 ask in cross is do you know whether there is any
13 difference between your opinions and those of the
14 client that you're representing. If the person says
15 no, then you can take the views that he's presented as
16 those belonging to his party. I would suggest that
17 you only go into whether there's a discrepancy he has
18 specific reason to believe.

19 For example, a published article that is
20 different that the views that he's presenting here may
21 be inconsistent with the client that he represents.
22 But I don't think we need to do this every time. I
23 mean, it's presumed that in fact the views are the
24 same unless you have reason to believe otherwise.

25 CHAIRMAN FARRAR: Mr. Turk.

1 MR. TURK: Thank you, Your Honor. I'm not
2 sure which portion of the testimony is of greatest
3 interest to Ms. Chancellor. But presumably what we're
4 going to be spending most of the examination on today
5 is Dr. Stamatakos's explanation of the hazard curves
6 and slopes and their relevance with respect to the
7 citing of nuclear power plants in the Western United
8 States.

9 There is nothing new about the position of
10 Dr. Stamatakos. I would start first of all by noting
11 that Staff Exhibit C which an official Staff document,
12 the consolidated SER specifically includes a statement
13 that is consistent with Dr. Stamatakos's views that he
14 expresses in his testimony. If you permit me, I'll
15 get that specific reference. It's in one of the
16 bullets that Dr. Arabasz criticized.

17 MS. CHANCELLOR: I understand he
18 criticized most of the bullets.

19 MR. TURK: If you would look at page 2-50
20 of the consolidated SER at the bottom the following
21 statement appears. Let me read two sentences
22 together. This is in a bullet that discusses the
23 seismic design for commercial nuclear power plants.
24 Towards the end of that bullet on page 2-50, the
25 following statements appear. "The reference

1 probability which is defined in terms of the median
2 probability of accedence corresponds a mean annual
3 probability of accedence of ten to the minus four."
4 Citation to Murphy, et al 1997. It continues "That is
5 the same --

6 CHAIRMAN FARRAR: Mr. Turk, I've lost
7 where you're going with this.

8 MS. CHANCELLOR: Me too.

9 MR. TURK: Well, the testimony addresses
10 the point which the Staff itself has put forward in
11 its official SER for this facility.

12 CHAIRMAN FARRAR: Ms. Chancellor, maybe it
13 was the form of the question that threw me. Obviously
14 you're entitled to ask any opposing witness if there
15 isn't some other position either Staff position or
16 other expert position that's inconsistent with his
17 testimony.

18 MS. CHANCELLOR: I think part of the
19 problem is that there really isn't a position by the
20 NRC; a consistent and official if you will position as
21 to the reference probability for a nuclear power plant
22 in the InterMountain West. If they want to put Dr.
23 Stamatakos forward as a representative of the Staff or
24 if it's his own personal view as a contractor to the
25 NRC Staff who is speaking in this proceeding for the

1 Staff, I just want to know which hat Dr. Stamatakos is
2 wearing.

3 CHAIRMAN FARRAR: We'll give you some
4 leeway here. Go ahead.

5 MR. TURK: Your Honor, I want to bring one
6 statement to your attention. The point that Ms.
7 Chancellor made is exactly the point that I was going
8 to show is incorrect. The last sentence of the --

9 CHAIRMAN FARRAR: The objection is
10 overruled. We're going to let her ask this kind of
11 question. Then if you have something else to present,
12 we'll let you.

13 JUDGE LAM: I do share in Ms. Chancellor's
14 sentiment because in this proceeding we have observed
15 the Staff coming forward and saying NUREG contractor
16 reports sometimes do not reflect the official Staff
17 position. So I think Ms. Chancellor's questioning
18 here has some merit.

19 CHAIRMAN FARRAR: Go ahead, Ms.
20 Chancellor.

21 BY MS. CHANCELLOR:

22 Q Dr. Stamatakos, are you aware of any
23 portion of your testimony in which you take a
24 different position from an official NRC Staff
25 position?

1 A Well, in trying to read, let me see if I
2 can get what I think is the heart of your question
3 implies. The analysis that we did here in looking at
4 reference probabilities for nuclear power plants is
5 based on analysis that was both performed by the DOE
6 and by NRC. In particular, I'm pointing to the type
7 of analyses that NRC performed in Reg Guide 1.165
8 which is an official NRC document.

9 To my knowledge, there have not been any
10 nuclear power plants that have been cited in the
11 Western United States in a very long time. None of
12 the citings of nuclear power plants even involved full
13 scale probablistic seismic hazard assessments. The
14 analysis that's been done to try to determine what an
15 appropriate reference probability would be for nuclear
16 power plants was done after those nuclear power plants
17 were cited and licensed and when NRC and others went
18 back and looked at what the SSE, the Safe Shutdown
19 Earthquake and other types of information mean in
20 terms of a probablistic approach to this kind of an
21 issue.

22 So, if you're ultimately going to try to
23 ask me whether or not a 5,000 or 10,000 year return
24 period design ground motion is an official NRC policy
25 for nuclear power plants in the Western United States,

1 the answer is no because that issue has not come up
2 under the appropriate regulations. No nuclear power
3 plants have been designed in a long time. No nuclear
4 power plants are currently being proposed or evaluated
5 by the NRC in the Western United States. We're simply
6 trying to look for what information we can use that's
7 available and that we can link to explicit statements
8 that the Commission made about the relative risks of
9 these types of facilities in comparison to nuclear
10 power plants.

11 Q Thank you, Dr. Stamatakos. Do you recall
12 Dr. Arabasz testifying on June 6th with respect to
13 question 1 in which he criticized the Staff for
14 circular reasoning? Do you recall Dr. Arabasz stating
15 that it was "ancient history?"

16 A I remember that comment, yes.

17 Q Given that comment, do you feel that
18 there's a need for rebuttal on answer 1?

19 MR. TURK: I would object, Your Honor. I
20 don't want to interrupt the flow, but we've presented
21 the testimony that we believe to be appropriate.

22 CHAIRMAN FARRAR: Right. That's your
23 right, and she has the right to challenge whether it's
24 appropriate. It's cross examination. Overruled.

25 DR. STAMATAKOS: The point of providing

1 the question and answer number 1 not to belay ancient
2 history, but since Dr. Arabasz made those statements,
3 we've had some discussions about preliminary
4 evaluations of this issue by the State based on
5 sections of documents that were only provided to us
6 subsequent to much of the process. Those are the
7 paragraphs I don't remember the specific exhibits.

8 But there is the sense or the question
9 that's out there in my mind is that if Dr. Arabasz
10 reviewed the geomatrix report in February 1999 as he
11 originally said he did, he had no comments and in fact
12 in that exhibit he made no comments about the 2000
13 year ground motion which was provided by geomatrix.
14 Then subsequent to our preliminary SER, there were
15 comments.

16 So there's that question that remains out
17 there. I think the other aspect of this is to make it
18 clear that the point at which I think Dr. Arabasz was
19 calling circular was in fact a reference back to a
20 geomatrix report that essentially provided the same
21 kinds of justifications that we later brought forth in
22 the SER.

23 BY MS. CHANCELLOR:

24 Q Well, let's dissect answer 1.

25 MS. CHANCELLOR: This is why, Your Honor,

1 I couldn't guarantee how long we were going to take.

2 BY MS. CHANCELLOR:

3 Q The premise of question 1 is that Dr.
4 Arabasz observed no problems with PFS's exemption
5 request until the Staff issued a preliminary SER in
6 December 1999. Do you really believe that is your
7 understanding of Dr. Arabasz's testimony in this
8 proceeding?

9 A Well, no. I phrased my answer in the form
10 of a question. I don't know. In my opinion, I wonder
11 how in his original review of the '99 geomatrix report
12 there weren't any comments. When we provided a very
13 similar argument the following year, then all of a
14 sudden there was some criticism. Maybe he changed his
15 views. He certainly has the right to do that.

16 Q Let's look at the timing then. If you
17 would, we can begin on June 5th on the transcript on
18 page 9967 lines 2 through 8 where Mr. Turk begins his
19 examination of Dr. Arabasz with the document that Dr.
20 Arabasz co-authored with Dr. Pechmann entitled "Issues
21 and perspectives relating to hazard assessment of
22 earthquake ground motion, shaking and surface fault
23 displacement for licensing of the private fuel storage
24 facility Skull Valley, Utah."

25 A I'm sorry. What page are you on?

1 Q The page is 9967 of the June 5th
2 transcript.

3 A I have the question you were just reading.

4 Q Okay. So at 9967 lines 2 through 8, Mr.
5 Turk refers to this letter that was offered by Dr.
6 Arabasz and Dr. Pechmann dated April 28th.

7 A Yes.

8 Q And then on page --

9 A April 28th or April 21st?

10 Q Sorry, April 21st, you're right. Then Mr.
11 Turk read into the record at page 9980 and 9982
12 excerpts from that document. The key point of the
13 document I'm sure you will remember is on page 9982 at
14 line 8. It states "If indeed the dry storage casks
15 and canisters even under the conditions of a major
16 seismic event are as safe as asserted by PFS and
17 believed by the NRC Staff, then we can think of no
18 compelling argument to put forth against awarding the
19 exemption." Do you see that?

20 A I do.

21 Q So, the statement starts with "If indeed."
22 Do you see that?

23 A Yes.

24 Q That's a qualified we see no problems.
25 Correct?

1 A That's correct.

2 Q And on June 5th, Dr. Arabasz explained
3 that just a few days later, nine days later he
4 assisted the State in challenging PFS's exemption
5 request. So how does that correspond with the premise
6 of answer 1 to which you are responding that Dr.
7 Arabasz observed no problems until PFS issued its SER
8 in December 1999?

9 A Well, I don't know what preparations he
10 had in helping you. The first criticisms that we saw
11 were criticisms of the SER. So I don't know what
12 transpired in June or that summer at that particular
13 time. Although he gives an important qualifier in
14 that statement that you read, there's no added
15 discussion there that said by the way these are the
16 points at which I think are incorrect which are the
17 same bullet points are incorrect in the geomatrix
18 report that he later then criticized in the SER. So
19 my time line that I give in my answer is relative to
20 when we saw comments criticizing what we did after we
21 had issued the preliminary Staff SER.

22 Q Are you aware that Dr. Arabasz assisted
23 the State in drafting the first of many contentions
24 that the State filed challenging the grant of the
25 exemption request? That was filed April 30, 1999.

1 A I can't recall from his testimony the
2 level of involvement that he had in those
3 preparations. I don't know the details of that. My
4 time line was based on things that were provided to us
5 and our analysis from the State.

6 Q And you weren't aware of any discovery
7 that Dr. Arabasz assisted the State in preparing on
8 June 28, 1999.

9 A No.

10 Q What about the State's request for
11 admission of modified basis due to contention L on
12 January 26, 2000?

13 A I'm not sure of what level of involvement
14 he had.

15 Q In answer 1 you state at the end of
16 paragraph 1, the Staff's preliminary SER issued in
17 December 1999 contains statement which are similar to
18 the geomatrix statements and in essence pointed out
19 that the Applicant's consultant had advanced arguments
20 in favor of a 2000 year return period. Do you see
21 that?

22 A That's correct.

23 Q I'd like to now turn to the preliminary
24 SER which is dated at the end of 1999. This is pages
25 244 and 245 from what we've been referring to as

1 preliminary safety evaluation report and a cover
2 letter dated December 15, 1999.

3 CHAIRMAN FARRAR: Ms. Chancellor, did you
4 say that you wanted this marked?

5 MS. CHANCELLOR: No. This is just a
6 courtesy copy so that we can all follow along with the
7 wording, Your Honor.

8 MR. TURK: Just for clarity, Your Honor,
9 this is part of Staff Exhibit A. It's the original
10 preliminary SER that was introduced in the 2000 year
11 hearings. We made a hand out of this entire section
12 at the last round of hearings.

13 JUDGE LAM: A as in Adam?

14 MR. TURK: Yes.

15 MS. CHANCELLOR: Can we refer to this as
16 the preliminary SER?

17 CHAIRMAN FARRAR: That's fine.

18 BY MS. CHANCELLOR:

19 Q And on page 2-44 of the preliminary SER,
20 "the Staff reviewed the Applicant's request and
21 supporting analysis for use of a 1000 year return
22 period value and does not find this value acceptable
23 because of the following reasons." Do you see that?

24 A Yes.

25 Q Then there's a bullet contained in 2-45 of

1 the SER. The last bullet. In its formal evaluation
2 study in seismic hazard assessment study, final report
3 for the site, Geomatrix Consultants Inc. 1999-A
4 concluded that "an appropriate design probability
5 level for both laboratory ground motion and fault
6 displacement for the site is five times ten to the
7 minus four (or a 2000 year return period)." Do you
8 see that?

