

**RAS 4632 Official Transcript of Proceedings**

**NUCLEAR REGULATORY COMMISSION**

Title: Private Fuel Storage, LLC

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

Location: Rockville, Maryland

Date: Tuesday, June 25, 2002

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UNITED STATES OF AMERICA  
 NUCLEAR REGULATORY COMMISSION

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

ASLBP Hearing Room  
 Third Floor  
 Two White Flint North Building  
 11545 Rockville Pike  
 Rockville, Maryland

June 25, 2002

The above-entitled matter came on for hearing,  
 pursuant to notice, at 9:00 a.m. before:

MICHAEL C. FARRAR, CHAIRMAN  
 Administrative Judge  
 U. S. Nuclear Regulatory Commission

DR. JERRY R. KLINE  
 Administrative Judge  
 U. S. Nuclear Regulatory Commission

DR. PETER S. LAM  
 Administrative Judge  
 U. S. Nuclear Regulatory Commission

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E X H I B I T S

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60	PFS SAR 2.1-4 through 2.1-4	12337	12338
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P-R-O-C-E-E-D-I-N-G-S

(9:01 a.m.)

1  
2  
3 CHAIRMAN FARRAR: Good morning everyone.  
4 Any preliminary matters?

5 MR. TURK: Your Honor, before cross  
6 examination begins, Mr. Waters has indicated to me  
7 that he'd like to clarify a statement he made in  
8 response to Judge Lam.

9 CHAIRMAN FARRAR: Let's hold that for a  
10 moment. Anything -- we have one. I just wanted to  
11 make sure we're on target for tomorrow's  
12 teleconference, given the pace at which we're moving.  
13 Do we have a prediction as to when Dr. Stamatakos will  
14 be on the stand?

15 MR. TURK: I would estimate tomorrow at  
16 noon time. I don't know how much cross the State has  
17 of Mr. Waters. I do know that I'll have quite a bit  
18 with Dr. Resnikoff, unless the Applicant covers issues  
19 first.

20 MS. CHANCELLOR: Your Honor, I don't have  
21 a whole lot with Mr. Waters, but we make these  
22 predictions, but it sort of ebbs and flows. It just  
23 depends on what we get into.

24 CHAIRMAN FARRAR: Well, given that we have  
25 to set up the teleconference facility, should we pick

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1 a time tomorrow -- Wednesday afternoon and just stick  
2 with it?

3 MS. CHANCELLOR: Let me make a couple of  
4 suggestions about Dr. Arabasz and Dr. Stamatakos --  
5 Dr. Arabasz' involvement with Dr. Stamatakos'  
6 rebuttal. I think that the cross examination -- I  
7 would like to try and not have to use Dr. Arabasz for  
8 rebuttal testimony, because that just creates more  
9 lines of questioning, and I think in the end that that  
10 will be longer than if I can make the points through  
11 cross examination. However, to do that, cross  
12 examination may be somewhat lengthy, could be four to  
13 five hours. I mean, Dr. Arabasz has to script this  
14 out for me. It's like -- you know, if I could get Dr.  
15 Stamatakos to agree to certain things, then it's going  
16 to be fairly brief. If he doesn't, I'm going to have  
17 to take the long way around. So maybe the -- rather  
18 than tie up video conference time, we could do this by  
19 telephone conference with respect to my cross  
20 examination of Dr. Stamatakos. That would make the  
21 logistics easier. It would be less costly, and we  
22 would be willing to do that. And then only --

23 CHAIRMAN FARRAR: So what we would need  
24 for that is --

25 MS. CHANCELLOR: A speaker phone.

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1 CHAIRMAN FARRAR: -- a speaker phone that  
2 we don't -- this would be Dr. Arabasz as your advisor  
3 while you're cross examining, so what we need is a  
4 speaker phone. And ideally, an earpiece for you so  
5 that you can hear him, but we can't.

6 MS. CHANCELLOR: Or alternatively, I can  
7 take a break and call him on the cell phone. But I  
8 don't think I will need Dr. Arabasz there to whisper  
9 in my ear. I think that we will --

10 CHAIRMAN FARRAR: If he can hear what's  
11 going on and then you talk to him periodically, that  
12 would --

13 MS. CHANCELLOR: That would be just fine.  
14 And then only if we need to bring Dr. Arabasz back for  
15 rebuttal testimony, which I don't anticipate, would we  
16 need to get some video conferencing.

17 CHAIRMAN FARRAR: It's your case, and you  
18 can anticipate what you want, but our experience has  
19 been, as we discussed last week, you're sometimes  
20 better to have your own witness say what he believes,  
21 than to try eight times to get the other side to do a  
22 "Perry Mason" confession that they were, you know,  
23 lying all along, and they've suddenly seen the light.

24 MS. CHANCELLOR: But using the Perry Mason  
25 analogy, we don't want to go off on an investigation

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1 of Dr. Arabasz, and why he believes certain things --  
2 trying to get Dr. Arabasz to change his mind. If Dr.  
3 Arabasz gets on the stand, then that's going to create  
4 a whole new series of questions, and this thing will  
5 just get prolonged, because it will -- I think that by  
6 cross examining Dr. Stamatakos, we can stick to the  
7 specific issues that he raised in his rebuttal  
8 testimony. And even if he doesn't fess up, Your  
9 Honor, there are ways to make the record. We shall  
10 use circumstantial evidence, so to speak, and I don't  
11 necessarily need a confession, but I just need to make  
12 a record to clarify the rebuttal testimony.

13 CHAIRMAN FARRAR: All right. Then let's  
14 do it your way, and that eases the logistics, because  
15 all we have to do now is make sure you have Dr.  
16 Arabasz available when Dr. Stamatakos comes on, as  
17 opposed to us having to reserve video conference time.

18 MS. CHANCELLOR: But I'd like an hour or  
19 two advance notice as to the approximate time, and  
20 then Dr. Arabasz would probably go up to our office  
21 and have an attorney there.

22 CHAIRMAN FARRAR: Okay. Then let's, as  
23 the last order of business tonight, see if we can zero  
24 in on when we'll need Dr. Arabasz tomorrow.

25 MS. CHANCELLOR: Okay. Thank you, Your

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1 Honor.

2 MR. TURK: Your Honor, I have a cross  
3 examination plan for Dr. Resnikoff. Would this be a  
4 good time to give it to you?

5 CHAIRMAN FARRAR: Yes. Thanks.

6 MR. TURK: And I'm hoping that many of  
7 these areas I don't have to go into.

8 CHAIRMAN FARRAR: My colleagues had  
9 already started hoping that.

10 MR. TURK: I was hoping it last night  
11 around midnight and 1 a.m.

12 JUDGE LAM: And, Mr. Turk, you mentioned  
13 that your witness had additional comments in response  
14 to my questions yesterday.

15 MR. TURK: Yes. Whenever you're ready to  
16 start.

17 CHAIRMAN FARRAR: Go ahead.

18 REDIRECT EXAMINATION

19 MR. TURK: Mr. Waters, you indicated you  
20 wanted to clarify a response you had given to Dr. Lam.

21 MR. WATERS: Yes. Judge Lam asked  
22 yesterday exactly what I considered in my orientation  
23 analysis for tip-over, as compared to Dr. Resnikoff.  
24 I just wanted to clarify what I meant to say, or what  
25 I did say.

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1 I consider tip-over of all 4,000 casks in  
2 a northern direction. If you look at Staff Exhibit X,  
3 which provides a configuration outline of the PFS  
4 facility, there are 50 casks along the northern face  
5 of the array, and there are 80 casks along the western  
6 side of the array. It turns out that during normal  
7 conditions, the bounding dose is actually in the  
8 northern direction where the 50 casks would face.  
9 This is because there's more spacing between the casks  
10 behind it, the second, third, and fourth row of casks,  
11 and that presents a bounding dose rate of basically  
12 2.9 microrem per hour.

13 On the western face, if you were standing  
14 on the western face and looking -- if you're standing  
15 on the western boundary looking at the western face,  
16 you would see 80 casks. However, your bounding dose  
17 rate is less, and it's about 2.2 microrem an hour.

18 In essence, when I considered the 4,000  
19 casks tipping northern, I did consider there was 80  
20 casks. However, those are all facing north, and  
21 obviously, there would be shielding. They'd be lined  
22 up with each other. However, I still believe this is  
23 bounding because there's closer space in the casks on  
24 the western side, and doses would still be less. As  
25 with Dr. Resnikoff, he just considered a row of 80

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1 casks would overturn, and directed calculated a dose  
2 rate.

3 JUDGE LAM: Thank you.

4 CHAIRMAN FARRAR: So the 80 on the west is  
5 the four on each pad times 20 pads.

6 MR. WATERS: Yes.

7 CHAIRMAN FARRAR: And you said how many on  
8 the north?

9 MR. WATERS: There are 25 pads.

10 CHAIRMAN FARRAR: Times two.

11 MR. WATERS: And it'll be times two.

12 CHAIRMAN FARRAR: Right. Is that all, Mr.  
13 Turk?

14 MR. TURK: If that's what the witness is  
15 satisfied with his answer.

16 MR. WATERS: Yes.

17 MR. TURK: Yes.

18 CHAIRMAN FARRAR: Okay. Then, Ms.  
19 Chancellor, you can start your cross examination.

20 MS. CHANCELLOR: Mr. Gaukler, did you --  
21 I know you didn't have any yesterday. Do you have any  
22 cross?

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

24 CHAIRMAN FARRAR: I'm -- had you already  
25 said that, or --

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1 MR. GAUKLER: Yes, I had.

2 MS. CHANCELLOR: Good morning, Mr.  
3 Waters. My name is Denise Chancellor, representing  
4 the State of Utah.

5 MR. WATERS: Good morning.

6 CROSS EXAMINATION

7 MS. CHANCELLOR: You have a MS degree from  
8 the University of Florida. Correct?

9 MR. WATERS: Yes.

10 MS. CHANCELLOR: And you're a health  
11 physicist?

12 MR. WATERS: Yes.

13 MS. CHANCELLOR: And you don't have a  
14 Ph.D. Correct?

15 MR. WATERS: No, I do not.

16 MS. CHANCELLOR: And you're not  
17 experienced in modeling radiation dose consequences.  
18 Is that right?

19 MR. WATERS: Could you repeat the  
20 question?

21 MS. CHANCELLOR: You're not experienced in  
22 modeling radiation dose consequences.

23 MR. WATERS: Yes, I am.

24 MS. CHANCELLOR: Have you performed a  
25 Monte Carlo analysis?

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1 MR. WATERS: Yes, I've performed several.

2 MS. CHANCELLOR: For what situation?

3 MR. WATERS: In the past six years at NRC,  
4 I've been involved with licensing for storage casks  
5 and transportation casks as a radiological protection  
6 reviewer and a shielding reviewer.

7 MS. CHANCELLOR: I'm sorry. I didn't  
8 quite understand.

9 MR. WATERS: In the past six years at NRC,  
10 I have reviewed, evaluated spent fuel storage casks  
11 designs and spent fuel transportation cask designs as  
12 a shielding reviewer, and as a radiological protection  
13 reviewer.

14 MS. CHANCELLOR: As a what reviewer?

15 MR. WATERS: Radiological protection.

16 CHAIRMAN FARRAR: No, there was a word  
17 before.

18 MS. CHANCELLOR: Oh, shielding.

19 CHAIRMAN FARRAR: Shielding.

20 MS. CHANCELLOR: Oh, thank you. Shielding  
21 reviewer. I see.

22 MR. WATERS: As part of that review, I  
23 perform confirmatory analysis of Monte Carlo codes  
24 such as scale, which you use the Monte Carlo, and  
25 MCBEND, which uses Monte Carlo.

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1 MR. TURK: Which element?

2 MR. WATERS: It's a computer code called  
3 MCBEND, M-C-B-E-N-D, and it's basically the same as  
4 MCMP. I also have experience at the University of  
5 Florida running MCMP, and I've also programmed Monte  
6 Carlo codes for Fortran.