9 A That's correct.

10 Q I'll refer to this as the geomatrix
11 bullet. Is that okay?

12 A That's okay.

13 Q Do you recognize that the argument made in
14 the form of the geomatrix bullet is independent of
15 what is to be demonstrated, namely the non-
16 acceptability of the 1000 year return period?

17 A Well, let me put this bullet in context.
18 There's a reason why it doesn't appear in later
19 versions of the SER. When we were working on our
20 preliminary list of reasons for the exemption, we had
21 read the geomatrix report in '99 and they had in there
22 the proposed 2000 years. PFS later that year came
23 forth with a proposal for an exemption based on 1000
24 year.

25 So many of the arguments and this argument

1 in particular has provided to site information why we
2 didn't think the PFS proposed 1000 year was
3 appropriate. One of the obvious ones was to say your
4 own experts have proposed 2000 years. Your
5 contractors Geomatrix proposed 2000 years and not 1000
6 years. So in many respects in this early preliminary
7 SER we were as much trying to develop a technical
8 basis of why 1000 years was not appropriate.

9 When we issued the final SER and after the
10 Staff then agreed with the exemption request, we then
11 I believe proffered some more supporting technical
12 bases in favor of the 2000 year. This particular
13 statement is to make an explicit recognition to PFS
14 that in fact their own experts had recommended 2000
15 years, not 1000 years.

16 Q Are you sure you want to continue with
17 this discussion as to whether Dr. Arabasz was correct
18 in his allegation that the Staff practiced in circular
19 reasoning when in fact you didn't rely on this in the
20 consolidated SER? Do you still want to stick to that
21 position that you disagree with Dr. Arabasz and you
22 find it necessary to present the rebuttal testimony?

23 MR. TURK: I would object, Your Honor.

24 MS. CHANCELLOR: I'm just trying to see if

25 we can --

1 MR. TURK: I think that's arguing with the
2 witness.

3 MS. CHANCELLOR: I'm trying to short
4 circuit this, Your Honor.

5 MR. TURK: Your Honor, I don't have a
6 problem if she asks him if he wants to change his
7 testimony. But the question is framed as just an
8 argument.

9 CHAIRMAN FARRAR: It would be better, Ms.
10 Chancellor, to frame it about whether he still adheres
11 to this testimony rather than whether he finds it
12 necessary to present rebuttal testimony. That's
13 probably a decision that Counsel makes. You're free
14 to challenge him as strongly as you want to on his
15 position.

16 MS. CHANCELLOR: Point well taken, Your
17 Honor.

18 BY MS. CHANCELLOR:

19 Q Dr. Stamatakos, do you still wish to go
20 forward with this rebuttal testimony in answer A-1?
21 Do you think it's necessary?

22 CHAIRMAN FARRAR: I understand the
23 question the way she meant it, Mr. Turk.

24 DR. STAMATAKOS: I think that this point
25 now that we've been able to provide all of the

1 underlying factors about what we did when we did it,
2 that all the points that have been made on this have
3 been made. So in that regard, I think we can move on.
4 I think all of the technical points have been made on
5 both sides. If you're asking me whether I now agree
6 with Dr. Arabasz that our reasoning was circular, my
7 answer is no. I don't agree with him that our
8 reasoning was circular.

9 BY MS. CHANCELLOR:

10 Q Okay. We'll proceed on a little bit
11 further because I don't think we'll quite make all our
12 points.

13 CHAIRMAN FARRAR: Okay. Remember what we
14 said the other day, Ms. Chancellor. Sometimes the
15 witness just isn't going to agree with you. Then you
16 have to make the points through your own witness.

17 MS. CHANCELLOR: That's all right, Your
18 Honor. I won't belabor this very much longer. I'd
19 like to pass out a courtesy copy of NRC Exhibit TT.

20 CHAIRMAN FARRAR: While we're doing that,
21 Dr. Arabasz, are you still there?

22 DR. ARABASZ: Yes I am, Judge Farrar.

23 CHAIRMAN FARRAR: Thank you.

24 BY MS. CHANCELLOR:

25 Q In the preliminary SER as the lead in

1 sentence to the various bullets, the preliminary SER
2 states "However the Staff has determined that a 2000
3 year return value with a PSHA methodology can be
4 acceptable for the following reasons." One of those
5 reasons is the geomatrix bullet that we discussed a
6 little bit ago. Correct?

7 A That's correct.

8 Q Staff's Exhibit TT, you're familiar with
9 the stuff in it. Right? Final report volume 203
10 about geomatrix evaluation study, *et cetera*.

11 A That's correct. I may be mistaken and I
12 might have to refresh my memory, but I believe that
13 the more detailed discussion was also provided in
14 volume 3 of this report.

15 Q In terms of discussing the PSHA
16 methodology on 6.1.1 probability level of interest.

17 A Yes.

18 Q Do you see where Geomatrix states that the
19 NRC recommends that a risk-informed approach to
20 seismic design be used?

21 A Yes.

22 Q Then in the same paragraph, second line
23 from the bottom, "the NRC recognizes that the value of
24 this approach." Do you see that?

25 A That's not the end of that paragraph which

1 continues on the next page, but it's the last sentence
2 of that page.

3 Q Right. Then on page 55, it states towards
4 the end of that paragraph "the NRC therefore
5 recommends that a probablistic approach be taken."

6 A That's correct.

7 Q Then on the beginning of the next
8 paragraph it states "until the part 72 rulemaking is
9 completed, there is only indirect guidance from the
10 Staff." Do you see that?

11 A Yes.

12 Q At the beginning of the last paragraph on
13 page 55, "the staff also note that 10 CFR Part 60
14 design basis event rulemaking also adopts a graded
15 approach." Do you see that?

16 A That's right.

17 Q And on page 56, the beginning of that
18 paragraph, "based on the above arguments of the risk-
19 informed graded approach, we conclude that the
20 appropriate design basis level for the PFS site is
21 five times ten to the minus four 2000 years."

22 A That's right.

23 Q Dr. Stamatakos, is it not plain that all
24 the bases where Geomatrix conclusion of the last
25 sentence are in fact guidance from the NRC Staff?

1 A Many of them are, yes. I would agree with
2 that.

3 Q Then why is it not circular for the Staff
4 to take Geomatrix conclusion that an appropriate
5 design probability level for the PFS site is a 2000
6 year return period and use it to argue the proposition
7 that the Staff has determined that a 2000 year return
8 value for PFS can be acceptable?

9 A Again, as I go back through the context of
10 why and how this was provided, this was provided in
11 the preliminary SER and this bullet doesn't appear in
12 subsequent versions of the SER. The issue here was to
13 make an explicit recognition to PFS that they had come
14 forward and proposed a design basis exceedence
15 probability for ground motions that was different from
16 the one that their own expert consultants had proposed
17 in a document prepared by Geomatrix.

18 So the whole point of this particular
19 bullet was to make an explicit recognition that PFS
20 was coming forward with a recommendation that was
21 different from the recommendation of their own
22 experts. They did not appear once. We as you
23 remember in the preliminary SER there was this
24 question of what the exemption request should be left
25 open. It wasn't until we issued the final SER that

1 Staff then agreed with the exemption request.

2 CHAIRMAN FARRAR: Ms. Chancellor, let me
3 interject here. When it comes time to write the
4 opinion in this case, we don't care whether the Staff
5 was right or wrong in calling Dr. Arabasz's reasoning
6 circular. We care whether the Staff is right or wrong
7 in its opinions and whether Dr. Arabasz is right or
8 wrong in his opinions. It seems to me if you're going
9 to go after this witness, you have to go after him
10 more directly and challenge the merits of what he
11 says, not the way each party characterizes each
12 other's testimony.

13 I would rather and you have in your
14 questions a basis for challenging the Staff's
15 position. Why don't we challenge the Staff's position
16 directly rather than challenge what they said about
17 somebody else's position?

18 MS. CHANCELLOR: The point of going
19 through this exercise, Your Honor, was to point out
20 the way in which the Staff has analyzed the exemption
21 request and the faulty logic that they have used.
22 This was just one example.

23 CHAIRMAN FARRAR: Go right after that. In
24 other words, if you have them for faulty reasoning,
25 then go right after them as hard as you want on that

1 faulty reasoning. It makes it more difficult to
2 follow and gives them if you have them --

3 (Inaudible.)

4 MS. CHANCELLOR: Isn't that what you said?

5 CHAIRMAN FARRAR: We've had this with
6 other parties earlier in the case, go right after them
7 and challenge them. Don't wrap it up so it's so
8 indirect that they get a chance to escape if they're
9 wrong.

10 MR. TURK: -- one thing, Your Honor.

11 CHAIRMAN FARRAR: Without expressing any
12 opinion on whether they are or not.

13 JUDGE LAM: If it's circular reasoning or
14 rectangular reasoning, it doesn't help us.

15 MR. TURK: Let me note one thing. We have
16 not accused Dr. Arabasz of circular reasoning. That's
17 the word that he used to describe the Staff. We're
18 not making that assertion about him. I want to
19 explain that clearly. I thought the question was
20 clear that it was Dr. Arabasz who said the Staff's
21 reasoning was circular. We're merely responding to
22 that charge.

23 CHAIRMAN FARRAR: Just go right after him
24 directly. That I think would be a better use of time
25 and probably more profitable from establishing the

1 validity of your client's case.

2 BY MS. CHANCELLOR:

3 Q Moving on to Section B of your testimony,
4 Dr. Stamatakos. Here we stand at 1020 and
5 consideration of risk.

6 A That's correct.

7 Q In the first paragraph of answer 2, you
8 begin by establishing that you together with Dr.
9 McCann "stand a 1020 as a reference point in
10 considering what is an acceptable exceedence
11 probability for design."

12 A That's correct.

13 Q Then you go on to say that you consider
14 DOE's approach in establishing a target performance
15 goal on seismic hazard exceedence probability for the
16 PC-3 facilities. But you also considered what you
17 thought was the most important issue, the potential
18 for radiological risk. Correct?

19 A That's correct.

20 Q You don't explicitly say here what the
21 outcome was of your considering DOE's use of a target
22 seismic performance goal. If you can state it or if
23 you know it, what is the Staff's position regarding
24 adoption of the target seismic performance goal in DOE
25 Standard 1020 for PC-3 facilities?

1 A I know that NRC has not explicitly adopted
2 the DOE approach. They have explicitly not applied
3 the same kind of logic that DOE does in the
4 development of the 1020 Standard in linking specific
5 performance goal to a specific design. In NRC
6 evaluations, a more critical issue is to evaluate what
7 the potential radiological risks are. There's a
8 difference there in the NRC approach and in the DOE
9 approach.

10 In this particular instance, we were
11 following what guidance we had from the Commission,
12 explicitly guidance that was provided for the TMI-2 in
13 which Commission now well quoted statements about the
14 relative risks of these types of facilities in
15 comparison to nuclear power plants. So in the DOE
16 space, DOE has done a lot of analysis of its own
17 facilities, can't come up with a graded approach with
18 PC-3 being for facilities that are like dry cask
19 storage systems. Or as we've mentioned here those PC-
20 3 categorizations extend to liquid waste facilities
21 too.

22 DOE established a design basis for 2000
23 years as a target which is something that we
24 considered as appropriate reference in our decision to
25 grant the 2000 year term period ground motion and the

1 exemption request. But the overriding concern here
2 that we look at that we thought were statements that
3 would lead us to some understanding of risk. In this
4 particular case, we looked at what the Commission had
5 said for the TMI, similar facilities, similar
6 exemption requests.

7 MS. CHANCELLOR: Your Honor, I think if I
8 took a five minute break and had a chat with Dr.
9 Arabasz I may be able to cut down some of my
10 questions. Is that okay?

11 CHAIRMAN FARRAR: Why don't we do that and
12 since we've added an hour, let's make it a ten minute
13 break. In fact if you need more time than that.

14 MS. CHANCELLOR: I think ten minutes will
15 be fine.

16 CHAIRMAN FARRAR: Okay. Let's do that.
17 Let's make it a long ten. It's 3:02 p.m. We'll be
18 back at quarter after three.

19 MS. CHANCELLOR: Thank you.

20 CHAIRMAN FARRAR: Off the record.

21 (Whereupon, the foregoing matter went off
22 the record at 3:02 p.m. and went back on
23 the record at 3:17 p.m.)

24 CHAIRMAN FARRAR: Back on the record
25 again. Dr. Arabasz, you're rehooked up there?

1 DR. ARABASZ: Yes I am. Thank you, Judge
2 Farrar.

3 CHAIRMAN FARRAR: Okay, Ms. Chancellor,
4 you've had a chance to consult privately.

5 MS. CHANCELLOR: Yes I have, Your Honor.
6 Thank you for that break.

7 CHAIRMAN FARRAR: Let's proceed.

8 BY MS. CHANCELLOR:

9 Q Dr. Stamatakos, on page three on the top
10 of that page of your testimony, you state "The staff
11 acceptance of 2,000 year return period included
12 consideration of radiological risk as set forth in the
13 staff's consolidated SER and radiological risk
14 considerations were an integral part of our
15 reasoning." Do you see that part of your testimony?

16 A Yes I do.

17 Q When you say "our" are you referring to
18 yourself as well as Dr. McCann and Dr. Chen or are you
19 referring to the NRC staff in general?

20 A Well, you would start with Dr. McCann and
21 Dr. Chen because they were the co-authors with me on
22 those sections of the staff's consolidated SER but I
23 believe the consolidated SER has been reviewed and
24 accepted by NRC staff.

25 Q And DOE Standard 1020 from which the staff

1 originally adopted a 2,000 year if I said MAPE mean
2 annual return period event would you understand that
3 term? MAPE?

4 A MAPE is the annual probability accedence
5 but I understand what it means.

6 Q You probably understand it better than I
7 do, Dr. Stamatakos. With regard to DOE standard 1020
8 and the staff's adoption of the 2,000 year MAPE to be
9 acceptable for dry cask storage facilities that they
10 were applicable to PC3 facilities. Is that right?

11 A That's correct. PC3 facilities in the DOE
12 1020 logic have up until this past revision had design
13 basis using 2,000 year return period ground motion.

14 Q And the staff continues to justify the
15 2,000 year MAPE for PFS based on lack of substantial
16 radiological risk. Is that right?

17 A That's part of the reasoning but in the
18 SER as we stated the guidance on risk comes from what
19 the commission had stated in the supporting documents
20 and in the TMI 2 exemption and in other places where
21 the commission explicitly recognized that the
22 radiological risk posed by these types of facilities
23 I believe the quote is "inherently less dangerous than
24 nuclear power plants."

25 Q And in the last sentence you state "The

1 staff's SER addresses the design and safety of the PFS
2 facility and in this regard we rely upon the staff's
3 evaluation of these matters as set forth in other
4 sections of the consolidated SER.

5 A And that's in reference to specific design
6 analysis either dynamic or static or whatever other
7 parts that the engineers would do and is clearly
8 outside of our expertise.

9 Q And the "we" again is yourself, Dr. McCann
10 and Dr. Chen, right?

11 A Yes. In this context that's right.

12 Q Is it correct than that the justification
13 for the 2,000 year MAPE by you, Dr. McCann and Dr.
14 Chen fundamentally depends on the validity of
15 evaluations made by others regarding safety of the
16 facility, cask tip over, accident analysis and release
17 of radioactivity. Is that right?

18 A Well, I certainly think that that would be
19 an integral part. Our original logic though relied on
20 what the commission had previously recognized with
21 these types of facilities. In particular we were
22 looking at what the commission had done in the case of
23 the exemption request for TMI 2 and the supporting
24 document. But certainly we would agree that an
25 integral part is that the facility would have to be

1 able to maintain its safety following other parts of
2 NRC regulations and design and so forth.

3 Q So for the acceptability of a 2,000 year
4 MAPE you need to depend on whether it's adequately
5 conservative or sufficiently protected. You need to
6 rely on engineers and others on the design side. Is
7 that correct?

8 MR. TURK: With respect to the specific
9 facility or the general concepts expressed in the
10 bullets?

11 MS. CHANCELLOR: Specifically with respect
12 to the PFS facility.

13 DR. STAMATAKOS: I'm not exactly sure I
14 follow that. If you could maybe clarify that question
15 a little bit for me.

16 BY MS. CHANCELLOR:

17 Q Just like Dr. Arabasz handed off to the
18 State's engineers the design, safety requirements and
19 the radiological risk factors, don't you at bottom
20 have to do the same thing to decide whether this 2,000
21 year MAPE is acceptable?

22 A I think fundamentally that's right. We
23 have to rely on judgement across the board and I think
24 those conclusions were reached in the other parts of
25 the SER. That's what we allude to in this answer.

1 Q Turning to part C which begins on page 3,
2 Dr. Stamatakos, do you know whether it is the staff's
3 position that if a nuclear power plant were to be
4 licensed in the Western United States, west of
5 approximately 105 degrees west longitude, the staff
6 would find acceptable a reference probability of five
7 times 10 to the minus four per year. That is 5,000
8 year return period.

9 A No, as I stated before no such proposals
10 have come forward and no plants were designed under
11 this type of probablistic approach. So I don't know
12 explicitly yet how the staff would explicitly evaluate
13 it although I would think that these kinds of
14 considerations that we made in what we think is an
15 appropriate probability level to compare against for
16 this facility, it would certainly be an important part
17 of that assessment when the time comes and if the
18 times comes to do that.

19 Q So if the time came next week and you got
20 an application on your desk you wouldn't have an
21 opinion of whether it should be a 5,000 year return
22 period a mean annual probability of exceeding the
23 shutdown earthquake ground rations?

24 A I would not have a blanket opinion because
25 I would want to know the specifics of the application.

1 Q Question three asks you to describe your
2 understanding of Dr. Arabasz's concerns relating to
3 the application of hazard accedence probabilities in
4 the Western United States for a nuclear power plant.
5 Is that right?

6 A Yes, it was a question designed to address
7 I think an "epiphany" that's in quotes that Dr.
8 Arabasz said he had in looking at table C-3 of
9 Appendix C of DOE 1020. That applicability or non-
10 applicability of the analysis that was done by DOE in
11 topical Corps (PH) 2 whether or not that was
12 applicable to only sites located along the tectonic
13 plate margin in the United States or whether it could
14 be applied overall the Western United States.

15 Q Now you are familiar with table C-3 in DOE
16 Standard 1020 where there's a list of the five nuclear
17 power plant sites in the west that we have discussed
18 at length in this proceeding.

19 A Yes.

20 Q Both you and Dr. Arabasz appear to agree
21 that the Diablo Canyon in San Onofre appropriately
22 characterized as near tectonic plate boundaries in
23 terminology of table C-3. Would you agree to that?

24 A I would agree to that, yes.

25 Q And that Paolo Verde and nuclear power

1 plant two near Hampford, Washington are not near
2 tectonic plate boundaries.

3 A I would agree to that statement.

4 Q Is there disagreement with respect to the
5 fifth plant, the Washington nuclear plant three near
6 south Washington?

7 A Well, that one's been discussed and again
8 it's a relative term about what you mean by near and
9 how you define near relative to a subduction zone as
10 opposed to near against a strike slip plate boundary.
11 I think the fundamental difference is not whether or
12 not which plants are right on a tectonic plate
13 boundary or not but the applicability of the logic of
14 excluding those just because they happen to be near a
15 plate boundary or not as compared to sites throughout
16 the rest of the United States.

17 Q Well I'm not going to do a tour of the
18 tectonic plates so we'll just say that there may be
19 disagreement with the Washington nuclear power plant
20 three. On the top of page four referring to this
21 table C-2 again, you state at the end of that sentence
22 your belief that your supposition that Dr. Arabasz
23 supports his view that only tectonic plate nuclear
24 power plant sites may have shorter return periods than
25 the 10,000 year MAPE equal to one times ten to the

1 minus four that exists more commonly at other nuclear
2 power plant sites. Are you sure that this is Dr.
3 Arabasz's view that the only proposition is their
4 location next to tectonic plates?

5 A That was my understanding about his
6 fundamental concern in saying that using the reference
7 probabilities that were derived for these nuclear
8 power plants was not applicable there and that his
9 epiphany was based on the realization that plants
10 located near tectonic plate boundaries should be
11 treated differently according to the DOE logic than
12 plants elsewhere in the Western United States.

13 Q Wasn't one of the key conditions for
14 justifying the 5,000 reference probability in the DOE
15 framework for these near tectonic sources the ability
16 to demonstrate a larger risk reduction ratio of the
17 order of 20 or more?

18 A I don't think that was in the analysis.
19 I think the logic is reverse slightly in the analysis
20 that NRC would have done under 1165 in the sense that
21 they looked at it from the fact that the nuclear power
22 plants had operated safely. That they did in the
23 INEEE I think it is or in that framework they had done
24 some probabilistic risk assessments to look at core
25 frequency damage. Then based on those kinds of

1 analyses, would show that the performance of these
2 plants was well beyond what they were designed then
3 they went back and used that kind of information and
4 developed the reference probability based on the safe
5 shutdown earthquakes.

6 Q But the question three goes to your
7 description of or your understanding of Dr. Arabasz's
8 concerns. Isn't it true that Dr. Arabasz's concern is
9 the large risk reduction ratio resulting from steep
10 hazard curves that that is a critical element not the
11 sitting per say near tectonic plate boundaries?

12 A Well, the way I understood his logic I
13 thought that he argued that because these sites were
14 located on the tectonic plate boundaries and that they
15 had steep hazard curves. Because they had steep
16 hazard curves, they could achieve large risk
17 reductions easier than sites that had shallower hazard
18 curves.

19 That coupled with the analysis that is
20 given in the DOE 1020 would allow them to use a 5,000
21 year rather than a 10,000 year design ground motion
22 and they could still achieve the same performance.
23 That was a achievable because they had steep hazard
24 curves.

25 My point is that when I look at the

1 underlying factors that control the hazard curves I
2 don't see a logical connection at least as a geologist
3 necessarily between the shape or slope of the hazard
4 curves and whether or not they are located right on a
5 plate boundary or not.

6 Q Sounds like a bit of a chicken and egg
7 problem.

8 A It might be but I think that as I said in
9 my testimony that the steepness of the hazard curve is
10 certainly important for engineering concerns but the
11 factors that influence whether or not a hazard curve
12 is steep or not go well beyond its geographical
13 position. And that if the hazard curve meets the
14 criteria for what is defined as tectonic plate sites
15 which I in my testimony have argued that the PFS site
16 does that it can meet the same kinds of criteria as
17 those that were sighted near tectonic plate
18 boundaries.

19 Q In the bottom of page four you state that
20 the sample mean of the NAPE of two times ten to the
21 minus four set forth in table C-2 does not represent
22 the value that should be limited to sites near
23 tectonic plate boundaries or subduction zones. Rather
24 it is applicable to the entire Western United States.
25 The very last sentence on page four.

1 A I have it.

2 Q Do you believe that you would be on firm
3 footing in a licensing proceeding for a new nuclear
4 power plant in arguing that the results from four
5 sights, Diablo, San Onofre, Washington nuclear power
6 plant one, maybe three, justify our priority a mean
7 reference probability of two times ten to the minus
8 four for the entire Western United States?

9 A Well, as I said before, if and when an
10 application comes forward for a nuclear power plant in
11 the Western United States, there will be a lot of
12 things that will be considered in the design. I'm
13 sure that this analysis will be part of that
14 consideration.

15 I can't predict how that evaluation would
16 go but the point here is to say that the evaluation of
17 what the reference probability is for the five western
18 nuclear power plants that are evaluated in a DOE
19 topical report does not necessarily have to be limited
20 to the tectonic plate barrier but could be applied
21 across the Western United States if site conditions
22 meet what DOE has defined as high tectonic sites which
23 I think the PFS site at least as it's been
24 characterized by Geomatrix in their hazard assessment
25 is in my view as a high seismicity site.

1 Q Now you are doing work at the Yuca
2 Mountain is that correct?

3 A That's correct.

4 Q Would you say that for a hypothetical
5 nuclear power plant at Yuca Mountain the MAPE should
6 be two times ten to the minus four?

7 A Again I would want to know the specifics
8 and certainly would have to work through the
9 specifics. You keep wanting me to cite a nuclear
10 power plant and there are other considerations and
11 other factors that may go into what will happen when
12 and if a new nuclear power plant is proposed for a
13 site in the Western United States.

14 The analysis that was done was based on
15 existing nuclear power plants and back calculated from
16 the SSEs what the appropriate probability levels are
17 that corresponds to those SSEs backed up by the
18 information about the safe operation of those nuclear
19 power plants and the analyses that have been done on
20 their core frequency of damage failure and all the
21 other parts of the risk assessments that were done for
22 the nuclear power plants.

23 MS. CHANCELLOR: I'm going to need to
24 refer to you Staff Exhibit QQ. I'm going to hand out
25 courtesy copy of QQ.

1 MR. TURK: This is the portion of DOE
2 Standard 1020 2002.

3 MS. CHANCELLOR: That's correct, Mr. Turk.
4 It's Staff Exhibit QQ.

5 BY MS. CHANCELLOR:

6 Q The large paragraph on the bottom of page
7 five where you talk about a conclusion that has
8 occurred that the Western U.S. nuclear power plant
9 sites may not be distinguished based upon the
10 proximity of the site to a tectonic plate boundary or
11 subduction zone.