7 MS. CHANCELLOR: And for the PFS case,  
8 have you personally carried out a Monte Carlo analysis  
9 of any aspect of the PFS project?

10 MR. WATERS: Not for PFS, but I have for  
11 the HI-STORM 100.

12 MS. CHANCELLOR: And you were a reviewer  
13 for the HI-STORM 100 for the generic COC. Is that  
14 right?

15 MR. WATERS: Yes.

16 MS. CHANCELLOR: And also, for the HI-STAR  
17 COC?

18 MR. WATERS: Yes, for the storage cask and  
19 for the transportation certification.

20 MS. CHANCELLOR: And specifically, what  
21 did you review for the HI-STORM COC?

22 MR. WATERS: I reviewed radiological doses  
23 around the cask, and at the site boundary, and cleaned  
24 those around the HI-TRAC transfer cask. I reviewed  
25 the contents. I reviewed the design of the shield,

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1 and the modeling and the analysis that applicants  
2 submitted to certify the cask.

3 MS. CHANCELLOR: Did you evaluate the MPC  
4 drop analysis?

5 MR. WATERS: I did not, not as a  
6 structural review.

7 MS. CHANCELLOR: Have you ever visited the  
8 PFS site?

9 MR. WATERS: No, I have not. I've seen it  
10 in pictures, and I reviewed the layout of the facility  
11 and the area in the SAR.

12 MS. CHANCELLOR: Are you familiar with  
13 housing development in that area?

14 MR. WATERS: Not specifically. I know  
15 that the closest resident is approximately two to two  
16 and a half miles away.

17 MS. CHANCELLOR: Are you familiar with any  
18 land use planning for that area?

19 MR. WATERS: No, I am not.

20 MS. CHANCELLOR: Did you review PFS'  
21 seismic exemption request, which was submitted to the  
22 NRC in April 1999 for a 1,000 year return period  
23 earthquake as the design-basis earthquake?

24 MR. WATERS: No, I have not.

25 MS. CHANCELLOR: You didn't review any of

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1 the dose analysis that PFS submitted with that  
2 exemption request?

3 MR. WATERS: No.

4 MS. CHANCELLOR: Did you have any  
5 involvement with the Rule Making Plan, SECY-98-026,  
6 which was in effect - I don't know if in effect is the  
7 right word - but which was relevant from April of '98  
8 through last year?

9 MR. TURK: Could I ask for a  
10 clarification? Was he involved in the Rule Making?  
11 Is that the question?

12 MS. CHANCELLOR: Was he involved in any  
13 aspect of that Rule Making Plan?

14 MR. WATERS: No, I was not.

15 MS. CHANCELLOR: In answer 7 on page 4,  
16 you refer to 72.104A, and refer to a real individual.  
17 What is your definition of a real individual, for  
18 purposes of 104A?

19 MR. WATERS: A real individual is the  
20 realistic people that would be around a proposed  
21 storage installation, taking account for the realistic  
22 population, and locations of people, it's not a  
23 hypothetical person. For instance, at two and a half  
24 miles away, the real individual is a resident.

25 MS. CHANCELLOR: Well, 106B, the

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1 regulation refers to any individual. How would you  
2 define any individual under the accident dose  
3 regulation, 106B?

4 MR. GAUKLER: . I object to the extent it  
5 calls for a legal conclusion. He certainly can state  
6 his understanding.

7 CHAIRMAN FARRAR: Mr. Gaukler is correct.  
8 If we can -- can you repeat the way you worded the  
9 question?

10 MS. CHANCELLOR: In your testimony you  
11 state that, "The Commission has established radiation  
12 dose limits for individuals located on or beyond the  
13 nearest boundary of the controlled area for any  
14 design-basis accident, as set forth in 106B." In your  
15 testimony, what do you mean by individuals?

16 MR. WATERS: A person --

17 MS. CHANCELLOR: Is that a real person or  
18 a hypothetical person?

19 MR. WATERS: In the individual, that's at  
20 the site boundary.

21 MS. CHANCELLOR: A real person, or a  
22 hypothetical person?

23 MR. WATERS: A real person.

24 MS. CHANCELLOR: And what's your basis for  
25 saying it under an accident condition, that at the

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1 fence post, or at the boundary you must have a real  
2 individual?

3 MR. WATERS: Can you clarify the question?

4 MS. CHANCELLOR: As opposed to a  
5 hypothetical -- what's the basis for your  
6 understanding that the individual in 106B appears to  
7 be the same as the real individual on 104A?

8 MR. WATERS: 104 states real individual,  
9 and I think 106 states any individual.

10 MS. CHANCELLOR: And what's the  
11 distinction between those two terms, if you know?

12 MR. WATERS: The real individual assumes  
13 actual conditions during the normal operation year.  
14 The dose limit in 104 is an annual one limit.  
15 Therefore, you assume who is there annually, a real  
16 individual. The dose limit in 72-106B is for an  
17 event. It's not an annual limit, so you assume an  
18 individual is present at the site during an accident.

19 MS. CHANCELLOR: And in answer 20 on page  
20 13, you use a 30-days duration when referring to an  
21 analysis under 106B. What was your -- what was the  
22 reason for choosing 30 days?

23 MR. WATERS: What page was that again,  
24 please?

25 MS. CHANCELLOR: Answer 20, page 13. If

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1 you look towards the end of the page, you have a dose  
2 rate for 30 days for a hypothetical tip-over event.  
3 And you use 30 days.

4 MR. WATERS: Yes.

5 MS. CHANCELLOR: What's the basis for  
6 using 30 days?

7 MR. WATERS: The limit in 106B is a limit  
8 for an accident event. In licensing, we assume a  
9 conservative exposure time. Thirty days as a  
10 conservative exposure time is consistent with long  
11 term accidents you evaluate in power reactors, and  
12 accidents evaluated for confinement accidents.  
13 Therefore, I determined that was an appropriate basis  
14 for using that exposure time for my analysis.

15 MS. CHANCELLOR: And specific to the PFS  
16 site, did you assume that casks could be uprighted in  
17 30 days?

18 MR. WATERS: No, I did not.

19 MS. CHANCELLOR: How did you relate the 30  
20 days to the PFS site?

21 MR. WATERS: I believe 30 days is a  
22 conservative time to allow someone to react to a  
23 beyond design-basis event, such as tip-over, to  
24 mitigate dose rates, by using fundamental principles  
25 of radiological protection, such as time, distance,

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1 and shielding.

2 MS. CHANCELLOR: Could you repeat that  
3 answer? Sorry, I got distracted. Would you repeat  
4 that answer?

5 MR. TURK: Could we have the reporter read  
6 it back, or do you want him to restate it?

7 MS. CHANCELLOR: That's fine. Could --

8 CHAIRMAN FARRAR: Yeah. Let's have the  
9 reporter read it back, play it back.

10 (Last answer played back.)

11 CHAIRMAN FARRAR: That's fine. Thank you.

12 MS. CHANCELLOR: When you say "distance",  
13 what do you mean by distance with respect to the PFS  
14 site?

15 MR. WATERS: Distance is the most  
16 important factor of reducing dose rates from the spent  
17 fuel source on the facility pad. The Owner Controlled  
18 Area Boundary distance is 600 meters. If there was  
19 hypothetically some event where direct dose was a  
20 consideration or a problem, then it's reasonable to  
21 assume within 30 days we would not have someone  
22 standing at the site boundary just sitting there being  
23 unshielded, and being exposed to the dose rate. In my  
24 mind, it's reasonable to assume that necessary action  
25 be taken to remove people at the site boundary.

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1 MS. CHANCELLOR: So you assume 30 days, 24  
2 hours a day.

3 MR. WATERS: Yes, unshielded.

4 MS. CHANCELLOR: Unshielded. And if you  
5 didn't assume that the casks would be uprighted in 30  
6 days, what did you assume with respect to shielding?

7 MR. TURK: Do you understand that  
8 question?

9 MR. WATERS: No, I do not.

10 MS. CHANCELLOR: You stated that the  
11 reason for choosing 30 days was time, distance, and  
12 shielding.

13 MR. WATERS: Right.

14 MS. CHANCELLOR: What did you assume with  
15 respect to shielding at the PFS site in an accident  
16 condition relating to this 30 days you used?

17 MR. WATERS: As far as shielding, it's my  
18 belief that within 30 days there could be temporary  
19 shielding, if necessary. If there was a  
20 consideration, direct dose rates would be temporary  
21 shielding that could be placed appropriately around  
22 the storage casks to reduce dose rates.

23 MS. CHANCELLOR: And what type of  
24 temporary shielding?

25 MR. WATERS: You could have lead blankets,

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1 you could have steel plates. You could, for instance,  
2 bring in dump trucks and build a temporary berm,  
3 basically bring in some masks to reduce the radiation.

4 MR. TURK: Bring in some?

5 MR. WATERS: Basically bring in --

6 MR. TURK: I didn't hear --

7 MR. WATERS: -- masks to reduce radiation.

8 MR. TURK: Masks.

9 MR. WATERS: Yes. You could also possibly  
10 -- no, strike that.

11 MS. CHANCELLOR: Have you seen or reviewed  
12 any contingency plan by PFS in the case of cask tip-  
13 over?

14 MR. WATERS: No, I have not.

15 MS. CHANCELLOR: To your knowledge, has  
16 NRC requested such a plan from PFS?

17 MR. WATERS: No, we typically do not have  
18 emergency plans or contingency plans for beyond  
19 design-basis events, including the hypothetical cask  
20 tip-over.

21 MS. CHANCELLOR: I meant to ask you this  
22 question at the beginning. You're not a contractor of  
23 NRC. You're actually a staff employee. Is that  
24 correct?

25 MR. WATERS: I am employee.

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1 MS. CHANCELLOR: In answer 15, right at  
2 the bottom on page 7 and 8, you state that, "The MPC  
3 is bounded by the analysis that was done in the COC  
4 valuation by the Staff's HI-STORM 100 SCR."

5 MR. WATERS: Excuse me. I lost my place.  
6 Where at again, please?

7 MS. CHANCELLOR: The very bottom of page  
8 7, carrying over to page 8.

9 MR. WATERS: Okay.

10 MS. CHANCELLOR: Now you stated you did  
11 not conduct the review for the multi-purpose canister  
12 drop. Is that correct?

13 MR. WATERS: Yes.

14 MS. CHANCELLOR: And are you aware of the  
15 ground motions in the Holtec Certificate of Compliance  
16 that they analyzed?

17 MR. WATERS: I do not recall the exact  
18 ground motions in the Certificate of Compliance.

19 MS. CHANCELLOR: Do you know the ground  
20 motions at the PFS site?

21 MR. WATERS: I think it's .69 G in one  
22 direction, and .71 in the other direction.

23 MS. CHANCELLOR: Correct. And in the  
24 Holtec COC, they've got various ground motions. One  
25 is .445 on the horizontal, and .16 on the vertical.

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1 Does that sound about right?

2 MR. WATERS: I would have to review the  
3 COC. I do not know.

4 MS. CHANCELLOR: That's just fine. Also,  
5 in the Certificate of Compliance, Holtec conducted an  
6 analysis with the casks standing vertically with all  
7 vents blocked. Is that correct?

8 MR. WATERS: I believe they performed a  
9 thermal calculation, yes.

10 MS. CHANCELLOR: And the Certificate of  
11 Compliance requires casks to be uprighted within 33  
12 hours?

13 MR. WATERS: No, it does not.

14 MS. CHANCELLOR: It requires all the vents  
15 to remain open, and that the person using the cask has  
16 33 hours to conduct inspections to ensure that all  
17 vents remain open?

18 MR. WATERS: I believe it has a  
19 surveillance requirement of 24 hours to check for vent  
20 blockage. And if such vent blockage occurs, they must  
21 remove it.

22 MS. CHANCELLOR: Has NRC or any of its  
23 contractors done any modeling of heat-up of the  
24 canister and concrete due to the cask laying on its  
25 side?

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1 MR. WATERS: Yes.

2 MS. CHANCELLOR: And is that -- let me  
3 hold off on that one for a moment. In question 18 of  
4 your testimony, you state that, "You conducted an  
5 analysis of a multi-cask tip-over at PFS, and you  
6 basically looked at three things, damage to cask  
7 shield from cask/pad interaction, thermal degradation  
8 of the cask in the horizontal position from radial  
9 concrete shield due to loss of hydrogen and spatial  
10 orientation, and doses at the fence post." Does that  
11 --

12 MR. WATERS: Yes.

13 MS. CHANCELLOR: And then in your  
14 testimony in answer 19, you -- is it correct here,  
15 "You rely on PFS' tip-over analysis to reach  
16 conclusions that there would be localized damage near  
17 the cask impact area"?

18 MR. WATERS: I relied on that and my  
19 conversations with our structural reviewers.

20 MS. CHANCELLOR: And also, thinning of the  
21 steel shell, that there would be thinning of the steel  
22 shell too?

23 MR. TURK: Same question?

24 MS. CHANCELLOR: Same question. If you  
25 look at page 10 of your testimony.

1 MR. WATERS: Well, thinning the shell was  
2 postulated. I'm not sure if it's been calculated.

3 MS. CHANCELLOR: In answer 19, these are  
4 qualitative evaluations by you. Is that correct?

5 MR. TURK: Perhaps he should look at his  
6 answer before he answers.

7 MR. WATERS: Yes, the answer is in the  
8 qualitative format.

9 MS. CHANCELLOR: And you said you spoke  
10 with structural reviewers with respect to the thinning  
11 of the steel shell?

12 MR. WATERS: No, with respect to localized  
13 damage.

14 MS. CHANCELLOR: Localized damage. And  
15 who are the structural reviewers?

16 MR. WATERS: I spoke with Mr. Daniel  
17 Huang, H-U-A-N-G. He was a structural reviewer for  
18 the HI-STORM 100 overpack review. I've also spoken  
19 with Dr. Mahendra Shaw, as well.

20 MS. CHANCELLOR: And Dr. Huang, is he a  
21 contractor or an NRC --

22 MR. WATERS: He's an NRC employee.

23 MS. CHANCELLOR: And Dr. Mahendra Shaw is  
24 an NRC employee too.

25 MR. WATERS: Yes.

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1 MS. CHANCELLOR: Isn't it true that  
2 localized damage in some areas of the cask would be  
3 more important, such as towards the center where the  
4 fuel is hotter, than say at the top or bottom of the  
5 cask in terms of shielding?

6 MR. WATERS: What type of localized  
7 damage?

8 MS. CHANCELLOR: Well, whatever type of  
9 localized damage you have in your testimony, localized  
10 damage and flattening of the concrete.

11 MR. WATERS: It would not, except for  
12 possibly thinning of the steel. If one were to  
13 postulate thinning of the steel in a particular area,  
14 then yes, in theory it would be more important at the  
15 center of the cask than at the top.

16 MS. CHANCELLOR: So even though you have  
17 the same mass of concrete and steel, where that  
18 thinning or flattening occurs, is not equal with  
19 respect to potential loss of shielding.

20 MR. TURK: Objection. The witness clearly  
21 distinguished steel from other portions of the cask.  
22 The question asked steel and concrete together.

23 CHAIRMAN FARRAR: Well, he can -- he's  
24 free to separate them in his answer. Overruled.

25 MR. WATERS: The question was unclear to

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1 me. Can you repeat it, please?

2 MS. CHANCELLOR: With respect to concrete  
3 flattening --

4 MR. WATERS: Yes.

5 MS. CHANCELLOR: -- all concrete  
6 flattening is not equal in the HI-STORM 100 cask in  
7 terms of shielding. Is that correct? That flattening  
8 in the center of the cask may be more important in  
9 terms of loss of shielding than at the top or the  
10 bottom?

11 MR. WATERS: No, not for concrete  
12 flattening with respect to off-site doses.

13 MS. CHANCELLOR: What about with respect  
14 to flattening -- thinning of the steel, steel shell?

15 MR. WATERS: Well, thinning of the steel  
16 shell is a very minor -- would only result in a very  
17 insignificant or minor change. But as I said in my  
18 earlier response, the dose rates are higher in the  
19 center of the cask compared to the top, so if you were  
20 to remove or thin the steel in the middle, then yes,  
21 the dose rates would have -- would be higher. But the  
22 relative effect would be the same as if you thin it on  
23 top, as well.

24 MS. CHANCELLOR: With respect to your con  
25 -- was it conversations or written communication that

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1 you had with Dr. Huang and Dr. Shaw?

2 MR. WATERS: It was oral communications.

3 MS. CHANCELLOR: And what was -- what  
4 information did -- specifically, what information did  
5 you obtain from Dr. Huang with respect to localized  
6 damage?

7 MR. WATERS: They basically concurred with  
8 the Applicant's assessment of localized damage. It  
9 would be very minor.

10 MS. CHANCELLOR: What assessment -- where  
11 was the assess -- in what document was the assessment  
12 by the Applicant of localized damage?

13 MR. WATERS: In the FSAR, PFS FSAR. They  
14 may have referred to the Holtec SAR within that FSAR.  
15 It's not -- I apologize. Not FSAR, it's an SAR.

16 MS. CHANCELLOR: That's correct. And with  
17 respect to your conversation with Dr. Mahendra Shaw,  
18 what was the content of those conversations, or that  
19 conversation?

20 MR. WATERS: Basically, he reiterated and  
21 concurred with the Applicant's assessment in the SAR  
22 that the damage to the shield would be very localized  
23 and relatively minor, with respect to shielding.

24 MS. CHANCELLOR: And was this just one  
25 conversation, or did you have several conversations

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1 with these gentlemen?

2 MR. WATERS: I had more than one  
3 conversation, yes.

4 MS. CHANCELLOR: And in the PFS SAR, was  
5 that a quantitative assessment, or a qualitative  
6 assessment of localized damage, and microcracking, and  
7 flattening of concrete, and thinning of the steel  
8 shell?

9 MR. WATERS: I am not aware of the exact  
10 analyses word for word in the SAR, but I believe it  
11 was generally qualitative in nature. However, they  
12 did calculate the deformation of the inner shield  
13 overpack, and that was on the order of a tenth of an  
14 inch.

15 MS. CHANCELLOR: With respect to this  
16 issue, have you reviewed the PFS SAR?

17 MR. WATERS: Yes, I reviewed portions of  
18 it.

19 MS. CHANCELLOR: Have you reviewed the  
20 calculation performed by Dr. Redmond in support of the  
21 PFS license application, radiation shielding analysis  
22 for the PFS site?

23 MR. WATERS: Yes, I've looked over it.

24 MS. CHANCELLOR: Looked over it, or have  
25 you reviewed? I mean, have you just glanced at it, or

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1 have you --

2 MR. WATERS: I did not perform a  
3 confirmatory analysis. We had a contractor, the  
4 Center for Nuclear Waste and Regulatory Analysis, who  
5 did a very detailed review of that calc package.  
6 However, I did review the overall results, and  
7 reviewed the general methodology.

8 MS. CHANCELLOR: And in that analysis, Dr.  
9 Redmond comes up with 5.58 millirems per year at the  
10 boundary under normal operating conditions. Is that  
11 right?

12 MR. WATERS: Yes.

13 MS. CHANCELLOR: And do you concur with  
14 that analysis?

15 MR. WATERS: I believe that's a reasonable  
16 dose rate, and I have no reason to believe not.

17 MS. CHANCELLOR: And you don't take issue  
18 with anything that you have reviewed in Dr. Redmond's  
19 calculations.

20 MR. WATERS: I did not find anything, no.

21 MS. CHANCELLOR: Okay. If you would turn  
22 to page 11 of your testimony, and in question -- this  
23 is a rather lengthy answer. In question -- in answer  
24 20 deals with thermal degradation of the concrete  
25 shield, and from hydrogen loss. In the first

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1 paragraph, is it correct that you take PFS' normal  
2 operating dose of 5.8 millirems per year, and then  
3 convert it into millirems per hour, and you divide by  
4 2000 hours, and you come up with a number of .00293  
5 millirems per hour. Is that correct?

6 MR. WATERS: Yes, but the individual  
7 components are repeated elsewhere in that calc  
8 package.

9 MS. CHANCELLOR: And then also in this  
10 first paragraph, basically fractionate the millirems  
11 per hour into contributions by neutrons and gamma. Is  
12 that correct? Nineteen percent for neutrons, and 81  
13 percent for gamma?

14 MR. WATERS: Yes, that was the neutron and  
15 gamma dose that was reported in the calculation  
16 package.

17 MS. CHANCELLOR: And those doses are  
18 measured at or near the cask, a meter from the cask.  
19 Is that right?

20 MR. WATERS: These values are at 600  
21 meters from the restricted area.

22 MS. CHANCELLOR: I'd like to hand you a  
23 page from Dr. Redmond's calculation, radiation  
24 shielding analysis for the PFS on page C-4, and  
25 Appendix C to Dr. Redmond's calculation is results of

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1 various overpack configuration analyses. And I'll  
2 need to come over here, because I didn't realize I'd  
3 need to do this. Just one moment.

4 MR. TURK: You don't have extra copies?

5 MS. CHANCELLOR: No, I didn't think. You  
6 have a copy of --

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

9 CHAIRMAN FARRAR: Yes.

10 (Off the record 9:41:47 - 9:43:19 a.m.)

11 CHAIRMAN FARRAR: Back on the record.

12 MS. CHANCELLOR: Mr. Waters, if you look  
13 at page C-4 of Holtec report HI-971645, Radiation  
14 Shielding Analysis for the PFS, the first column, DIS  
15 is distance. Is that right?

16 MR. WATERS: It appears to be, yes.

17 MR. TURK: Can I look over the witness'  
18 shoulder since I don't have a copy of it?

19 CHAIRMAN FARRAR: Yes.

20 MS. CHANCELLOR: Then the next column is  
21 neutron value. Correct?

22 MR. WATERS: Yes.

23 MS. CHANCELLOR: And then photon is the  
24 one, two, fourth column?

25 MR. WATERS: Yes, that's neutron. That's

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1 photons reduced from neutron interactions, yes.

2 MS. CHANCELLOR: And then in the sixth  
3 column are they photons produced by -- is that a gamma  
4 contribution?

5 MR. WATERS: I would imagine these are  
6 fuel gammas.

7 MS. CHANCELLOR: And then if you go over  
8 two columns to cobalt value. Is that also gamma  
9 contribution?

10 MR. WATERS: Yes, from lack of their  
11 hardware in the spent fuel.

12 MS. CHANCELLOR: Now if you look at the  
13 value for at 600 -- the Owner Controlled Area is 600  
14 meters. Correct?

15 MR. WATERS: Yes.

16 MS. CHANCELLOR: To the fence post. Okay.  
17 So if you look at the neutron value at 600 meters,  
18 it's 1.28 times ten to the minus three for neutron,  
19 and 3.1 times ten to the minus three for photons, so  
20 that's a neutron contribution. Right? At the fence  
21 post.

22 MR. WATERS: Yes, but I'd like to clarify.  
23 I do not know in what context this particular page is.  
24 If it's from a row of casks, a single cask, partially  
25 shaded casks, I do not know. I obtained my results

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1 from page D-7.

2 MS. CHANCELLOR: You used page D-7?

3 MR. WATERS: Yes.

4 MS. CHANCELLOR: D as in dog. And why did  
5 you choose page D-7?

6 MR. WATERS: Page D-7 has the total dose  
7 rates when you consider all 4,000 casks for the  
8 bounding condition at the northern boundary. If you  
9 look halfway down, or in my copy, there's in bold at  
10 2,118.5 feet, there are values for the neutron and  
11 gamma in millirem per hour.

12 MS. CHANCELLOR: Well, do the numbers on  
13 page D-7, do they -- is there a difference between  
14 those on D-7 and those on C-4? They're not the same  
15 values. Right?