12 A I'm sorry. You are going to have to point
13 me to this.

14 Q Page five of your testimony.

15 A Testimony. Excuse me. I was looking for
16 it.

17 Q QQ is a preBoard. Page five, fourth
18 paragraph where you talk about the hazard curves of
19 the Western U.S. nuclear power plants may not be
20 distinguished based upon the proximity of the site to
21 a tectonic plate boundary or subduction zone. Do you
22 see that?

23 A That's right.

24 Q Then you go on to say "DOE Standard 1020
25 page C-9, DOE provides a clear definition of high

1 hazard sites that fall in the 'near tectonic plate
2 boundary classification' ". Do you see that?

3 A Yes.

4 Q Let's turn to NRC Exhibit QQ on page C-9.
5 Could you please point to a clear definition by
6 showing us the term that is being defined and the
7 words that describe the essential nature or meaning of
8 that term?

9 A I think that reference to page 9 is in
10 error. I'm trying to find the correction for that.
11 It might have been that I looked at a different
12 version of the same document but I know and I'd have
13 to go back actually in Dr. Arabasz's testimony.

14 Q Let me help you and see if this is what
15 you mean. If you look under the K_H fox with the -- if
16 you read that paragraph is there anything in there?
17 For example the third sentence.

18 A That summarizes it but I thought there was
19 and I can't say for sure now and remember this without
20 reading through it in detail but I thought there was
21 a clear definition elsewhere in this appendix to DOE
22 1020. But it basically has the same three elements:
23 high seismicity sites near sites dominated with close
24 active faults with high recurrence rates.

25 Q Take your time and see if there is

1 anything else.

2 MR. TURK: May I note that Dr. Stamatakos
3 does have the entire 1020 document with him. Could we
4 perhaps go off the record for a moment and let him
5 look at the document?

6 MS. CHANCELLOR: Certainly.

7 CHAIRMAN FARRAR: All right.

8 DR. STAMATAKOS: I can address it. Those
9 are still the core elements of what the definition is
10 in my view.

11 BY MS. CHANCELLOR:

12 Q Well, the wording is very important so I
13 would like you to take the time to see if there is
14 anything else.

15 A I think we can proceed with this version
16 of it.

17 Q And would you read what you consider to be
18 the definition?

19 A "For California and other high seismic
20 sites near tectonic plate boundaries with seismicity
21 dominated by close active faults with high recurrence
22 rates (a) AR typically ranges from 1.5 to 2.25.

23 Q Do you recognize that the first sentence,
24 the clause, "the seismicity dominated by close active
25 faults with high recurrence rates" is simply a

1 restrictive modifier to the term "high seismic sites
2 near tectonic plate boundaries"?

3 A I would look at it as that's part of the
4 definition of high seismic sites. So in my view and
5 as I said in my testimony the definition that you
6 would want to meet here would be sites that had high
7 seismicity with close active faults and high
8 recurrence rates.

9 Q Do you understand what a restrictive
10 modifier is?

11 A It's been a long time since I had that.

12 Q If I said that it qualifies and limits the
13 term that it modifies and could not be omitted without
14 affecting the meaning of the sentence. Would that
15 change your view that this is not a definitive but
16 this is just a clause with a restrictive modifier?

17 A Well if that was the intent of the author.
18 I don't see that author stating that this is a
19 restrictive modifier.

20 Q Do you see that it also states that it's
21 a definition?

22 A The reference has to go back to the
23 footnote in the table which calls for cites on
24 tectonic plate boundaries so we have to look at what
25 is meant by that or interpret that. So my

1 interpretation is that this was a definition to
2 support a footnote that Dr. Arabasz cited as part of
3 his epiphany in his logic for separately the tectonic
4 plate boundary sites from the rest of the Western
5 United States.

6 Q Would you agree that the authors are
7 suggesting that recurrence rates have an influence on
8 the -- value?

9 A I don't know whether the author is. We
10 went through this with testimony of Dr. Arabasz. I
11 don't know whether the authors knew or did not know
12 whether recurrence rates or slip rates are activity
13 that had an influence on slopes of the hazard curves.

14 But I think in my view and we provided an
15 example of that in exhibit that the activity or
16 recurrence rates do not strongly influence or may
17 influence the slope of the hazard curve and other
18 factors as I think even Dr. Arabasz stated that he
19 didn't know for sure. But he did say that he thought
20 other factors would come into play in determining what
21 influenced the slope of a hazard curve.

22 JUDGE LAM: If I may interrupt, Ms.
23 Chancellor. Dr. Stamatakos, is there a consensus out
24 there on what influences the slope of a hazard curve?

25 THE WITNESS: Not that I'm aware of. I

1 think that when you look at the complexity of
2 probablistic seismic hazard assessments that there are
3 probably a number of factors in those assessments that
4 come into play. My feeling is that probably the most
5 important influence on the shape of the hazard curves
6 come in how uncertainty is modeled in a particular
7 PSHA. My best understanding of that is in working in
8 the economic PSHA which has a very shallow slope to
9 its hazard curve.

10 In the process of the economic PSHA there
11 was a lot of discussion about how uncertainty is going
12 to modeled and captured in the analysis. Especially in
13 the ground motion part of the economic study
14 uncertainty was explicitly modeled by at least four
15 parameters. So those large uncertainties I think
16 drive the hazard curve to become very shallow at low
17 probabilities.

18 JUDGE LAM: That being the case, can it be
19 both you and Dr. Arabasz be right?

20 THE WITNESS: Well I certainly think that
21 there may be aspects on the source that side that can
22 influence. What I don't think is correct is that
23 recurrence rate or slip rate or activity rate strongly
24 influences the slope. In my view that is the main
25 distinguishing geologic reasoning behind separately

1 sites along the margin from sites that are not
2 directly along the plate tectonic margin.

3 Certainly as you can see on my map
4 historic seismicity is much larger and many more
5 frequent earthquakes along the plate boundary as it
6 should be in the plate tectonic model. But other than
7 those earthquakes occurring more frequently I don't
8 think that the frequency of how often those
9 earthquakes occur affects the slope very much. I
10 think other factors affect the slope.

11 The counter example to the Yuca Mountain
12 slope is the Diablo Canyon analysis in which
13 uncertainty especially the eolian tor (PH) uncertainty
14 in the ground motion was limited to a smaller degree
15 and that curve has a very steep slope.

16 JUDGE LAM: But with so much uncertainty
17 out there do you have the opinion that we should
18 seriously consider Dr. Arabasz's opinion as well?

19 THE WITNESS: My opinion is that slope is
20 a very difficult parameter at the moment to
21 understand. I would not use slope as a discriminator
22 to rule out nuclear power plants along a tectonic
23 margin from the rest inner mountain west.

24 I think that the analysis performed by DOE
25 on those plants is justified and that we shouldn't

1 have to separate just because of their geographic
2 position plants that are on a tectonic plate boundary
3 from plants that are not.

4 JUDGE LAM: Thank you for your comments.

5 CHAIRMAN FARRAR: I thought I heard Dr.
6 Lam ask you twice if there was a possibility of merit
7 in both what you said and what Dr. Arabasz says.

8 THE WITNESS: Well --

9 CHAIRMAN FARRAR: Let me finish. And the
10 answer I heard was for you to express your opinion
11 again. Let me ask the question again directly and ask
12 for a yes or no answer.

13 THE WITNESS: Let me ask back then. In
14 what regard? I mean limited to a discussion of slope
15 or in the discussion of whether 10,000 or 5,000 years
16 is appropriate? At what level do you want me to say
17 that we may both be right?

18 CHAIRMAN FARRAR: How about both?

19 MR. TURK: Now we have him asking his own
20 questions.

21 THE WITNESS: I don't think that there's
22 a possibility that we both could be correct as I
23 interpret what Dr. Arabasz said on slope and we'll
24 stick to the slope although I think he freely admitted
25 that he wasn't clear whether or not slip rate or

1 recurrence rate has a strong influence on a slope of
2 a hazard curve. In that aspect I would disagree and
3 say no.

4 I think on many of the other issues I
5 think we have come to many agreements. Certainly the
6 10,000 year part of the contention I think is no
7 longer something that we disagree on. I think he
8 would agree that 10,000 year mean is something that
9 can be established. I don't want to put words in his
10 mouth but my interpretation of his position.

11 Certainly we would agree that risk is an
12 important part in this whole assessment that in your
13 analogy you can't do this with one hand alone. You
14 need both. The hand that carries a lot of the
15 engineering side by its very nature has to do a lot of
16 the heavy lifting.

17 (Judges conferring.)

18 DR. ARABASZ: Am I still connected?

19 MS. CHANCELLOR: Yes, Dr. Arabasz.

20 MR. TURK: The judges are conferring.

21 CHAIRMAN FARRAR: Dr. Arabasz, I'm sorry.
22 Everyone else in the room saw that the Board was
23 conferring but I forgot that you wouldn't know that.
24 So that was the reason for the silence. Go ahead, Ms.
25 Chancellor.

1 MR. TURK: Your Honor, before we lose the
2 place may I ask for a clarification of something that
3 Dr. Stamatakos said in response to Judge Lam or to
4 your question actually?

5 CHAIRMAN FARRAR: All right.

6 MR. TURK: I thought that Dr. Stamatakos
7 said that he and Dr. Arabasz would both agree that the
8 10,000 year mean can be established. I didn't
9 understand that.

10 THE WITNESS: This is in reference to one
11 of the points of the contention. There was an
12 argument whether we could use mean or median whether
13 10,000 applied only to the Central and Eastern U.S. or
14 the Western U.S. I think now and I don't want to put
15 words into his mouth again my reading of his testimony
16 would seem to indicate that we would now agree on
17 that.

18 DR. STAMATAKOS: In other words, mean
19 instead of median?

20 THE WITNESS: Mean instead median and at
21 certainly 10,000 year return period is something that
22 would be considered as an appropriate starting point.
23 The question now really is whether or not the analysis
24 in the DOE 1020 looking at a 5,000 year return period
25 ground motion is something that's appropriate or not.

1 MS. CHANCELLOR: Are you finished, Mr.
2 Turk?

3 MR. TURK: Yes I thought that it was an
4 important clarification. Thank you.

5 BY MS. CHANCELLOR:

6 Q I would like Ms. Braxton to hand out a
7 courtesy copy of Utah Exhibit 203. When we were
8 talking about as I call it the restrictive modifier in
9 Staff Exhibit QQ there's a reference to AR values and
10 on State Exhibit 203 there's a table with those AR
11 values by Kennedy and Short. Do you agree that
12 there's overlap between the first range of AR values
13 that is 1.5 to 2.25 and the second range of values
14 1.75 to 3.0?

15 A Yes.

16 MR. TURK: I'm sorry. I don't see where
17 you're reading from. Are you on page A-4?

18 THE WITNESS: C-9.

19 MR. TURK: I was looking at the State
20 Exhibit. May I ask where in table C-9 are you
21 looking?

22 THE WITNESS: Not table. Page C-9, the
23 middle paragraph I believe is what you were referring
24 to.

25 MS. CHANCELLOR: That's right. It's okay.

1 I'm a little ahead of the game with Utah 203.

2 MR. TURK: In other words, I'm sorry. I
3 don't mean to interrupt but we are only looking at
4 page C-9.

5 MS. CHANCELLOR: That's correct.

6 MR. TURK: And that's what the question
7 was.

8 MS. CHANCELLOR: Right.

9 MR. TURK: Thank you.

10 BY MS. CHANCELLOR:

11 Q And so the authors of DOE 1020 are
12 applying an AR value is some sort of generic
13 identifier that discriminates whether a site is near
14 or away from a tectonic plate boundary. Is that
15 right?

16 A What I think what they were giving was
17 overlapping ranges but they were giving specific
18 target ranges where they thought two different
19 categories of where hazard slopes would fall, those on
20 tectonic plate boundaries and those away from tectonic
21 plate boundaries.

22 Q So the distribution of AR values from the
23 two groups of Western U.S. sites are different. Would
24 you agree with that?

25 A That's what their claim is and that's

1 based on the analysis that appears to have been
2 performed by Kennedy and Short in this paper that they
3 see some differences when you go from east to the west
4 to the what they call high seismic sites near tectonic
5 plate boundaries you see a general overall trend that
6 the AR values get smaller so the slopes could get
7 steeper.