16 MR. WATERS: They are not the same values,  
17 but I do not know what context page C-4 was in. What  
18 the applicant did was perform several calculations,  
19 basically assuming different shading factors based on  
20 the pitch and configuration of the storage facility.  
21 And I believe the applicant provided several different  
22 outputs and values for these different configurations.

23 MS. CHANCELLOR: That's all I have on  
24 those calculations, Mr. Turk.

25 MR. TURK: Thank you.

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1 MS. CHANCELLOR: Staying with answer 20,  
2 in paragraph 2, you state in your testimony, "The  
3 Staff performed sensitivity calculations of the  
4 surface does rates, gamma and neutron." Who -- in  
5 this context, who are you referring to with respect to  
6 the Staff?

7 MR. WATERS: It was myself and Julia Myers  
8 in the Spent Fuel Project Office. Julia Myers Barto,  
9 actually.

10 MR. TURK: Julia Myers?

11 MR. WATERS: Julia Myers Barto.

12 MR. TURK: B-A-R-T-O?

13 MR. WATERS: Yes.

14 MS. CHANCELLOR: And was this with respect  
15 to the generic HI-STORM license application, or was it  
16 specific to the PFS site?

17 MR. WATERS: The HI-STORM 100 cask design  
18 that we analyzed was based on Amendment O of the COC  
19 which will be used at PFS.

20 MS. CHANCELLOR: Okay. So the sensitivity  
21 calculations were performed for the HI-STORM COC. Is  
22 that correct?

23 MR. TURK: Objection.

24 MR. WATERS: No, it was performed --

25 CHAIRMAN FARRAR: Wait, wait, wait. We've

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1 got an objection.

2 MR. TURK: The witness handled it.

3 CHAIRMAN FARRAR: Then why did you speak  
4 up?

5 MS. CHANCELLOR: I couldn't hear because  
6 Mr. Turk was objecting.

7 CHAIRMAN FARRAR: So what was the answer  
8 again, please?

9 MR. WATERS: The answer was no, this  
10 analysis, this calculation was performed for this  
11 testimony.

12 MS. CHANCELLOR: Oh, it was performed  
13 specifically for these hearings.

14 MR. WATERS: Yes.

15 MS. CHANCELLOR: And also, in the next  
16 paragraph on page 12, the second full paragraph on  
17 page 12, "The Staff predicted worst case temperatures  
18 with cobalt." Was that -- who are you referring to  
19 there with respect to the Staff?

20 MR. WATERS: Staff at the Pacific  
21 Northwest National Laboratories.

22 MS. CHANCELLOR: And that's a contractor  
23 to the NRC?

24 MR. WATERS: That's a contractor, yes.

25 MS. CHANCELLOR: And then in the third

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1 paragraph you state, "The Staff performed multiple  
2 dose calculations with respect to fuel burn-up and  
3 cooling time." Who are you referring to there with  
4 respect to the Staff?

5 MR. WATERS: Myself and Julia Myers Barto.

6 MS. CHANCELLOR: And again, this was  
7 specific for this testimony?

8 MR. WATERS: Yes.

9 MS. CHANCELLOR: Now with respect to the  
10 worst case temperatures of the COBRA computer code  
11 done by Pacific Northwest Labs, I'd like to hand out  
12 and have marked as State's Exhibit -- I'd like to have  
13 marked a three-page document that we received from the  
14 NRC entitled, "COBRA-SFS Analysis of the Holtec HI-  
15 STORM 100 Storage System Following a Tip-Over."

16 CHAIRMAN FARRAR: And you want this marked  
17 as what?

18 MS. CHANCELLOR: State's Exhibit 214,  
19 please.

20 (State's Exhibit 214 marked for identification.)

21 JUDGE LAM: Ms. Chancellor, do you have an  
22 extra copy for our law clerk?

23 MS. CHANCELLOR: Certainly.

24 JUDGE LAM: Thank you.

25 MS. CHANCELLOR: Mr. Waters, are you

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1 familiar with this document?

2 MR. WATERS: Yes, I am.

3 MS. CHANCELLOR: Did you prepare this  
4 document?

5 MR. WATERS: No, I did not.

6 MS. CHANCELLOR: Do you know who prepared  
7 the document?

8 MR. WATERS: Yes. Mr. Tom Michener at  
9 Pacific Northwest National Laboratories.

10 MS. CHANCELLOR: And was it Mr. Michener,  
11 or Dr. Michener, was it Tom Michener who prepared the  
12 COBRA-SFS Analysis?

13 MR. WATERS: Yes, it was.

14 MS. CHANCELLOR: And is that what you are  
15 -- and is that analysis what you are relying on in  
16 your testimony on page 12, where you talk about worst  
17 case temperatures using COBRA-SFS computer code?

18 MR. WATERS: Yes.

19 MS. CHANCELLOR: And what date was this  
20 prepared?

21 MR. WATERS: It was prepared in March. I  
22 do not know the exact date.

23 MS. CHANCELLOR: March, 2002.

24 MR. WATERS: No, wait a second. Yes, this  
25 memo was prepared in March, 2002. The analysis was

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1 performed before that.

2 MS. CHANCELLOR: Any idea how long  
3 beforehand?

4 MR. WATERS: , I believe in January or  
5 February, but I can't -- I do not know the exact time  
6 frame. It may have been before, as well.

7 MS. CHANCELLOR: But it was prepared  
8 specifically for your testimony in this proceeding.  
9 Is that correct? To support your testimony in this  
10 proceeding.

11 MR. TURK: The memo was prepared for that  
12 reason?

13 MS. CHANCELLOR: The analysis, the  
14 analysis and the memo that describes the results.

15 MR. WATERS: The analysis -- there's  
16 actually two analyses. The report of one is in normal  
17 storage, and one is in tip-over case all vents blocks.  
18 The second analysis was performed, I think, basically  
19 for this proceeding, yes.

20 MS. CHANCELLOR: Specifically -- are you  
21 referring to a particular section of this document?

22 MR. WATERS: This document reports -- if  
23 you look at the last page to summarize, this Figure 1  
24 and Figure 2. Figure 2 are the results that we used,  
25 and I believe that portion of the analyses was

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1 performed to support my testimony. Figure 1 was --  
2 the results of Figure 1, I believe, were performed for  
3 other reasons, to support our general licensing of HI-  
4 STORM casks.

5 MS. CHANCELLOR: So Figure 1 would have  
6 been -- was that performed at the time that NRC was  
7 reviewing the HI-STORM Certificate of Compliance?

8 MR. WATERS: No, I believe it was  
9 performed afterwards.

10 MS. CHANCELLOR: Why would you perform an  
11 analysis after you've granted the COC?

12 MR. WATERS: I do not know.

13 MS. CHANCELLOR: And with respect to  
14 Figure 2 that shows the results, that would have been  
15 -- the analysis that produced those results would have  
16 been prepared in January or February of this year. Is  
17 that right?

18 MR. WATERS: I believe so, but I'd have to  
19 talk to Tom Michener on the exact dates he performed  
20 those analyses. Let me clarify. I think I remember  
21 as part of -- HI-STORM had asked to rely internal  
22 convection within its MPC, and I believe these  
23 analyses were performed to confirm those -- that  
24 request.

25 MS. CHANCELLOR: An amendment to their

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1 COC?

2 MR. WATERS: I do not know if it was an  
3 amendment or a general topical review for generic  
4 approval.

5 MS. CHANCELLOR: And then if you look at  
6 page 2 on the last paragraph of State's Exhibit 214,  
7 it talks about future analyses.

8 MR. WATERS: Yes.

9 MS. CHANCELLOR: And it states that, "The  
10 work is expected to be completed in May of 2002. And  
11 this is for a detailed model of heat transfer from the  
12 fuel canister wall on outwards using STAR-CD  
13 Commercial CFD Software." Do you see that?

14 MR. WATERS: Yes.

15 MS. CHANCELLOR: It states that, "The work  
16 is expected to be completed in May of 2002"?

17 MR. WATERS: Yes.

18 MS. CHANCELLOR: Has that been done?

19 MR. WATERS: Yes, it has been, and the  
20 temperatures are much lower.

21 MS. CHANCELLOR: And did you rely on that  
22 future analysis done in May --

23 MR. WATERS: No, I did not.

24 MS. CHANCELLOR: -- for your testimony?

25 MR. WATERS: No, I did not.

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1 MS. CHANCELLOR: Your Honor, we would  
2 request copies of whatever this work that was done in  
3 May of 2002. We haven't seen that.

4 CHAIRMAN FARRAR: Has that been completed,  
5 to your knowledge?

6 MR. WATERS: I have a report that is  
7 similar to this report, but a little bit more in  
8 detail and in length. It's dated June 8<sup>th</sup> or 11<sup>th</sup>, I  
9 believe.

10 CHAIRMAN FARRAR: I'm not sure I  
11 understood that answer. Is that the report that's  
12 envisioned -- is the report you just mentioned dated  
13 June 8<sup>th</sup> or 11<sup>th</sup>, the report envisioned in the last  
14 paragraph of this exhibit?

15 MR. WATERS: Yes. I have here a report  
16 from Tom Michener in PNNL entitled, "Tip-over Thermal  
17 Analysis for Holtec HI-STORM Ventilated Concrete Spent  
18 Fuel Storage Casks", in which he performed an analysis  
19 of a cask tip-over with the vents open, and include  
20 temperature profiles in three dimensions. I do not  
21 know if that fulfills a contract responsibility. They  
22 may be performing additional analyses, or they may  
23 not. I do not know that.

24 CHAIRMAN FARRAR: Ms. Chancellor, what is  
25 it you want?

1 MS. CHANCELLOR: We'd request a copy of  
2 the report that Mr. Waters referred to, that is dated  
3 somewhere around June 8<sup>th</sup> or 11<sup>th</sup>.

4 MR. WATERS: It's dated June 11<sup>th</sup>, 2002.

5 MS. CHANCELLOR: June 11<sup>th</sup>.

6 CHAIRMAN FARRAR: Mr. Turk.

7 MR. TURK: Relevance, Your Honor. The  
8 witness has indicated he did not rely on it in doing  
9 his testimony. He also indicated that it's a vents-  
10 open configuration. His testimony addresses the worst  
11 case of vents-blocked, so I don't see the relevance to  
12 anything in his testimony, or to the contention before  
13 us, because what the State is arguing is that the  
14 casks will tip-over. The worst case is vents are  
15 blocked, and we could have serious consequences.  
16 That's what the testimony addresses. That's not what  
17 this further report addresses.

18 CHAIRMAN FARRAR: Well, if this further  
19 report addresses -- I don't know what the further  
20 report says.

21 MR. TURK: Neither do I.

22 CHAIRMAN FARRAR: But if the further  
23 report says with the vents open, there's a problem,  
24 that would seem to have some relevance to what we're  
25 talking about here.

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1 MR. WATERS: I can summarize. The  
2 temperatures are much lower because there's partial  
3 convection --

4 CHAIRMAN FARRAR: Wait.

5 MR. WATERS: I apologize.

6 JUDGE LAM: But isn't it true, Ms.  
7 Chancellor, this further report, if assuming what you  
8 have given us on State Exhibit 214 is reliable, State  
9 Exhibit 214 provides you with the worst case estimate.  
10 It is, assuming this is reliable, gives you the  
11 bounding estimate on the worst case in terms of  
12 temperature, because based on what it states here, it  
13 shut down all the flows, even within -- I mean  
14 axially, and then through the annulus, so there's no  
15 flow inside the storage cask.

16 MS. CHANCELLOR: That's true, Your Honor,  
17 that the program -- the COBRA program found that there  
18 was no air flow whatsoever when the cask was tipped  
19 over. I just don't want to be surprised on rebuttal,  
20 and find another new report coming in.

21 CHAIRMAN FARRAR: I mean, Mr. Turk's  
22 objection, you're not suggesting at this point, or  
23 you're not attempting to introduce this report into  
24 evidence. You just want it. Is that right?

25 MS. CHANCELLOR: That's right.

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1 CHAIRMAN FARRAR: Mr. Turk.

2 MR. TURK: I have nothing to add, Your  
3 Honor.

4 CHAIRMAN FARRAR: Well, I'm quite -- I  
5 would like to know what you think about your relevance  
6 objection, if all she wants is the report. Is your  
7 relevance objection better saved until she attempts,  
8 if she does, to introduce the report?

9 MR. TURK: Your Honor, we can produce the  
10 report to make things simple. As I indicated, it's  
11 not something that I feel we had an obligation to turn  
12 over. On the other hand, it's easy enough to give it  
13 to her.

14 CHAIRMAN FARRAR: Then let's do that. Do  
15 you need that right now, Ms. Chancellor, or --

16 MS. CHANCELLOR: If we could copy Mr.  
17 Waters' copy after we finish -- after we take a break,  
18 that would be just fine with me, if that's acceptable.

19 MR. TURK: May I ask if the witness has a  
20 clean copy of that document with him?

21 MR. WATERS: I do not. I have one  
22 available, I believe, on my computer back at my  
23 office. I could attempt to print one out perhaps  
24 during lunch.

25 MS. CHANCELLOR: That would be fine, Your

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1 Honor.

2 CHAIRMAN FARRAR: Okay.

3 MS. CHANCELLOR: And, Mr. Waters, just to  
4 confirm Judge Lam's observation, on page 1 of the  
5 report, isn't it true that with the casks in a  
6 horizontal position, that it was not possible for  
7 COBRA to model the resultant complex flow field in the  
8 annulus?

9 MR. WATERS: Could you repeat the  
10 question, and point to the specific sentence you're  
11 referring to?

12 MS. CHANCELLOR: Let me back up. You are  
13 familiar with this document. Correct?

14 MR. WATERS: Yes, I am.

15 MS. CHANCELLOR: And what was -- in the  
16 summary of results, can you just summarize what the  
17 results were of this COBRA run with respect to the  
18 cask tipped over in a horizontal direction, and the  
19 air flow in the -- around the annulus, or through the  
20 annulus?

21 MR. WATERS: Basically, Tom Michener  
22 turned off, in his terms, the air flow in the annulus,  
23 which essentially replicates all vents are blocked.

24 MS. CHANCELLOR: Turned off, or it was not  
25 possible to model the air flow in the annulus?

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1 MR. TURK: The document speaks for itself.  
2 It indicates what was done and why.

3 MS. CHANCELLOR: The witness is relying on  
4 this document for his testimony. He should be  
5 familiar with it. He can testify as to his  
6 understanding of the document.

7 CHAIRMAN FARRAR: Mr. Turk, are you making  
8 an objection or --

9 MR. TURK: Yes. The document speaks for  
10 itself. It's the best evidence, Your Honor.

11 MS. CHANCELLOR: Mr. Waters is relying on  
12 this document for his testimony. He should be able to  
13 explain the document.

14 CHAIRMAN FARRAR: Objection overruled.

15 MR. TURK: May I note one other factor,  
16 Your Honor? Mr. Waters is a radiation dose reviewer  
17 for us in this proceeding. The thermal analysis was  
18 done by Pacific Northwest Laboratory. The document is  
19 prepared by Pacific Northwest Laboratory. I have no  
20 problem if you want to ask Mr. Waters for his  
21 understanding of what Mr. Michener did, but I think  
22 the best evidence is Mr. Michener's own explanation,  
23 as set forth in the document.

24 CHAIRMAN FARRAR: I tend not to agree with  
25 -- that may be the best -- you know, that may be a

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1 start, but this is a witness who has the document and  
2 has looked at it in the course of his business, so  
3 we'll permit the questioning.

4 MR. TURK: Do you need the question  
5 repeated?

6 MR. WATERS: Yes, please.

7 MS. CHANCELLOR: That's okay. I'll just  
8 repeat it. You testified that Tom Michener turned off  
9 the air flow to the annulus.

10 MR. WATERS: Yes.

11 MS. CHANCELLOR: In this report, it states  
12 that it was not possible to model the resultant  
13 complex flow field.

14 MR. WATERS: I do not believe so in the  
15 horizontal configuration. If you look at Figure 1 in  
16 the normal upright position, that was modeled with air  
17 flow going -- entering -- it's in the vertical  
18 configuration, entering the bottom vents and flowing  
19 up the annulus, and exiting the outer vents. That was  
20 in my understanding, was especially modeled by Tom  
21 Michener. Without convection, all you have left is  
22 conduction and radial heat transfer. I believe what  
23 Tom Michener did was basically turn off that flow,  
24 that convective flow, assuming all four vents were  
25 blocked.

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1 MS. CHANCELLOR: Well, let's look at this  
2 sentence, and maybe it's because it was written in the  
3 passive voice, it's hard to understand who's doing  
4 what.

5 MR. WATERS: Which sentence again, please?

6 MS. CHANCELLOR: The one, two, three, four  
7 lines from the bottom of page 1. "As a first try at  
8 approximating the thermal impact of the tip-over  
9 incident, the internal flow within the fuel region was  
10 shut-off in COBRA-SFS model, as was the flow through  
11 the annulus." What is your understanding of that  
12 sentence?

13 MR. WATERS: And you might also ask him to  
14 look at the entire paragraph.

15 MS. CHANCELLOR: Mr. Turk.

16 CHAIRMAN FARRAR: Mr. Turk, let her  
17 continue with her cross. If he needs some help, he'll  
18 ask for it.

19 MR. WATERS: Frankly, I haven't found the  
20 sentence yet. Which headers is it under?

21 MS. CHANCELLOR: Summary of Results.

22 MR. WATERS: Okay.

23 MS. CHANCELLOR: Page 1, three lines from  
24 the bottom of page 1.

25 MR. WATERS: Okay.

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1 MS. CHANCELLOR: Four lines from the  
2 bottom of page 1.

3 MR. WATERS: Okay. Yes.

4 MS. CHANCELLOR: What is your  
5 understanding of that sentence? Who's doing the  
6 shutting off? Is it the computer program that --

7 MR. WATERS: The computer code does not  
8 have -- the computer code does not assume any  
9 convective air flow events. It basically assumes all  
10 vents are closed. It says, "As a first try at  
11 approximating thermal impact", that basically means  
12 they're not taking credit for reduced convection which  
13 would be present if the vents were open. At a first  
14 try approximating, to obtain the worst case results,  
15 all four vents were assumed to be blocked.

16 MS. CHANCELLOR: So your testimony that  
17 Tom Michener shut off all the air vents is not quite  
18 accurate. Is that right?

19 MR. TURK: Objection. The witness --

20 MS. CHANCELLOR: I'm trying to understand.

21 MR. TURK: It mischaracterizes the  
22 testimony, Your Honor.

23 CHAIRMAN FARRAR: Then he can say so.

24 MR. TURK: Well, Your Honor, a lawyer has  
25 a certain function in a hearing. I'm performing mine.

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1 CHAIRMAN FARRAR: I understand, and I'm  
2 performing mine. Objection overruled.

3 MR. WATERS: Well, let me clarify shut-off  
4 as I understood it from Tom Michener. It was first  
5 modeled in the normal upright condition in which you  
6 have air flow entering the bottom vents, going up  
7 around the annulus and exiting. That air flow  
8 provides convective heat transfer, which removes the  
9 heat from the system. My understanding is he took  
10 that model and --

11 MS. CHANCELLOR: For the upright case.

12 MR. WATERS: For the upright case.

13 MS. CHANCELLOR: Okay.

14 MR. WATERS: My understanding is he took  
15 that model and stopped the convection flow.

16 MS. CHANCELLOR: That's where I'm getting  
17 hung up. He stopped the convection flow, yet in this  
18 sentence that we've been looking at, "At the first try  
19 at approximating the thermal impact of the tip-over  
20 event, the internal flow within the region was shut  
21 off." And I'm a little confused whether the program  
22 shut it off, or whether it was something that this Tom  
23 Michener did that interrupted the program, and that he  
24 physically caused the program to shut it off. That it  
25 couldn't be modeled?

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1 MR. WATERS: No. It's been a long time  
2 since I ran COBRA, but I believe he had inputs for  
3 convective properties, radial heat transfer  
4 properties, and conduction properties. And basically,  
5 he did not program any convective properties in the  
6 annulus region. All you have left is radiative heat  
7 transfer and conduction heat transfer.

8 CHAIRMAN FARRAR: Mr. Waters, let me help  
9 you answer Ms. Chancellor's question. Part of her  
10 question dealt with whether this is in the modeling  
11 world or the physical world. Physically, he did  
12 nothing. Is that right? I mean, this is not a  
13 physical experiment where you block the flow. This is  
14 all computer --

15 MR. WATERS: This is all computer  
16 simulation of COBRA. Yes.

17 CHAIRMAN FARRAR: Right. Okay. Ms.  
18 Chancellor, does that help? You had asked if any of  
19 this is in the physical world, and the answer is no.  
20 This is all computer modeling.

21 MR. WATERS: Yes.

22 CHAIRMAN FARRAR: And as I understand it,  
23 Mr. Michener took the vertical model and eliminated  
24 the inputs about the convection flow in order to  
25 simulate, as best he could in that model, what would

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1 happen with the cask horizontal.

2 MR. WATERS: Yes. And all that's left is  
3 conduction and radiative heat transfer, and that  
4 really is not impacted whether it's horizontal or  
5 vertical. Only convective heat transfer is impacted.

6 CHAIRMAN FARRAR: So in his mind, what he  
7 was trying to do was simulate a cask that was  
8 horizontal with its vents blocked.

9 MR. WATERS: Yes. In his mind -- well, I  
10 can't speak for his mind, but in my mind, it's not  
11 looking at whether it's vertical or horizontal,  
12 because conduction and radiative is not really  
13 affected by that.

14 JUDGE LAM: Now, Ms. Chancellor, I don't  
15 want to testify on behalf of Mr. Waters. If you share  
16 with me where you are going, maybe I have  
17 clarification comments for you, if that would make it  
18 easier.

19 MS. CHANCELLOR: I can't understand  
20 whether what happened with this computer modeling, was  
21 whether the computer became unstable and didn't reach  
22 convergence, and Mr. Michener had to shut it down. Or  
23 whether he somehow interceded with the computer  
24 program and somehow directed it not to model any air  
25 flow in the annulus. It's just a little confusing as

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1 to --

2 CHAIRMAN FARRAR: Can you answer that?

3 MR. WATERS: Yes, I can.

4 CHAIRMAN FARRAR: Go ahead.

5 MR. WATERS: The computer worked -- the  
6 code worked correctly. There was no problems  
7 predicting temperatures. In summary, I think this  
8 sentence basically refers to an assumption he made  
9 regarding convective heat transfer in the annulus.

10 CHAIRMAN FARRAR: so he tinkered with  
11 the --

12 MR. WATERS: Right.

13 CHAIRMAN FARRAR: -- program, and  
14 everything came out and he got his answer.

15 MR. WATERS: Yes.

16 MS. CHANCELLOR: On page 13 of your  
17 testimony, Mr. Waters, you state, "By comparison, my  
18 own evaluation", and you use the off-site dose of the  
19 Owner Controlled -- you state that, "The off-site dose  
20 needs to increase to approximately 6.94 millirem per  
21 hour." Why do you use, "By comparison, in my own  
22 investigation"? What are you comparing there?

23 MR. WATERS: I am comparing that  
24 previously I reported that hypothetically that off-  
25 site dose would increase by a factor of 2.4. By

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1 comparison, I determined that the off-site dose would  
2 have to increase by a factor of 2400 to reach 5 rem.  
3 In conclusion, 2.4 is much, much less than 2400,  
4 therefore, 5 rem would never be reached or exceeded.

5 MS. CHANCELLOR: Is the way you arrived at  
6 the 6.94 millirem per hour, is that you just did an  
7 algebraic equation and X millirems per hour times 30  
8 days, times 24 hours equals 5 rem. You solved for X  
9 and got 6.94 millirem per hour? Is that how you came  
10 up with 6.94?