8 Q In cross examination way back on May 11 of
9 you, you testified that you had reviewed information
10 provided by PFS and evaluated PFS's analysis of
11 historical seismicity and that the staff found no
12 evidence of historic seismicity in the vicinity of the
13 site. Do you recall that?

14 A Yes I do.

15 Q That's still correct that there's no
16 evidence of historic seismicity. Correct?

17 A As you pointed out to me during that cross
18 examination, there's a 1915 magnitude 4.1 earthquake
19 that was not included in our evaluation. I think my
20 response at the time was because the magnitude was
21 small. It was filtered out of the USGS set that we
22 had looked at that had filtered out all earthquakes
23 smaller than magnitude five that occurred prior to
24 1930. But otherwise that statement is correct.

25 Q Dr. Stamatakos, what is your definition of

1 seismicity? You refer to it for example at the bottom
2 on page five of your testimony where you state that
3 "in my view high ground motions predicted that
4 Geomatrix which is similar to those with high seismic
5 sites like Diablo and PFS site has high seismicity."

6 A I think I then go on to say that there is
7 a difference here. This is a noted difference between
8 my interpretation and that of Dr. Arabasz. In my view
9 high seismicity would be a site that would have high
10 predicted ground motions. A point to this is simply
11 either this is not a high seismicity site as would be
12 indicated by the historic seismic record in which
13 there is not a lot of historic earthquakes that have
14 occurred near the PFS site.

15 Then the Geomatrix analysis must in my
16 view be considered conservative. Or Geomatrix is
17 correct and that this area does have this high ground
18 motions. Therefore I can't see it not being
19 considered a high seismicity site. The Geomatrix
20 analysis predicts very large ground motions for the
21 PFS site.

22 Q But you agreed with PFS by in large that
23 there is no evidence of historic seismicity in the PFS
24 site.

25 A Right.

1 Q I'm sorry. I don't think I caught the
2 definition of you consider to be seismicity.

3 A In this view, this has to be a high
4 seismicity site.

5 Q No, the definition of seismicity. Not
6 what's occurring at PFS. What you mean by seismicity.

7 A Seismicity can mean that a site shows
8 evidence in the past of many and large earthquakes.
9 So now you have to interpret how you get a record of
10 that. We can look at the historic seismic record
11 which a little over a hundred year record or we can
12 look at the probabilistic seismic hazard assessment
13 that was carried out by Geomatrix which includes
14 evidence of prehistoric earthquake information. So
15 high seismicity to me means a site that likely to
16 produce large ground motions from fairly frequent and
17 large earthquakes.

18 Q Let's look at the exhibit that's attached
19 to your testimony, Staff Exhibit 62.

20 A 62 is the map?

21 Q Right. This is historic seismicity of
22 nuclear facilities in the United States. And your
23 definition again of seismicity was high predicted of
24 ground motions from past events.

25 A Prehistoric. In this case it could be a

1 whole set of paleo-earthquakes as it applies to hazard
2 assessments.

3 Q What's the point of this map here on Staff
4 Exhibit 62?

5 A The point of the map was to provide some
6 geographic contacts for discussions about where
7 particular nuclear facilities are located relative to
8 the tectonic plate boundary and located relative to
9 the occurrence of historic earthquakes over the 100
10 years.

11 Q For the Intermountain Seismic Belt, what
12 is the evidence of historic seismicity there around
13 the PFS site?

14 A There is not evidence of high historic
15 seismicity around the PFS site.

16 Q Okay.

17 A But there certainly is evidence of high
18 historic seismicity on the Wasatch Fault.

19 Q Do you have a definition of high
20 recurrence rates? Or could you define that term?

21 A That term has not explicitly defined
22 anywhere that I know of but in my view when you have
23 slip rates that are certainly above a couple of tenths
24 of a millimeter a year and you have earthquakes with
25 recurrences rates on the order of 100 years to 1,000

1 years, maybe there are several thousand years between
2 very large earthquakes. That to me would be sites
3 that would be a higher recurrence compared to most of
4 the United States where the recurrences rates are in
5 the order of 10,000 years or more.

6 Q So you said high recurrence would be slip
7 rates greater than?

8 A A few tenths of a millimeter a year.

9 Q Are you familiar with a paper by Steven G.
10 Wesnowsky in the general geophysical research in which
11 there is a table of slip rates?

12 A No.

13 Q Faxed in my hotel.

14 CHAIRMAN FARRAR: You mean you don't have
15 it here?

16 MS. CHANCELLOR: That's right, Your Honor.
17 Dr. Arabasz faxed me an exhibit.

18 CHAIRMAN FARRAR: Which hotel?

19 MS. CHANCELLOR: Doubletree.

20 CHAIRMAN FARRAR: Up at Twin Brook?

21 MS. CHANCELLOR: Yes. Is there a fax
22 number here we could fax something to?

23 CHAIRMAN FARRAR: There sure is. Dr.
24 Arabasz, do you have a copy of it there?

25 DR. ARABASZ: I guess I do.

1 CHAIRMAN FARRAR: Is there a fax machine
2 handy?

3 DR. ARABASZ: Yes, sir.

4 CHAIRMAN FARRAR: How about sending it to
5 301-415-5599?

6 DR. ARABASZ: 301-415-5599. I'll just put
7 the telephone receiver down and walk to another room.

8 CHAIRMAN FARRAR: Okay. Let us know when
9 you are back.

10 DR. ARABASZ: Thank you.

11 CHAIRMAN FARRAR: Ms. Chancellor, after
12 you get that how much longer are you looking at?

13 MS. CHANCELLOR: Not much longer at all,
14 Your Honor.

15 CHAIRMAN FARRAR: How much redirect is the
16 staff looking at?

17 MR. TURK: Somewhere between 10 and 15
18 minutes.

19 CHAIRMAN FARRAR: Okay.

20 MS. CHANCELLOR: Your Honor, I think I can
21 just move on with the questioning while Dr. Arabasz is
22 doing that.

23 CHAIRMAN FARRAR: Okay.

24 MS. CHANCELLOR: What? You need a break.
25 Okay.

1 CHAIRMAN FARRAR: Sounds good.

2 MS. CHANCELLOR: Dr. Stamatakos would like
3 a break.

4 CHAIRMAN FARRAR: It's nine after. Let's
5 come back at twenty after four.

6 (Whereupon, the foregoing matter went off
7 the record at 4:09 p.m. and went back on
8 the record at 4:21 p.m.)

9 MS. CHANCELLOR: I have too much paper
10 here, Judge Farrar.

11 CHAIRMAN FARRAR: That happens.

12 MS. CHANCELLOR: I would like to have
13 marked and will distribute as State's Exhibit 219,
14 "Earthquakes, Quaternary Faults, and Seismic Hazard in
15 California" from the Journal of Geophysical Research,
16 Volume 91, November 1998.

17 [Whereupon, the above-referred-
18 to document was marked as
19 State's Exhibit 219 for
20 identification.]

21 MS. CHANCELLOR: Dr. Stamatakos, this is
22 an article by Steven G. Wesnousky. Have you seen this
23 document before?

24 DR. STAMATAKOS: No, I have not, not in my
25 recollection. I may have come across in -- you know,

1 I read lots of papers, but this one, I don't remember
2 this one.

3 MS. CHANCELLOR: Now you stated that --

4 MR. TRAVIESO-DIAZ: Pardon me, Ms.
5 Chancellor. Is this a complete paper? It seems to
6 skip from page 587 to page 603?

7 MS. CHANCELLOR: We really only need the
8 last page, Mr. Travieso-Diaz, but after the
9 questioning, if you need more, let me know.

10 MR. TRAVIESO-DIAZ: No, but my question
11 was just clarification to make sure that the record
12 showed that --

13 MS. CHANCELLOR: Oh, I beg your pardon.
14 This is a three-page exhibit which is page Nos.
15 12,587, 12,603, and 12,610.

16 MR. TRAVIESO-DIAZ: All right, thank you.

17 MR. TURK: And I would just note that it
18 appears this is from November 10, 1986 rather than
19 1998.

20 MS. CHANCELLOR: 1986, sure, that's right.
21 Thank you.

22 I was trying to keep all my papers in
23 order. I'm glad you caught that.

24 Dr. Stamatakos, you stated that in your
25 definition high recurrence rates were slip rates

1 greater than about 2/10ths of a millimeter a year?

2 DR. STAMATAKOS: That's correct.

3 MS. CHANCELLOR: If you look down at the
4 footnote in this paper, at the sign like for a number,
5 and it's got slip rate class --

6 DR. STAMATAKOS: Yes, I see that.

7 MS. CHANCELLOR: "AA greater than 10
8 millimeters a year"?

9 DR. STAMATAKOS: Yes.

10 MS. CHANCELLOR: "A greater than 1
11 millimeter a year"?

12 DR. STAMATAKOS: Greater than or equal to,
13 yes.

14 MS. CHANCELLOR: Greater than or equal to,
15 correct. "B greater than or equal to 0.1 millimeter
16 a year"?

17 DR. STAMATAKOS: Correct.

18 MS. CHANCELLOR: Et cetera.

19 MR. TURK: May I ask where you're reading
20 from?

21 MS. CHANCELLOR: Yes, footnote on the last
22 page. There's a symbol like the number sign with a
23 hatch mark. Do you see it? It's got a little
24 checkmark beside it.

25 MR. TURK: Okay.

1 MS. CHANCELLOR: And --

2 MR. TURK: Just so the record is correct,
3 Your Honors, maybe just to have that read more
4 correctly, it indicates, "Slip rate class AA equal to
5 or greater than 10 millimeters per year. Class A
6 equal to or greater than 1 millimeter per year. Class
7 B equal to or greater than 0.1 millimeter per year,
8 and Class C greater than or equal to 0.01 millimeter
9 per year."

10 MS. CHANCELLOR: Are you done?

11 MR. TURK: My only point is let's make the
12 record clear.

13 MS. CHANCELLOR: That's fine, Mr. Turk.
14 I just wanted to know if you were finished.

15 Dr. Stamatakos, do you see the slip rate
16 for the San Andreas Fault? It's above the footnotes
17 on the last page of State's Exhibit --

18 DR. STAMATAKOS: Is it in the table, in
19 the table itself, or in --

20 MS. CHANCELLOR: It's in the table itself.

21 DR. STAMATAKOS: Okay, there are a number
22 of parts of the San Andreas Fault listed.

23 MS. CHANCELLOR: Right, and the "MN," I
24 believe, stands for minimum, "MX" is maximum, and "PR"
25 is preferred. Would you consider the San Andrea Fault

1 to be a high slip rate?

2 DR. STAMATAKOS: Yes.

3 MS. CHANCELLOR: And the values there
4 range from values there of 12, 5, 33.9, correct?

5 DR. STAMATAKOS: For PR, yes. For the
6 preferred -- I guess you said "PR" was preferred. I
7 didn't check that, but if that's the preferred, the
8 numbers you read are correct.

9 MR. TURK: How do we know that's
10 preferred?

11 MS. CHANCELLOR: Because Dr. Arabasz told
12 me.

13 (Laughter.)

14 MR. TURK: You're asking the witness to
15 make that assumption, and if we can see that in the
16 document, it would help to understand what the term is
17 that we're dealing with.

18 CHAIRMAN FARRAR: Dr. Arabasz, are you on
19 the phone still?

20 DR. ARABASZ: Yes, I am. It is in the
21 footnote explanation just beneath "slip grade class."

22 CHAIRMAN FARRAR: Yes, I see it. That is
23 the --

24 MR. TURK: Yes, I see it, yes.

25 CHAIRMAN FARRAR: All right, thanks.

1 MS. CHANCELLOR: At the PFS site, do you
2 recall what the slip rates are for the various faults?

3 DR. STAMATAKOS: Not explicitly, but I
4 know they're in the 10th of a millimeter to half a
5 millimeter, I believe, range, something on that order.

6 MS. CHANCELLOR: And State's Exhibit 185,
7 let me read you these values. Then I'll show you the
8 document, so you can confirm.

9 MR. TURK: May we have an opportunity to
10 get the document, please?

11 MS. CHANCELLOR: Certainly.

12 MR. TURK: Thank you.

13 MS. CHANCELLOR: The slip rate on the
14 East, West, and Spring line faults is .2; the West
15 Fault, 0.4; on the Stansbury, 0.4, and on the East
16 Cedar Mountain, 0.1 through 0.7. I'll give you
17 State's Exhibit 185.

18 MR. TURK: I would note that that is not
19 a correct representation of the charts that I see in
20 this exhibit. Are you looking at the curves? Where
21 are you reading here?