11 MR. WATERS: Yes. The equation in that  
12 paragraph is pretty self-explanatory, 6.94 times 30  
13 times 24 equals 5 rem.

14 MS. CHANCELLOR: But the values you had  
15 were the 30 days and 24 hours and 5 rem. Is that  
16 right?

17 MR. WATERS: Yes. You can move those  
18 terms over there and take 5 and divide it by 30 and 24  
19 and get 6.94. That's correct.

20 MR. TURK: There may be some confusion.  
21 He starts with the 5 rem and works backwards. That's  
22 what that equation shows.

23 MS. CHANCELLOR: That's fine, Mr. Turk.  
24 I have the answer I need.

25 MR. TURK: Could I ask Mr. Waters to

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1 confirm what I just stated, Your Honor, so that the  
2 record is clear?

3 CHAIRMAN FARRAR: Yes.

4 MR. WATERS: .Yes.

5 MS. CHANCELLOR: Mr. Waters, there are no  
6 known NRC site-specific calculations for radiation  
7 doses from the bottom of the HI-STORM casks at the PFS  
8 site. Is that right?

9 MR. WATERS: NRC calculations?

10 MS. CHANCELLOR: Yes.

11 MR. WATERS: No.

12 MR. TURK: I'm sorry. Could I have the  
13 question and answer read back, please? I think there  
14 was a disconnect.

15 (Last question and answer played back.)

16 MR. TURK: Thank you, Your Honor.

17 MR. WATERS: I'd like to clarify my  
18 response, please.

19 CHAIRMAN FARRAR: Oh, wait a minute. Let  
20 me see counsel at the bench, please.

21 (Whereupon, the proceedings went off the  
22 record at 10:17 a.m. and resumed at 10:18 a.m.)

23 CHAIRMAN FARRAR: We are back on the  
24 record.

25 BY MS. CHANCELLOR:

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1 Q Mr. Waters, you wanted to clarify  
2 something on your last answer about no-known NRC site  
3 specific calculations for radiation doses from the  
4 bottom of the HI-STORM cask?

5 A Yes, in my testimony I did calculate the  
6 increases in off-site doses at the bottoms of all  
7 4,000 casks facing the northern direction. And in the  
8 analysis I assumed the conservative dose values  
9 emanating from the bottom of the HI-STORM, based on  
10 doses calculated from the bottom of the HI-TRAC casks,  
11 which has less shielding.

12 Q So you extrapolated from the HI-TRAC to  
13 obtain the doses?

14 A I used the HI-TRAC values.

15 Q I see. And just to clarify, PFS has no  
16 recovery plan to upright the casks if they tipover in  
17 the event of an earthquake, for example, that you know  
18 of?

19 A I am not aware of any recovery plans for  
20 beyond design basis events.

21 Q And you are not -- that is fine.

22 MS. CHANCELLOR: That is all I have, Your  
23 Honor.

24 CHAIRMAN FARRAR: Okay, thank you, Ms.  
25 Chancellor.

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1 MS. CHANCELLOR: One moment. I would like  
2 to move into evidence State's exhibit 214.

3 CHAIRMAN FARRAR: 214?

4 MS. CHANCELLOR: Yes, please, Your Honor.

5 CHAIRMAN FARRAR: Any objections?

6 MR. TURK: No objection, Your Honor.

7 MR. GAUKLER: No, Your Honor.

8 CHAIRMAN FARRAR: Then that will be  
9 admitted.

10 (The document referred to,  
11 having been previously marked  
12 for identification as State  
13 Exhibit No. 214 was received in  
14 evidence.)

15 MS. CHANCELLOR: That is it, Your Honor.

16 JUDGE LAM: I think it would be helpful  
17 for me to clarify, for the record, what Ms. Chancellor  
18 was asking you, Mr. Waters.

19 On State exhibit 214, page 1, the last  
20 paragraph. Ms. Chancellor was asking you about the  
21 impossibility to model, and you provide some answer.

22 Now, the way I understand the situation is  
23 this. I think the model, as shown here in State  
24 exhibit 214, is basically a two dimensional model,  
25 axial and radial.

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1                   When you lay a cask on its side it is no  
2 longer a two dimensional problem, it would now be a  
3 three dimensional problem, because radially -- then  
4 the answer depending on the orientation, how close you  
5 are to the ground, but at the top.

6                   Because of this changing of the model,  
7 therefore, within the two dimensional model it is  
8 impossible to model the flow?

9                   THE WITNESS: Yes, you said it very well.

10                  JUDGE LAM: Thank you.

11                  JUDGE KLINE: I just have a couple of  
12 questions related to the technical role of 72.104  
13 versus 72.106.

14                  It appears to me that 72.104 sets dose  
15 limits that are, in a sense, have their genesis in  
16 Part 20, is that correct?

17                  THE WITNESS: It is a little more  
18 complicated.

19                  JUDGE KLINE: In any sense, reconcile for  
20 me the dose we see in part 72 with respect to what we  
21 see in part 20.

22                  THE WITNESS: Part 20 is a generic dose of  
23 100 milli-REM.

24                  JUDGE KLINE: Yes, that is what I was --

25                  THE WITNESS: For all licensees. Our dose

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1 limit of 25 milli-REM is based on EPA guidelines. And  
2 I believe, by law, that EPA is responsible for  
3 establishing radiation standards, and EPA established  
4 25 milli-REM for fuel cycle facilities.

5 And this type of facility, therefore, the  
6 Commission promulgated 25 milli-REM in its regulation  
7 for storage installations.

8 JUDGE KLINE: Okay. And if we go to  
9 72.106, that appears to be a regulation designed to  
10 control the design of the facility, not more than a  
11 regulation of dose, per se. In other words, have its  
12 roots more traceable to Part 100?

13 Again, clarify for me how this works.

14 THE WITNESS: My clarity on that is not  
15 exact. I know that 5 REM is the EPA protected action  
16 guideline. I believe it comes from that end, and from  
17 the reactor, where we do have 5 REM.

18 JUDGE KLINE: But when you are dealing  
19 with an accident dose, this is not a dose that you can  
20 enforce, or inspect, it is a predicted dose, isn't it?

21 THE WITNESS: Yes.

22 JUDGE KLINE: Okay.

23 THE WITNESS: I think what you are saying  
24 is that the design basis is based on the 5 REM?

25 JUDGE KLINE: Yes, that is what I'm trying

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1 to get at, that as I read part 106, part A just  
2 establishes the requirement to set a controlled area.  
3 And then Part B goes on to say what this -- what the  
4 criteria this controlled area would meet.

5 Is that your understanding of it? I mean,  
6 in terms of dose, of course.

7 THE WITNESS: Yes, I believe you  
8 characterized it earlier as correct. It is my  
9 understanding, I'm not a scholar, my understanding is  
10 the 5 REM does set the design basis limit, and that is  
11 what it is designed for.

12 JUDGE KLINE: Let me ask you as a  
13 regulator, then. If you, in the course of your  
14 review, were to encounter a case where the 5 REM limit  
15 were exceeded, what requirement would the Applicant  
16 have to meet, or what would he have to do?

17 THE WITNESS: We would not approve it.

18 JUDGE KLINE: Yes, I understand that. But  
19 in order to gain approval would he have to, then,  
20 redesign the facility, or would he have to go back to  
21 his design, or his boundaries, or something?

22 THE WITNESS: Yes, he would have to change  
23 his design to meet the 5 REM limit.

24 JUDGE KLINE: Yes, that is what I'm trying  
25 to get at.

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1 THE WITNESS: More shielding, more  
2 distance.

3 JUDGE KLINE: Yes, okay, thank you. That  
4 is what I'm trying to get at.

5 CHAIRMAN FARRAR: When you say more  
6 distance that could mean something as simple as having  
7 a larger controlled area?

8 THE WITNESS: Yes.

9 CHAIRMAN FARRAR: If that were -- if the  
10 land were available?

11 THE WITNESS: Yes, he can move those to a  
12 controlled area boundary to 700 meters, 800 meters.

13 JUDGE KLINE: And if he couldn't do that,  
14 that would bring site suitability into the matter? I  
15 mean, if he didn't have room to expand it, or --

16 THE WITNESS: Well, the Applicant would be  
17 in a pickle, because he couldn't submit a license  
18 application.

19 JUDGE LAM: Now, Mr. Waters, if I may go  
20 back to the 30 days residence time during an accident?

21 THE WITNESS: Yes.

22 JUDGE LAM: I understand in your testimony  
23 you indicated this is a reasonable amount of time for  
24 the Applicant to do mitigation, remedial type of  
25 actions.

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1           Now the question is, in reality, if and  
2 when an accident were to occur, except for the people  
3 that had the absolute need to be there, you would be  
4 hard pressed to find people around the fence for 30  
5 days?

6           THE WITNESS: Yes, that is why I believe  
7 it is pretty conservative. Yes, I agree, the closest  
8 resident is two and a half miles away. And for that  
9 particular case, by the way, the dose rate increased  
10 by a factor of 1.7 million to reach 5 REM.

11           That shows the benefit of the distance,  
12 and there are no residents, there is no institutions,  
13 no businesses that were identified at the site  
14 boundary, so there is no reason why expectation  
15 someone would be there to begin with.

16           But even if someone was there for 30 days  
17 my testimony shows that still would not be a problem.

18           JUDGE LAM:       Would you expect any  
19 spectators at the fence?

20           THE WITNESS: I'm sure the news media  
21 would probably enjoy it, but besides that, no.

22           CHAIRMAN FARRAR: But the regulation is  
23 structured for hypothetical -- in other words, even if  
24 Judge Lam is right that there would, in fact, be no  
25 one there, the design regulation is structured on a

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1 hypothetical individual being there for 30 days at the  
2 boundary; is that right?

3 THE WITNESS: The regulation does not  
4 specify 30 days. The regulation is for in the event,  
5 in licensing we have to assume some exposure time to  
6 ensure that the regulation is met.

7 CHAIRMAN FARRAR: And so in applying the  
8 regulation which you are right, doesn't specify 30  
9 days, you say that is -- let's take the hypothetical  
10 individual the regulation talks about, let's put him  
11 or her there for 30 days, and do a calculation?

12 THE WITNESS: Yes.

13 CHAIRMAN FARRAR: The Board has no other  
14 questions. It is a good time for our mid-morning  
15 break.

16 Mr. Waters, how long will it take you to,  
17 are you in the other building, or in this building?

18 THE WITNESS: I'm in the other building.

19 MS. CHANCELLOR: I can wait until  
20 lunchtime, Your Honor.

21 CHAIRMAN FARRAR: Oh, okay.

22 MR. TURK: I think we can get it now, Your  
23 Honor, just in case there is any question we can close  
24 it up right now. Could we ask Mr. Waters to obtain  
25 that copy over the recess?

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1 THE WITNESS: I have a lot of emails to go  
2 through to find it, but --

3 CHAIRMAN FARRAR: Let's -- and then when  
4 we come back, Mr. Turk, do you have much in the way of  
5 redirect?

6 MR. TURK: Very little.

7 CHAIRMAN FARRAR: Mr. Gaukler?

8 MR. GAUKLER: I have about three  
9 questions, four questions.

10 CHAIRMAN FARRAR: All right, then let's  
11 take a 15 minute break. It is 10:30, be back at  
12 10:45, and we will try to get the document by then.

13 (Whereupon, the above-entitled matter  
14 went off the record at 10:29 a.m. and  
15 went back on the record at 10:48 a.m.)

16 CHAIRMAN FARRAR: We are back from the  
17 break awaiting the color copying of the Staff Report  
18 we were talking about. So to save time we will go a  
19 little out of order and have the Applicant start its  
20 recross.

21 MR. GAUKLER: I have very few questions.

22 RECROSS EXAMINATION

23 BY MR. GAUKLER:

24 Q Mr. Waters, I've handed to you a copy of  
25 Staff Exhibit 53, which are the excerpts of the Staff

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1 review plan for spent fuel dry storage facilities that  
2 was admitted into evidence yesterday. Do you have  
3 that in front of you?

4 A Staff Exhibit, 53?

5 Q Yes.

6 A Yes.

7 Q And I would like to have you turn to page  
8 9-15 of that exhibit, please.

9 A Okay.

10 Q And I believe you've testified, earlier  
11 yesterday, that at the top of that page the reference,  
12 first two sentences, is the practice of the Staff with  
13 respect to computing doses under 72.106B for accident  
14 conditions, isn't that correct?

15 A Yes.

16 Q And the first sentence says that for  
17 hypothetical accident conditions the duration of the  
18 release is assumed to be 30 days (720 hours), correct?

19 A Correct.

20 Q And then I want you to focus particularly  
21 on the second sentence. It says a boundary exposure  
22 duration assumes that individual is also present at  
23 the controlled area boundary for 30 days, correct?

24 A Correct.

25 Q So I take it that your assumption that the

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1 individual is at the boundary for 30 days is meant to  
2 be a bounding assumption, a bounding calculation of  
3 potential dose radiations with respect to 72.106B?

4 A Yes, I consider it to be very bounding, it  
5 assumes a person standing there, not moving for 24  
6 hours a day, 30 days unshielded. And it is not  
7 reasonable to believe that would be realistic if an  
8 accident happened.

9 Q And, therefore, if you could show that  
10 someone wasn't there all the time, it might be  
11 appropriate to use a lesser amount?

12 A Correct. If the Applicant could  
13 demonstrate, for some reason, what justification it  
14 would be less exposure time then we possibly would  
15 accept it.

16 Q And, also, you refer to, here, that using  
17 this boundary exposure of 30 days for 24 hours a day,  
18 you come up with 720 hours as the basis for the  
19 boundary exposure for the accident conditions,  
20 correct?

21 A Yes.

22 Q And therefore you would certainly agree  
23 with me that the 8,760 hours that Dr. Resnikoff uses  
24 in his calculations, is wholly inappropriate for  
25 accident conditions, correct?

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1 A Could you repeat the question, please?

2 Q You would agree with me, therefore, that  
3 the 8,760 hours that Dr. Resnikoff uses in his  
4 calculations for calculating dose consequences is  
5 totally inappropriate for accident conditions under  
6 72.106B, correct?

7 A Yes, inappropriate, yes.

8 MR. GAUKLER: I have no further questions,  
9 Your Honor.

10 CHAIRMAN FARRAR: Thank you, Mr. Gaukler.

11 MR. TURK: Your Honor, I think we can go  
12 ahead and start with mine while we are waiting for the  
13 document.

14 CHAIRMAN FARRAR: Yes, if you can do  
15 something that does not rely on the document.

16 MS. CHANCELLOR: Your Honor, if Mr. Turk  
17 is going to get into the document that he -- is this  
18 the document that I requested from Mr. Waters?

19 CHAIRMAN FARRAR: Right, but he -- I would  
20 think we won't get into that.

21 MS. CHANCELLOR: Right. But if Mr. Turk  
22 is going to use that for cross examination it is going  
23 to delay things, because we haven't reviewed the  
24 document. If he is going to introduce that as  
25 testimony, then it is going to -- we will need to take

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1 a break, we will need to review it.

2 CHAIRMAN FARRAR: Well, maybe I was wrong,  
3 but I assumed he was going to ask another series,  
4 questions on some other subject, and then when the  
5 document comes back we would all take a break and look  
6 at it, and then we would decide what course of action  
7 to follow along the lines of what you are just  
8 suggesting.

9 MS. CHANCELLOR: That is correct, Your  
10 Honor. But I just want to forewarn that if this is a  
11 document that we haven't seen before, and if Mr. Turk  
12 is going to use it in this Proceeding, even though Mr.  
13 Waters is not relying on it, we are going to need time  
14 to review it.

15 CHAIRMAN FARRAR: What you are saying is  
16 you wanted to see it as part of your cross  
17 examination, but the fact that you wanted to see it,  
18 and now we are having it reproduced, doesn't mean you  
19 concede that the Staff can rely on it?

20 MS. CHANCELLOR: That is correct, Your  
21 Honor. It is more like a discovery request, where we  
22 need to know the universe of documents out there, look  
23 at them, see if they have any effect on our position,  
24 or the Staff's position, or PFS' position.

25 CHAIRMAN FARRAR: Well, let's do this,

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1 then, hold that concern for a moment, we will have the  
2 Staff start its redirect on subjects other than that.  
3 And then when the document shows up we will all see  
4 where we are.

5 Mr. Turk, is that all right?

6 MR. TURK: That is fine, Your Honor.

7 CHAIRMAN FARRAR: Okay.

8 MR. TURK: Should I go ahead and start,  
9 then?

10 CHAIRMAN FARRAR: Yes, go ahead.

11 REDIRECT EXAMINATION

12 BY MR. TURK:

13 Q Good morning, Mr. Waters.

14 A Good morning.

15 Q In your testimony you indicated that you  
16 considered the dose to the nearest residents. You  
17 also indicated that casks would produce a larger dose  
18 if they tip over in the northerly direction, than they  
19 would in the east or west direction, is that correct?

20 A Yes, that was my assumption.

21 MR. TURK: I would like to ask for a  
22 document to be distributed, and have this marked for  
23 identification as Staff Exhibit Number 59.

24 (Whereupon, the above-  
25 referenced to document was

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1 marked as Staff Exhibit No. 59

2 for identification.)

3 MR. TURK: And let me indicate that I'm  
4 distributing two pages from the Staff's Final  
5 Environmental Impact Statement, pages 1-3, and 2-2.  
6 The FEIS is in evidence, already, these are two pages  
7 from that document. And we are marking this as Staff  
8 Exhibit 59.

9 BY MR. TURK:

10 Q Mr. Waters, have you seen these two pages  
11 before?

12 A Yes, I have.

13 Q And they are, in fact, the pages that I  
14 mentioned from the FEIS?

15 A Yes.

16 Q The first page shows the location of the  
17 PFS facility in Skull Valley, Utah?

18 A Yes.

19 Q And on the second page there is a sketch  
20 of the reservation of the Skull Valley Band of Goshute  
21 Indians, as well as a location of the site. Do you  
22 see, on that figure, a description of where the  
23 closest residence is to the facility?

24 A Yes, it is southeast of the facility.

25 Q And in that respect, then, would the dose

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1 to the nearest residence be lower than the dose that  
2 you calculated, if all the casks were facing in a  
3 northerly direction? If all the casks had tipped over  
4 and were pointing with their bottoms facing a  
5 northerly direction, would the dose in the northerly  
6 direction, then, be the same as if the casks had  
7 tipped over and pointed at the nearest residence?

8 A Let me clarify. When we calculated at the  
9 dose to the resident, I think they assumed the  
10 resident was two miles north of the facility, which  
11 was a conservative assumption.

12 If the resident was two miles north,  
13 versus two miles southeast the resident would, in  
14 theory, have a higher dose two miles north.

15 So, yes, the dose would be less on the  
16 southeast, in the southeast.

17 MR. TURK: Your Honor, I would ask that  
18 this exhibit be admitted into evidence.

19 MR. GAUKLER: No objection, Your Honor.

20 MS. CHANCELLOR: No objection, Your Honor.

21 CHAIRMAN FARRAR: All right, then Staff 59  
22 will be admitted.

23 (The document referred to,  
24 having been previously marked  
25 for identification as Staff

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1 Exhibit No. 59 was received in  
2 evidence.)

3 CHAIRMAN FARRAR: Mr. Turk, I'm a little  
4 confused on the premise of your first question. I  
5 thought, Mr. Waters, you said at the beginning of your  
6 testimony today, that the dose to the west would be  
7 greater because you had 80 casks if they tipped that  
8 way, and you only had 50 if they tipped to the north.

9 And Mr. Turk's question had the premise  
10 that the north was worse than the west. Am I  
11 confused, or -- and it is okay to say yes to that  
12 question.

13 THE WITNESS: Yes. Bottom line the dose  
14 to the north is more, although there are less casks,  
15 there is greater spacing in between the casks in the  
16 second, third, and fourth rows, which allows more,  
17 basically, peaking of the dose from an inner cask.

18 And it turns out, although there is 50, it  
19 is higher.

20 CHAIRMAN FARRAR: Okay, thank you. Go  
21 ahead, Mr. Turk.

22 MR. TURK: Thank you.

23 BY MR. TURK:

24 Q And when you say the dose is peaking out,  
25 you are spelling that P-E-A-K? In other words the dos

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1 is able to get out in the northerly direction better  
2 than in the east or west direction, from the casks  
3 which are in the inside of the --

4 A Yes, I'm talking about the casks, the  
5 second, third, and fourth tasks. There will be a  
6 shading factor, a peaking factor which will partially  
7 basically travel in between in the 35 foot pathway  
8 that runs north to south.

9 Q You indicated, in cross examination, that  
10 you did not perform an evaluation of the cask drop of  
11 the MPC?

12 A Yes.

13 Q Did someone else in the Staff perform that  
14 evaluation?

15 A I believe we evaluated 11 inch drop as  
16 limiting condition, and the SAR evaluated that  
17 structural impact.

18 Q That was a structural review, rather than  
19 a radiation dose protection review?

20 A Yes, yes.

21 Q Are you aware of any Staff guidance with  
22 respect to the definition of a real individual?

23 A Yes, we have interim Staff guidance, some  
24 at 13 Titled Real Individual, and it clarifies  
25 guidance for NUREG 1567, which is the SRP, and NUREG

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1 1536, which is the SRP for dry cask storage, cask  
2 certifications.

3 Q Do you have a copy of the Interim Staff  
4 Guidance Number 13 with you?

5 A No, I do not.

6 MR. TURK: I'm going to ask to borrow  
7 someone else's copy.

8 Your Honor, may I approach the witness?

9 CHAIRMAN FARRAR: Yes, certainly.

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

12 CHAIRMAN FARRAR: Yes.

13 (Whereupon, the above-entitled matter  
14 went off the record at 11:01 a.m. and  
15 went back on the record at 11:04 a.m.)

16 CHAIRMAN FARRAR: Back on the record.

17 BY MR. TURK:

18 Q With respect to questions asked by Ms.  
19 Chancellor concerning the additional evaluation  
20 performed by Pacific Northwest Laboratories, is it  
21 correct that Mr. Michener used a different code in  
22 order to model the 3D effects of the casks lying on  
23 its side?

24 A Yes, he used a 3D on thermal code called  
25 STAR CD.

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1 Q And in that evaluation he showed that the  
2 temperatures within the concrete were less than  
3 predicted by the original calculation that is  
4 discussed in your testimony?

5 MS. CHANCELLOR: Objection, Your Honor, we  
6 haven't seen the document. Mr. Turk is asking Mr.  
7 Waters about the future analysis, which is on the  
8 second page of State's Exhibit 214. This is the  
9 document that is being reproduced that we have not  
10 seen.

11 And until we get that document I think it  
12 is unfair to pursue this line of questioning, and also  
13 before we've had time to review it, too.

14 CHAIRMAN FARRAR: Mr. Turk, it sounds like  
15 a legitimate request to me.

16 MR. TURK: It has a good ring to it. I  
17 would simply note perhaps we will never get back to  
18 this point. If the State doesn't wish to pursue it,  
19 then we won't, either.

20 The reason I raise it is because there was  
21 a suggestion made by Ms. Chancellor's questioning that  
22 Mr. Michener was unable to model the cask properly, as  
23 based on her interpretation of the other document,  
24 State Exhibit 214.

25 CHAIRMAN FARRAR: I thought the witness

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1 answered in response, at least to, I think it was my  
2 question, that he -- that the computer program ran  
3 fine, he put in these new inputs, and he came up with  
4 a result.

5 Now, that result may be good, bad, or  
6 indifferent, but that it worked and --

7 MR. TURK: That is correct, and that is  
8 with a bounding assumption that there was no  
9 convection going on.

10 CHAIRMAN FARRAR: Right. So I don't know  
11 that we need to pursue that any further.

12 MR. TURK: Okay. With that, Your Honor,  
13 I will withdraw the question, and we will distribute  
14 copies of the document when we get it back from  
15 photocopying.