22 MS. CHANCELLOR: No, I'm looking at the
23 slip rates on Table 6-2. This was in testimony by Dr.
24 Arabasz, and it's titled, "Mid Valley Faults," and you
25 look at the weight of the value, for example, for the

1 East Fault. Let's have Dr. Stamatakos explain this.

2 Do you mind if I stand over your shoulder?

3 DR. STAMATAKOS: No.

4 MS. CHANCELLOR: Thank you.

5 Dr. Stamatakos, are you familiar with this
6 document?

7 DR. STAMATAKOS: Yes.

8 MS. CHANCELLOR: And what is the slip rate
9 on the East Fault?

10 DR. STAMATAKOS: Well, the slip rate
11 ranges from 0.05 to 0.45, and those are all weighted,
12 and the highest weight is 0.2 millimeters per year.

13 MS. CHANCELLOR: And what's the highest
14 weight for the West Fault?

15 DR. STAMATAKOS: The highest weight is
16 0.04 millimeters per year.

17 MS. CHANCELLOR: And if you would turn the
18 page to the Stansbury Fault?

19 DR. STAMATAKOS: Highest weight is 0.4
20 millimeters a year.

21 MS. CHANCELLOR: And East Cedar?

22 DR. STAMATAKOS: Highest weight is 0.4
23 millimeters a year and 0.7 millimeters a year.
24 They're given equal high weight. Oh, and 0.1, excuse
25 me. All three of those values are given the same

1 weight.

2 MS. CHANCELLOR: Okay, thank you.

3 And turning to the definition in State's
4 Exhibit 219, would you consider the faults near the
5 PFS site to fit within which class?

6 DR. STAMATAKOS: Well, using Wesnousky's
7 class, they would fall primarily within B.

8 MS. CHANCELLOR: Okay, thank you.

9 Your Honor, I would like to move for entry
10 of State's Exhibit 219.

11 CHAIRMAN FARRAR: Gentlemen?

12 MR. TRAVIESO-DIAZ: No objection here.

13 MR. TURK: I would note an objection, Your
14 Honor. The witness has stated that he is not familiar
15 with this document. It's only an excerpt. We don't
16 know what else may be in this document that we haven't
17 been given here. I think the potential for misleading
18 exists.

19 CHAIRMAN FARRAR: What purpose are you
20 offering it for, Ms. Chancellor?

21 MS. CHANCELLOR: To show what may be
22 considered high slip rates as defined in this article,
23 and to show that, for example, the San Andreas Fault
24 would be an example of a high slip rate.

25 CHAIRMAN FARRAR: So what the portion of

1 it that you want to admit is basically the table --

2 MS. CHANCELLOR: The last page, Your
3 Honor.

4 CHAIRMAN FARRAR: -- the last page showing
5 the slip rates on the San Andreas.

6 Dr. Stamatakos, even you've never seen
7 this before, do you understand what that table is
8 dealing with, and does it seem legitimate from your
9 perspective?

10 DR. STAMATAKOS: Well, as I said, I am not
11 familiar with this paper. The slip rates look similar
12 to ones that I recall are relevant for the San Andreas
13 Fault. They may be a little high under the most
14 current assessments, but I would agree --

15 CHAIRMAN FARRAR: But they're in the ball
16 park if we're comparing them to --

17 DR. STAMATAKOS: That's right.

18 CHAIRMAN FARRAR: -- for example, the No.
19 2 --

20 DR. STAMATAKOS: That's correct.

21 CHAIRMAN FARRAR: -- as opposed to 33.9 or
22 12?

23 DR. STAMATAKOS: That's right.

24 CHAIRMAN FARRAR: So you would agree that
25 this could serve some purpose in letting us know what

1 the slip rate on a major fault is?

2 DR. STAMATAKOS: Sure, sure.

3 CHAIRMAN FARRAR: Mr. Turk, does that
4 eliminate your need to object?

5 MR. TURK: No, it doesn't, Your Honor. We
6 were handed this document for the first time just a
7 few minutes ago. I don't know what else appears in
8 it. Ms. Chancellor has pointed to that particular
9 portion, and the witness has indicated he considers
10 San Andreas to be a high slip rate. There's no
11 dispute about that. So what does the exhibit offer
12 for us? We stipulate that the San Andreas has a high
13 slip rate.

14 MS. CHANCELLOR: Your Honor, Dr.
15 Stamatakos has given his opinion about slip rates. He
16 gave a definition of what he considered to be --

17 CHAIRMAN FARRAR: Well, do we need the
18 exhibit if Dr. Stamatakos has just conceded that these
19 numbers for slip rates for the San Andreas Fault,
20 ranging from 5, 12, 33.9, numbers like that, even if
21 slightly high, are in the ball park within his
22 experience?

23 MS. CHANCELLOR: The point, Your Honor, is
24 that I could go through each of these slip rates in
25 California and establish that Dr. Stamatakos is aware

1 that they are within the range of -- within the ball
2 park of what his education and training would suggest
3 these rates are.

4 But the point is that we've got these
5 various classes of slip rates that give some sort of
6 a range as to what you could consider to be high slip
7 rates. I just pointed to the San Andreas Fault
8 because it was an extreme example, but if you look at
9 some of the other slip rates for California, they're
10 not as high as that, but they're certainly much
11 higher, magnitudes higher than anything in Skull
12 Valley. So that's the point of the contrast.

13 CHAIRMAN FARRAR: Hold on a second.

14 MR. TURK: I have one point to ask you to
15 consider while you think, Your Honor.

16 (Pause.)

17 CHAIRMAN FARRAR: Ms. Chancellor, will you
18 tell us more specifically what this will establish?
19 Are you trying to challenge Dr. Stamatakos because he
20 thinks any slip rate over 2 millimeters per year is
21 high and this indicates that 10 is high, and,
22 therefore, he's giving an erroneous opinion?

23 MS. CHANCELLOR: It goes to Dr. -- the
24 critical point it goes to is Dr. Stamatakos' view that
25 PFS in a high seismic area, and that the slip rate is

1 one indication of whether they're in a high seismic
2 area. The slip rate here, the slip rates here in
3 California show what high seismic area slip rates are,
4 and PFS slip rates are --

5 CHAIRMAN FARRAR: All right, maybe because
6 of the lateness of the hour and the length of the
7 hearing, I'm failing to connect something up. But if
8 you persuade us that Dr. Stamatakos is wrong and in
9 fact PFS is in a low seismic area, how does that
10 advance your case?

11 MS. CHANCELLOR: Ten thousand year time
12 period earthquake, Your Honor, not 5,000-year, in
13 terms of the reference probability for a power plant.

14 MR. TRAVIESO-DIAZ: Mr. Chairman, may I
15 make a comment?

16 CHAIRMAN FARRAR: Yes.

17 MR. TRAVIESO-DIAZ: I didn't object to the
18 exhibit because the only factual assertion that I
19 understood Ms. Chancellor to draw from the witness was
20 that, if you look at the classification on the
21 footnote with a number sign, the PFS site will fall
22 into Category B, being on the order of .2 slip rate
23 millimeters per year. I don't know whether that fact
24 -- I suspect that's already given to us in many, and
25 I don't know what inference she can draw from it. I

1 don't see anything else in this document that is
2 relevant or has been testified by the witness to its
3 relevance.

4 So my assumption was that to the extent
5 that this document is admitted into evidence, it would
6 be for a very limited purpose. So I wasn't originally
7 going to object.

8 If other purposes are going to be made of
9 it, I would object on the grounds that we don't know
10 what else is in the document, and some of the other
11 bases that Mr. Turk raised.

12 MS. CHANCELLOR: Your Honor, I could have
13 Dr. Arabasz take the stand by phone, if that's
14 permissible, or we could defer this and --

15 CHAIRMAN FARRAR: Let's defer -- we'll
16 deny admission at this time, and you can get it in
17 through him, if you would like.

18 MS. CHANCELLOR: Is it okay to do that by
19 phone?

20 CHAIRMAN FARRAR: Sure.

21 MS. CHANCELLOR: Okay.

22 CHAIRMAN FARRAR: Yes, we will do that --
23 we could take that on aircraft with a gentleman none
24 of us have ever seen.

25 MR. TURK: May I ask if the point is to

1 resuscitate this exhibit, that we be provided with a
2 complete copy of the article, so we can review in time
3 to address that testimony?

4 MS. CHANCELLOR: This will have to be
5 tomorrow, Your Honor.

6 MR. TURK: Could we ask for a fax tonight
7 if you intend to proceed with it?

8 CHAIRMAN FARRAR: How long is the
9 document, Dr. Arabasz?

10 DR. ARABASZ: Let's see, the first page
11 should be in the page number range 12,587 to 12,631.

12 CHAIRMAN FARRAR: Fifty pages.

13 MR. TURK: Fifty-some pages.

14 CHAIRMAN FARRAR: We will let it in for
15 the slip rate. We'll take the Applicant's suggestion
16 and let it in. Given the circumstances where this
17 witness isn't familiar and no one has seen it, we'll
18 take the Applicant's suggestion and let it in for the
19 slip rate classification information only.

20 MR. TURK: And I note in that regard, Your
21 Honor, and I certainly abide by your ruling, that
22 there's no definition of high seismic in here or high
23 slip rate classification.

24 CHAIRMAN FARRAR: Fine, we're moving on.

25 Let's go.

1 [Whereupon, the above-referred-
2 to document marked as State's
3 Exhibit 219 for identification
4 was received in evidence.]

5 MS. CHANCELLOR: Dr. Stamatakos, on page
6 of your testimony, the last paragraph, incomplete
7 paragraph on page 6, you state that, in your view, the
8 slope or AR value of a seismic has a curve, although
9 potentially important for engineering considerations,
10 it not an appropriate tool to differentiate between
11 sites along tectonic plate boundaries and other sites
12 in the InterMountain West.

13 I would like to focus on, "although
14 potentially important for engineering considerations."
15 Doesn't that vastly understate the critical importance
16 that slopes of seismic hazard curves on risk
17 consistency throughout the United States?

18 DR. STAMATAKOS: Well, if the goal is the
19 risk consistency throughout the United States, which
20 is something that Dr. Arabasz pointed to in his
21 testimony in regard to NUREG CR 6728, certainly if one
22 takes that approach, then the slopes become very
23 important.

24 The point here is whether or not you can
25 just look at a slope and use that as a -- I think you

1 used DNA; I think scientists often say "fingerprint"
2 of whether or not a site is on the tectonic plate
3 boundary or whether it is located somewhere else in
4 the Intermountain West.

5 And my point in this part of my testimony
6 is to present my opinion that the slope or the AR
7 value -- there are lots of underlying reasons which
8 control that that don't necessarily have to do with
9 where it's located in the West, either on the boundary
10 or not. Therefore, it shouldn't be used alone to make
11 decisions about segregating which plants are
12 appropriate because they're on a tectonic plate
13 boundary or not in the assessment.

14 MS. CHANCELLOR: Do you agree that the
15 regulatory goal that underpins Reg. Guide 1.165 and
16 DOE Standard 1020 is risk consistency?

17 DR. STAMATAKOS: I certainly see that risk
18 consistency is an underlying goal of DOE 1020. I
19 think 1.165 is looking at risk more from a sense of
20 what we know, based on the safe operation of existing
21 plants, and in light of how the safe shutdown
22 earthquakes for those plants translate into a
23 reference probability that may be part of the
24 consideration for a new nuclear power plant. I don't
25 think that the 1.165 gives explicit goal toward risk

1 consistency across the United States.

2 MS. CHANCELLOR: I would like to turn to
3 page 7 of your answer seven lines from the bottom
4 where you refer to Figure 3.2 and Staff's Exhibit 63.
5 Isn't the seismic hazard curve in Figure 3.2, isn't
6 that for a single seismic source?

7 DR. STAMATAKOS: That's correct.

8 MS. CHANCELLOR: Isn't it true that a
9 valid seismic hazard curve for a site must represent
10 the aggregate contribution of all significant seismic
11 sources?

12 DR. STAMATAKOS: And I didn't portray this
13 as a seismic hazard for a site. I simply pointed to
14 it as a way to pull out a lot of uncertainties that
15 are involved in seismic hazards. It's a sensitivity
16 study to evaluate the effects of several different
17 parameters on the seismic hazard curve. What it
18 illustrates is that slip rate or activity rate or, in
19 this case, recurrence rate -- in this case it's slip
20 rate -- does not have an influence on the shape or the
21 slope of the hazard curve.

22 MS. CHANCELLOR: Is it not correct that
23 reducing the slope of a seismic hazard curve basically
24 amounts to increasing the ground motion on the X axis
25 relative to some fixed reduction in probability of

1 exceedance on the Y axis?

2 DR. STAMATAKOS: I think I didn't catch
3 the whole question. I would ask either you or the
4 reporter to read it back.

5 MS. CHANCELLOR: Is it not correct that
6 reducing the slope of the seismic hazard curve
7 basically amounts to increasing the ground motion on
8 the X axis relative to some fixed reduction in
9 probability of exceedance on the Y axis?

10 DR. STAMATAKOS: For a given probability
11 of exceedance, yes.

12 MS. CHANCELLOR: Okay. And for multiple
13 sources, suppose one has a source with a relatively
14 large maximum magnitude, but with a very low
15 recurrence rate compared to other contributing
16 sources. At a relatively low probability level, will
17 it not contribute a large ground motion on the X axis
18 that reduces the slope of the hazard curve?

19 MR. TURK: I'm sorry, I couldn't catch the
20 entire question. Could you have the reporter restate
21 it or read it more slowly?

22 MS. CHANCELLOR: Dr. Stamatakos, did you
23 understand it?

24 DR. STAMATAKOS: No, I need you to
25 rephrase it.

1 MS. CHANCELLOR: Okay. Could you read
2 that back, please.

3 (Whereupon, the pending question was
4 played back.)

5 MR. TURK: I would have to object, Your
6 Honor. It's too complicated a question for me to
7 understand it, and, therefore, I'm not sure if we're
8 going to get a clear answer or if the witness would
9 understand the entire question.

10 MS. CHANCELLOR: Well, first, could we ask
11 if the witness understands?

12 DR. STAMATAKOS: I think I understand the
13 basis of your question, yes.

14 MR. TURK: Could you restate your
15 understanding of the question?

16 DR. STAMATAKOS: My understanding --

17 CHAIRMAN FARRAR: No, no, no. Answer the
18 question. Give us an answer.

19 Mr. Turk, we're wasting time here. I
20 don't want any more interruptions. Let's get through
21 this.

22 The witness said he understood the
23 question. We'll let him answer as he understood it.
24 We're not going to go over this over and over.

25 DR. STAMATAKOS: My answer is that I don't

1 know without performing the analysis. It may be that,
2 depending on other factors, that would also simply
3 scale the hazard curve up or it may have an influence
4 to shallow the slope. But the uncertainty, I think
5 the uncertainties that go into parts of the analysis
6 are much more important in contributing to slope than
7 activity rate or occurrence rate for single or
8 multiple sources.

9 MS. CHANCELLOR: Dr. Stamatakos, are you
10 familiar with NUREG /CR 2728 relating -- sorry, strike
11 the last one. Are you familiar with NUREG CR 2728?

12 DR. STAMATAKOS: I don't -- the number
13 doesn't strike a bell with me. So, no, I would say
14 no, unless I could see the title.

15 MS. CHANCELLOR: "Technical Basis for
16 Revision of Regulatory Guidance of Design Ground
17 Motion, Hazard and Risk Consistency Ground Motion
18 Spec. for Guidelines, October 2001," and the authors
19 are --

20 CHAIRMAN FARRAR: What's the number on
21 that, Ms. Chancellor, again? Is this the one --

22 MS. CHANCELLOR: 6728.

23 CHAIRMAN FARRAR: This is the one referred
24 to in his answer, Answer 6?

25 DR. STAMATAKOS: I thought you told me it

1 was 22-something.

2 MS. CHANCELLOR: 6728.

3 DR. STAMATAKOS: Oh, excuse me, 6728.

4 Yes, I'm familiar with that document. I haven't read
5 it, the entire thing, very carefully, but I have
6 looked through that.

7 This is the same NUREG that Dr. Arabasz
8 referred to in his testimony.

9 MS. CHANCELLOR: That's right, and Dr.
10 Arabasz referred to it as related to risk consistency,
11 is that right?

12 DR. STAMATAKOS: That's correct.

13 MS. CHANCELLOR: Do you have an opinion of
14 the author, Robin McGuire, and his co -- do you have
15 an opinion of the competency of Dr. Robin McGuire, one
16 of the authors of this document?

17 DR. STAMATAKOS: No.

18 MS. CHANCELLOR: W. J. Silva?

19 DR. STAMATAKOS: No.

20 MS. CHANCELLOR: You don't know the work
21 of Dr. McGuire?

22 DR. STAMATAKOS: I do.

23 MS. CHANCELLOR: But you don't have an
24 opinion?

25 DR. STAMATAKOS: Dr. McGuire's work is --

1 mainly I'm familiar with it in regard to what was done
2 for Yucca Mountain in Yucca Mountain PHA and the
3 analysis that was performed by Risk Engineering at the
4 Paducah site and the review that we did on the Paducah
5 site.

6 MS. CHANCELLOR: Now --

7 CHAIRMAN FARRAR: Ms. Chancellor --

8 MS. CHANCELLOR: This is my last question.

9 CHAIRMAN FARRAR: No, who are the authors?
10 What organization authored it for whom?

11 MS. CHANCELLOR: Oh, I beg your pardon,
12 Your Honor. It's authored by Risk Engineering, Inc.,
13 and it's prepared by R. K. McGuire.

14 CHAIRMAN FARRAR: But for whom?

15 MS. CHANCELLOR: Oh, excuse me, Your
16 Honor. It's prepared for NRC, the Division of
17 Engineering Technology, Office of Nuclear Regulatory
18 Research at the NRC.

19 CHAIRMAN FARRAR: And what's the name of
20 the organization that prepared it again?

21 MS. CHANCELLOR: Risk Engineering in
22 Boulder, Colorado. The subcontractor is Pacific
23 Engineering. Canelli is the NRC Project Manager.

24 CHAIRMAN FARRAR: In your answer here, Dr.
25 Stamatakos, you said the document hasn't been reviewed

1 or accepted by the staff or the Commission. Does that
2 mean it's not worth anything?

3 DR. STAMATAKOS: No, I'm sure it's -- I am
4 sure it may be worth something. The point here in my
5 testimony was recognition that this document didn't
6 enter into any of our, could not have entered into any
7 of our decisionmaking because it was published in
8 November of 2001, and basically we submitted the final
9 SER just a month later.

10 CHAIRMAN FARRAR: But, okay, that would
11 not be a reason for Dr. Arabasz not to rely on it, if
12 he read it and thought it was worthwhile, would it?

13 DR. STAMATAKOS: I wouldn't fault him for
14 that.

15 CHAIRMAN FARRAR: Okay.

16 MS. CHANCELLOR: Now, Dr. -- oh, excuse
17 me, Your Honor. Do you think you're done?

18 You're a structural geologist and geo --
19 structural geologist?

20 DR. STAMATAKOS: That's one of my --

21 MS. CHANCELLOR: And what's the other one?

22 DR. STAMATAKOS: Well, I've done
23 structural geology and geophysics, tectonics.

24 MS. CHANCELLOR: Okay. And if it's NRC's
25 goal to achieve risk consistency, if the staff were

1 considering how to achieve risk consistency design
2 ground motions at nuclear facilities throughout the
3 country, and they had before them the views of two
4 contractors, your view as a structural geologist and
5 geophysicist, and the authors of NUREG CR 6728, do you
6 agree that the views of the authors of NUREG CR 6728
7 would be given greater weight for developing
8 regulatory guidance than your views?

9 DR. STAMATAKOS: No --

10 MR. TURK: Objection, Your Honor. Goes to
11 what is in the mind of the staff. You can overrule me
12 if you'd like, but it not a question the witness can
13 speculate.

14 MR. TRAVIESO-DIAZ: I think if it's
15 hypothetical question, the answer would depend on what
16 the content of the document is. It is not only the
17 collections of the author.

18 CHAIRMAN FARRAR: Ms. Chancellor, try a
19 different form of that question, if you can.

20 MS. CHANCELLOR: If the goal is reaching,
21 is to achieve --

22 CHAIRMAN FARRAR: Wait, wait. Mr. Turk,
23 your objection is sustained. I didn't want you to
24 think --

25 MR. TURK: I appreciate that.

1 CHAIRMAN FARRAR: -- that you never win.

2 (Laughter.)

3 MR. TURK: I had a better batting average
4 at the beginning of this proceeding.

5 (Laughter.)

6 CHAIRMAN FARRAR: You did. One day I had
7 you six for six.

8 (Laughter.)

9 Go ahead, Ms. Chancellor.

10 MS. CHANCELLOR: I lost my train of
11 thought.

12 (Laughter.)

13 If the goal is to achieve risk
14 consistency, do you agree that the contents of NUREG
15 CR 6728 would be given preference in developing
16 regulatory guidance than an opinion of a structural
17 geologist and geophysicist?

18 MR. TURK: Same objection.

19 MR. TRAVIESO-DIAZ: Same objection. I
20 think it's the same question.

21 MS. CHANCELLOR: Mr. Travieso-Diaz
22 depended on the document, and I just cited the
23 document.

24 CHAIRMAN FARRAR: Okay, you're citing this
25 document and --

1 MS. CHANCELLOR: And Mr. Stamatakos'
2 opinion on this proceeding.

3 CHAIRMAN FARRAR: His opinion, given his
4 expertise --

5 MS. CHANCELLOR: Exactly.

6 CHAIRMAN FARRAR: -- versus -- but do we
7 know the expertise of these people?

8 MS. CHANCELLOR: I believe Dr. Arabasz
9 testified about the expertise of Robin McGuire.

10 CHAIRMAN FARRAR: I don't think the answer
11 is going to get us anywhere. Objection sustained.

12 MS. CHANCELLOR: That was my last
13 question, Your Honor.

14 CHAIRMAN FARRAR: Okay. It's now five
15 minutes to 5:00.

16 DR. ARABASZ: Judge Farrar, may I speak to
17 you, please?

18 CHAIRMAN FARRAR: May you what?

19 DR. ARABASZ: May I speak to you, please?

20 CHAIRMAN FARRAR: Certainly, but everyone
21 else can hear you.

22 DR. ARABASZ: Yes, I understand. The
23 consideration of my going back under oath, I don't
24 think that's necessary. I think a simple question
25 from Ms. Chancellor regarding the contested exhibit

1 and its entry into the record can be resolved very
2 simply if somehow I can communicate one simple
3 question to Ms. Chancellor that she can put to Dr.
4 Stamatakos while he's still under oath.

5 MR. TURK: I wouldn't object if Dr.
6 Arabasz just asked the question.

7 CHAIRMAN FARRAR: You would not object?

8 MR. TURK: I would not.

9 CHAIRMAN FARRAR: Okay, Dr. Arabasz, we've
10 had non-lawyers ask questions before in the
11 proceeding. I think there are three conditions in the
12 regulations that have to be met, and I think, given
13 your appearance here before, we would agree that you
14 meet those. So go ahead and ask Dr. Stamatakos the
15 question.

16 DR. ARABASZ: Dr. Stamatakos, with the
17 information provided from the Wesnousky paper simply
18 as a refresher on slip rates in California, do you
19 still want to classify the PFS site as a high-
20 recurrence or high-slip-rate site?

21 DR. STAMATAKOS: Well, I'm left with the
22 paradox that we started with, and that is, when you
23 look at the hazard curve that Geomatrix produced for
24 this site, it produces a hazard that is similar to
25 many high seismicity sites that you would cite along

1 the San Andrea Fault. I predict very high ground
2 motions even for the 2,000-year term period ground
3 motion.

4 So if it's not a high seismicity site, the
5 historic seismic is truly an indication of what's
6 going to happen at the site, then I can't see how we
7 can't judge the hazard curve that Geomatrix produced
8 as being quite conservative, and if the Geomatrix has
9 a curve that is an accurate prediction, based on the
10 paleoseismic record and its seismicity levels
11 predicted by that hazard assessment are real, and we
12 expect greater than .7 G for the 2,000-year return
13 period, then I can't help but saying that this,
14 according to my definition, would meet a high-
15 seismicity site.

16 So I'm left with either one or the other,
17 and it gets me to the same endpoint in the sense that,
18 if the hazard curve was really conservative, as I
19 contend, then these 2,000-year ground motions that
20 we're using in design really correspond to ground
21 motions at higher recurrence rates or lower
22 probabilities, or if it's accurate, then the 2,000-
23 year ground motions are accurately predicted by
24 Geomatrix, then I see this can only be compared in a
25 similar fashion to many high-seismicity sites, like

1 Diablo Canyon and other sites near the San Andrea
2 Fault or other faults in California that have high
3 slip rates.

4 DR. ARABASZ: I allowed you to speak or to
5 extemporize just as you allowed me when you were
6 questioning me. I guess --

7 DR. STAMATAKOS: And I appreciate that.

8 DR. ARABASZ: -- the simple question
9 relates to the issue of classification of high
10 recurrence or high slip rate, given the types of slip
11 rates that are observed at the PFS facility and the
12 classification, as an example, in California.

13 DR. STAMATAKOS: I would like to look at
14 that paper now that you've pointed me in that
15 direction, and perhaps Dr. Wesnousky's classification
16 is a better, more accurate way to try to group rather
17 than the relative terms of high, medium, low. So
18 that's as much as I can say.

19 I mean these qualifiers of high, medium,
20 and low are relative, and certainly relative to the
21 eastern United States; many spots in the eastern
22 United States, I would say, continue to say, yes, this
23 has high slip rates or high seismicity, compared to
24 the example that you presented in the San Andreas.
25 Now certainly the San Andreas and other fault systems

1 have much higher slip rates.

2 DR. ARABASZ: Judge Farrar, I think you
3 have enough on the record, and I don't need to pursue
4 any further.

5 CHAIRMAN FARRAR: All right, thank you,
6 Dr. Arabasz.

7 All right, then do you want to keep going?
8 The Board has no questions.

9 MR. TURK: I have some redirect, as I
10 mentioned before, Your Honor.

11 CHAIRMAN FARRAR: Yes, how long do you
12 think? And before you give me an answer, Dr.
13 Stamatakos has presented his written rebuttal. He
14 has, I think, largely adhered to that in the face of
15 the State's questioning. So we don't need to hear it
16 a third time.

17 MR. TURK: Absolutely.

18 CHAIRMAN FARRAR: Okay.

19 MR. TURK: My goal in redirect is always
20 simply to clarify something that may not be clear from
21 the statement that --

22 CHAIRMAN FARRAR: Okay, how long do you
23 need?

24 MR. TURK: Fifteen minutes.

25 CHAIRMAN FARRAR: Would it help you to

1 have a short break before? Obviously, you could
2 organize your thoughts before we start.

3 MR. TURK: Five minutes?

4 CHAIRMAN FARRAR: Yes, why don't we do
5 that? Well, it's two after; let's be back at 10
6 after.

7 (Whereupon, the foregoing matter went off
8 the record at 5:01 p.m. and went back on the record at
9 5:12 p.m.)

10 CHAIRMAN FARRAR: Dr. Arabasz, you're back
11 on there?

12 DR. ARABASZ: Yes, I am, Your Honor.

13 CHAIRMAN FARRAR: Okay, thank you.

14 Mr. Turk, go ahead.

15 MR. TURK: Thank you, Your Honor.

16 REDIRECT EXAMINATION BY MR. TURK

17 MR. TURK: Let me start, first of all,
18 with the document that Ms. Chancellor referred to as
19 NUREG CR 2728. Was that a correct citation of the
20 document that we have been talking about

21 DR. STAMATAKOS: No, I think when she
22 misspoke, she corrected herself to 6728, which is one
23 I am familiar with. The first number threw me off,
24 and that's not a number that I recognized.

25 MR. TURK: And in commenting upon NUREG CR

1 6728, you're not suggesting that the document has no
2 merit, are you?

3 DR. STAMATAKOS: Not at all. I think I
4 stated that it may be very useful, but the timing of
5 the publication of that document was such that it
6 could not have figured in at all into any of our
7 evaluations as presented in the SER.

8 MR. TURK: There were some questions about
9 your presentation of testimony here, your rebuttal
10 testimony, as being essentially representing your
11 views rather than the staff's views. Are you aware
12 whether your testimony has been reviewed by NRC staff
13 members?

14 DR. STAMATAKOS: Yes, NRC staff, yes, NRC
15 staff members have looked over my testimony and had no
16 comments.

17 MR. TURK: They had no problems with what
18 you were saying?

19 DR. STAMATAKOS: They had no problems with
20 what I was going to say.

21 MR. TURK: And, in fact, is your testimony
22 essentially consistent with the Consolidated SER? Do
23 you have the SER in front of you?

24 DR. STAMATAKOS: No, I don't, but I know
25 the Consolidated SER, and I would answer, yes, the

1 testimony is consistent with points we made in the
2 SER.

3 MR. TURK: I would like to read you a
4 sentence that appears on page 2-50. Quote: "Further
5 analyses of nuclear power plants in the western United
6 States show that the estimated average mean annual
7 probability of exceeding a safe shutdown earthquake is
8 2.0 times 10 to the minus 4." Close quote, and then
9 you give a citation to U.S. Department of Energy,
10 1997.

11 That essentially represents, as I
12 understand it, a statement that the 5,000-year return
13 period ground motion earthquake has been found to be
14 the MAPE at existing nuclear power plants in the
15 western United States referenced in the Department of
16 Energy document?

17 DR. STAMATAKOS: That's correct. It is a
18 calculated probability based on the existing safe
19 shutdown earthquakes for those nuclear power plants.

20 MR. TURK: And it's correct, isn't it,
21 that the statements that appear in that bullet of the
22 SER was reviewed by the NRC staff prior to the
23 publication of the SER?

24 DR. STAMATAKOS: That's correct.

25 MR. TURK: So it does, in fact, represent

1 a document and a position proffered by the NRC staff?

2 DR. STAMATAKOS: Put it that way; I would
3 agree, yes.

4 MR. TURK: And the staff, in fact,
5 participated in the drafting of this document, and
6 specifically this portion of the document?

7 DR. STAMATAKOS: The staff did participate
8 when we wrote our sections of the SER, and the staff
9 incorporated our inputs into the final SER, yes.

10 MR. TURK: Is it your testimony today with
11 respect to the 5,000-year MAPE any different, in
12 essence, from the statement that appears in that SER?

13 DR. STAMATAKOS: No.

14 MR. TURK: It's an amplification of that
15 statement?

16 DR. STAMATAKOS: That's correct.

17 MR. TURK: You're not suggesting that the
18 NRC staff is recommending that future nuclear power
19 plants in the western United States be sited based
20 upon a 5,000-year return period group motion, are you?

21 DR. STAMATAKOS: As I said, that would be
22 something that I'm sure would be considered if and
23 when a new nuclear power plant was proposed for the
24 western United States, but it's not a number in and of
25 itself that would automatically be considered -- the

1 point is that this is the number that was calculated
2 based on the approach in 1.165, Reg. Guide 1.165, for
3 calculating what the exceedance probability is for
4 existing nuclear power plants.

5 MR. TURK: So, in effect, then, your
6 testimony says that the PFS facility, if compared to
7 the MAPE under a ESHA approach for existing western
8 U.S. nuclear power plants would be compared to what is
9 in effect already established as a mean of about
10 5,000-year return period ground motion?

11 DR. STAMATAKOS: Yes, that's corrected.
12 We had the Commission statement in front of us that
13 said that these were inherently less risky than
14 nuclear power plants, and so we needed to look at what
15 basis there was for establishing appropriate
16 probability levels for western nuclear power plants,
17 and those studies are the DOE study and the Reg. Guide
18 1.165.

19 MR. TURK: At one point during cross
20 examination, and maybe I heard this wrong, I thought
21 that the State's attorney had referred to DOE Standard
22 1020 as, quote, "the", closed quote, reference point,
23 using your analysis. Were there other reference
24 points?

25 DR. STAMATAKOS: Absolutely. They would

1 characterize it as a reference that we considered, one
2 of the references that we considered in our analysis.

3 MR. TURK: There was also some discussion
4 of a handoff in which engineering analyses were done
5 by other persons, not including yourself or McCannard
6 or Dr. Chen. In making that statement, I want to make
7 sure I understand: You're not representing here any
8 professional opinion with respect to the engineering
9 analyses, correct?

10 DR. STAMATAKOS: That's correct. I would
11 not, don't have the expertise to make a judgment on
12 that.

13 MR. TURK: And in your bulletin, the SER,
14 and in your testimony, you are not relying upon the
15 engineering analyses for the PFS facility, are you?

16 DR. STAMATAKOS: We're not explicitly
17 relying on those engineering. Our risk considerations
18 went to the Commission and Commission statements that
19 were done for the TMI II and the documents that
20 related to TMI II.

21 MR. TURK: Is it fair to say, then, that
22 what you're referring to when you talk about those
23 other engineering analyses and evaluations, that what
24 you're saying is you're satisfied that the PFS
25 facility fits within the class of facilities which are

1 discussed in your SER and testimony; i.e., the
2 equivalent of a PC-3 facility?

3 DR. STAMATAKOS: That's correct.

4 MR. TURK: I would like to ask you for a
5 bottom-line position. You gave us an alternative, and
6 essentially, as I understand your statement, you
7 stated that either Geomatrix provided a very
8 conservative seismic hazard curve for the PFS site or
9 it's a high seismic zone, and, therefore, deserves to
10 be treated as if it was a fault or a tectonic plate
11 boundary site. Is that, more or less, a good summary
12 of the paradox that you described?

13 DR. STAMATAKOS: A fair summary, yes.

14 MR. TURK: Bottom line: Is it your view
15 that the Geomatrix seismic hazard curve which
16 estimates a 0.711 G peak ground acceleration in the
17 horizontal direction is a conservative seismic hazard
18 estimate?

19 DR. STAMATAKOS: We concluded that in the
20 SER, yes. We concluded that the assessment done by
21 Geomatrix was conservative, and, therefore, in the
22 type of assessment that we're asked to do, if an
23 applicant chooses to produce something that's
24 conservative, NRC accepts that.

25 MR. TURK: Oh, one other point: The

1 seismic hazard -- I'm sorry, the map of high
2 seismicity that we introduced, Staff Exhibit 62, if
3 you would, take a look at the inset for the
4 InterMountain Seismic Belt.

5 DR. STAMATAKOS: Yes.

6 MR. TURK: Do you have that?

7 DR. STAMATAKOS: Yes.

8 MR. TURK: Do you see that the location of
9 the PFS facility at the star that represented in the
10 inset for PFS is fairly close to a red dot?

11 DR. STAMATAKOS: That red dot, I believe,
12 represents that 1915 earthquake that was pointed out
13 to me under cross examination of my direct testimony.

14 MR. TURK: I have nothing further, Your
15 Honor.

16 CHAIRMAN FARRAR: Thank you, Mr. Turk.

17 If I recall correctly, the Applicant
18 passed any opportunity to cross examine earlier, but,
19 given the State's cross, do you have any?

20 MR. TRAVIESO-DIAZ: We're happy to pass
21 again.

22 CHAIRMAN FARRAR: Okay, thank you.

23 Ms. Chancellor, anything further?

24 MS. CHANCELLOR: Unless I hear screams
25 from Dr. Arabasz -- hearing none --

1 CHAIRMAN FARRAR: Dr. Arabasz, can we call
2 it a day here, do you think?

3 DR. ARABASZ: Yes, sir, Your Honor.

4 CHAIRMAN FARRAR: Thank you.

5 MR. TURK: And note I used nine minutes,
6 Your Honor.

7 (Laughter.)

8 CHAIRMAN FARRAR: Yes, very good, Mr.
9 Turk.

10 MR. TURK: I want to get back on the
11 positive side of the scoreboard.

12 (Laughter.)

13 CHAIRMAN FARRAR: All right, Dr.
14 Stamatakos, the Board thanks you for your testimony
15 here, as before.

16 (Witness excused.)

17 CHAIRMAN FARRAR: All right, a little bit
18 the worse for wear, we concluded what we've set out to
19 do today, for which I commend everyone. Then we are
20 on target, the target we set last week to get to Dr.
21 Bartlett and Dr. Cornell in the next two days. I
22 think you said a day and a half would do it?

23 MR. TRAVIESO-DIAZ: I hate to make
24 predictions, but my best guess is that we could
25 finished by lunchtime on Friday.

1 CHAIRMAN FARRAR: Okay.

2 MS. CHANCELLOR: Or even earlier.

3 CHAIRMAN FARRAR: Okay, that would be
4 good. Then we'll start at the normal nine o'clock
5 tomorrow. We have the Applicant's cross examination
6 plan. Can the staff get us another copy by tomorrow
7 morning of theirs?

8 MR. TURK: I can e-mail it to you as soon
9 as I go back to my office, and I'll bring you a hard
10 copy in the morning.

11 CHAIRMAN FARRAR: Yes, just bring a hard
12 copy tomorrow morning. That's fine.

13 Then we're done. Thank you all.

14 5:23 p.m.

15 (Whereupon, the foregoing matter went off
16 the record at 5:23 p.m., to reconvene the following
17 day, Thursday, June 27, 2002.)

18

19

20

21

22

23

24

25

CERTIFICATE

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

Name of Proceeding: Private Fuel Storage, LLC

Docket Number: Docket No. 72-22-ISFSI

ASLBP No. 97-732-02-ISFSI

Location: Rockville, Maryland

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

151 John Mongoven
John Mongoven
Official Reporter
Neal R. Gross & Co., Inc.