16 And I have no other questions of the  
17 witness at this time.

18 CHAIRMAN FARRAR: Ms. Chancellor, would  
19 you like to do some recross?

20 MS. CHANCELLOR: Yes, please, Your Honor.

21 CHAIRMAN FARRAR: And feel free to explore  
22 that area we just talked about. I mean, I think on  
23 the first go-round we got straightened out, at least  
24 what was --

25 MS. CHANCELLOR: I think Dr. Lam

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1 straightened us out, Your Honor.

2 CHAIRMAN FARRAR: Well, he some times does  
3 that behind the scenes, also.

4 RECROSS EXAMINATION

5 BY MS. CHANCELLOR:

6 Q Mr. Waters, you had a conversation with  
7 Judge Kline with respect to 72.104 and 72.106. And I  
8 guess the question I have is with respect to 106. It  
9 refers to accident conditions, correct?

10 It refers to an event, that is what you  
11 testified to, right?

12 A I believe it says design basis accidents.

13 Q But in your testimony you testified that  
14 the 30 days was your conservative estimate, or  
15 assumption, with respect to the accident condition, if  
16 you will?

17 A Beyond design basis.

18 Q Yes, beyond design basis. When do you  
19 consider that the accident, with respect to beyond  
20 design basis, when is that over?

21 A When is that over?

22 Q When is it over?

23 A After the spent fuel has been recovered  
24 into a safe condition.

25 Q If the casks have undergone some damage,

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1 and there is thinning of the concrete, flattening of  
2 the concrete, and thinning of the steel shell, and yet  
3 the casks are uprighted, but they are not brand new  
4 like they used to be, is the accident over, or do you  
5 still keep on measuring dose rates at the area  
6 controlled boundary?

7 A Well, I would be speculating what happens  
8 after design basis accident. But if an accident  
9 happened beyond design basis, and there was some type  
10 of damage, it would no longer meet the requirements in  
11 SAR, if for instance there was flattening or thinning,  
12 it would probably be outside of the design basis of  
13 the design drawings.

14 Therefore, by definition, it is not in a  
15 normal condition.

16 Q Okay, thank you.

17 CHAIRMAN FARRAR: And then what happens?  
18 You all sit down with the Applicant and --

19 THE WITNESS: Yes, I'm sure the NRC would  
20 be involved. You know, there's three things. There  
21 is mitigation, there is an immediate dose problem  
22 mitigation, there is safe recovery, get into a  
23 condition where it is safe.

24 That doesn't mean, necessarily in my mind  
25 uprighting casks, just get into a safe condition.

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1 And, third, return to compliance. You know, that is  
2 open time frame.

3 BY MS. CHANCELLOR:

4 Q Now, Mr. Waters, you testified that you  
5 reviewed the Holtec certificate of compliance  
6 application for the HI-STORM. Isn't it true that in  
7 that application Holtec used 8,760 hours for the  
8 radiation dose analysis for beyond design basis case?

9 A Yes.

10 Q And in the PFS --

11 MR. TURK: Could I ask for the question to  
12 be restated, reread, read by the reporter?

13 CHAIRMAN FARRAR: Did you miss it, or --

14 MR. TURK: I thought there was a  
15 disconnect.

16 CHAIRMAN FARRAR: A disconnect between the  
17 question and answer?

18 MR. TURK: Yes.

19 CHAIRMAN FARRAR: Okay.

20 MS. CHANCELLOR: I didn't hear it, Your  
21 Honor.

22 (Whereupon, the requested portion of the  
23 recording was played back.)

24 MR. TURK: It seemed to me that the  
25 witness answered the question with respect to the

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1 beyond design basis case.

2 MS. CHANCELLOR: Your Honor, the witness  
3 answered the question I asked him.

4 MR. TURK: Your Honor, I don't know where  
5 we go with an unclear record, but I will do it on  
6 redirect.

7 CHAIRMAN FARRAR: Make a note and do it on  
8 redirect.

9 BY MS. CHANCELLOR:

10 Q Mr. Waters, Mr. Gaukler asked you about  
11 REG Guide 1567. Isn't it true that REG Guide 1567  
12 refers specifically to loss of confinement systems,  
13 and not to release of radiation?

14 A 1567 refers to, chapter 9 refers to loss  
15 of confinement, which is a release of radioactive  
16 materials, yes.

17 Q Does this refer to release of neutrons and  
18 gamma?

19 A Direct radiation?

20 Q Yes.

21 A No.

22 Q Thank you. With respect to NRC exhibit  
23 59, the diagram from the Staff's Final Environmental  
24 Impact Statement, you testified that you haven't  
25 visited the site, correct?

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1 A That is correct.

2 Q Do you know the location of ranch houses  
3 in the vicinity of the Skull Valley, the PFS' ISFSI?

4 A No, I do not.

5 Q So you are not aware of the nearest  
6 resident to the north of the proposed ISFSI?

7 A My understanding, from the PFS SAR, the  
8 nearest resident is two to two and a half miles  
9 southeast.

10 Q That was not my question. Are you aware  
11 of the nearest resident to the north of the ISFSI?

12 A No, I'm only aware it is greater than two  
13 and a half miles.

14 Q And is the basis of that assumption that  
15 the EIS states that the nearest residence is on the  
16 reservation, which is south of the, south or southeast  
17 of the ISFSI, is that the basis for your --

18 A It is based on, I believe, section 2.1.3  
19 of the PFS SAR population trends. It identifies 36  
20 people within a five mile radius, the nearest resident  
21 being, I believe, two to two and a half miles away.

22 Q And you don't know the land use planning  
23 in this area, in the Skull Valley, for the next 20  
24 years, is that correct?

25 A No, I do not.

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1 Q And you are not aware of any population or  
2 land use trends in Tooele County? Do you know what --  
3 let me back up.

4 Do you know where Tooele County is?

5 A Where?

6 Q Yes.

7 A It is in Utah.

8 Q And how does that relate, does that relate  
9 at all to the Skull Valley site?

10 A The reservation is within Tooele County.

11 Q Okay. Are you aware of any population or  
12 land use trends in Tooele County?

13 A No, my only awareness is what was stated  
14 in the SAR within, I believe, 2.1.3, which states  
15 there is no businesses or institutions, or facilities  
16 near the site boundary, and there will be none  
17 expected during the licensing term.

18 Q Are you aware on section -- what was the  
19 section in the SAR?

20 A I believe it is 2.1.3.

21 Q Are you aware when that was drafted?

22 A I read the most current revision. I don't  
23 know when that actual text was drafted, no.

24 Q So you don't know if it takes into account  
25 population trends in Tooele County?

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1 A I don't know.

2 Q Mr. Turk asked you, started to ask you  
3 questions about ISG 13, and the definition of real  
4 individual. Do you know if ISG 13 refers only to  
5 72.104, as opposed to 72.106?

6 A It is 72.104.

7 MS. CHANCELLOR: Just one second, Your  
8 Honor, I'm almost done.

9 (Pause.)

10 BY MS. CHANCELLOR:

11 Q I believe in response to questioning with  
12 Judge Kline that the 5 REMs that is the beyond design  
13 basis event, isn't it true that in this part of the  
14 Contention the issue is not -- one of the issues is  
15 what should be the design basis earthquake for the PFS  
16 facility?

17 A First let me clarify. I did not say it is  
18 beyond design basis. I said it is at the design  
19 basis.

20 Q That is correct, thank you, thank you for  
21 that clarification. Design basis event, right. So  
22 isn't one of the issues, in this part of the  
23 Proceeding, what the design basis event, with respect  
24 to earthquakes, should be for the PFS site?

25 A I believe that is the purpose of this

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1 hearing, yes.

2 Q Thank you.

3 MS. CHANCELLOR: I have no further  
4 questions.

5 CHAIRMAN FARRAR: Mr. Turk, did you want  
6 to --

7 MR. TURK: Yes, I have some further  
8 questions, Your Honor.

9 FURTHER REDIRECT EXAMINATION

10 BY MR. TURK:

11 Q Mr. Waters, Ms. Chancellor asked you if  
12 there was flattening of the concrete and the steel  
13 shell in an accident, when would the accident  
14 terminate? And that is a paraphrase of her question.

15 And as I heard your answer you stated you  
16 wouldn't want to speculate about beyond design basis  
17 event. However, if there was damage, then the cask  
18 would no longer fit within the description of the SAR,  
19 and therefore it would not be in a normal condition.

20 In the event that there was to be some  
21 flattening of the steel shell, or some change in the  
22 concrete within the cask, would that necessarily mean  
23 that the Applicant, or that the cask could no longer  
24 be used at the PFS site?

25 A No, it does not mean that. They would

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1 have to modify their design in the SAR, and analyze  
2 the effects of that for normal storage.

3 Q Alternatively could they do an analysis to  
4 determine whether that change in the cask has any  
5 impact with respect to public health and safety?

6 A Yes, that would be part of the evaluation  
7 within the -- a revised SAR if they wanted to continue  
8 to use that cask.

9 Q And they also might, perhaps, be able to  
10 use a regulatory provision that allows them to  
11 evaluate whether an unreviewed safety question is  
12 presented by that orientation, or flattening change?

13 A Yes, the regulations now the Applicant is  
14 allowed to modify their FSAR if there is no  
15 significant increase in safety, otherwise they would  
16 submit a license amendment.

17 Q Would they also be able to do an  
18 evaluation under 10CFR72.48, I believe?

19 A Yes, that is the -- that was the first  
20 case I spoke to.

21 Q So that, in effect, they might not have to  
22 alter their design if they could show that the  
23 condition does not present a condition beyond what is  
24 contemplated in 72.48?

25 A They would have to modify their SAR and

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1 perform a safety analysis, but they wouldn't  
2 necessarily have to have NRC approval. Well, they  
3 have NRC approval, through 72.48 to make that type of  
4 change if there is no increase in safety, no  
5 significant increase -- no significant decrease in  
6 safety.

7 Q Ms. Chancellor also asked you about the  
8 Holtec CoC, and she asked you whether Holtec performed  
9 a beyond design basis evaluation using 8,760 hours.

10 Now, you indicated that you agreed that  
11 Holtec had done that. When you made that statement  
12 were you referring to the hypothetical cask tipover  
13 event analysis?

14 A No, I was not.

15 Q What were you referring to?

16 A I was referring to a hypothetical  
17 radioactive release assuming non-maginic selic,  
18 hypothetically that the confinement barrier was  
19 damaged.

20 Q And the CoC is for generic application at  
21 any reactor site anywhere in the country?

22 A Yes, all part 50 licensees have a general  
23 license to use a storage cask certified by the NRC.  
24 The HI-STORM 100 has been certified by the NRC.

25 Q And the use of the cask at any reactor

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1 facility in the country would mean that the population  
2 levels and distributions would vary from site to site?

3 A Yes, that is an unknown.

4 Q And is that a reason why the use of 8,760  
5 hours was included in that analysis?

6 A Yes, we used 8,760 because it was the  
7 ultimate, it is the most conservative value, because  
8 it would have proven their basis, and when we approve  
9 a cask for certification we don't necessarily know  
10 what is present in nuclear power plants.

11 However, when a power plant uses the cask,  
12 under 72.212 they must perform a site specific  
13 evaluation to verify that the cask they want to use  
14 will meet 72.104.

15 And in that evaluation they may take  
16 credit for a factor such as exposure time, distance,  
17 and actual field contents.

18 Q In the PFS site specific application,  
19 given the small number of persons residing or working  
20 in the immediate vicinity of the facility, do you  
21 believe that it is appropriate to use the 30 day  
22 calculation for accident doses?

23 A Yes.

24 MR. TURK: I would like to distribute one  
25 more document at this time.

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1 CHAIRMAN FARRAR: All right.

2 MR. TURK: And I would ask that this  
3 document be marked for identification as Staff Exhibit  
4 number 60.

5 (Whereupon, the above-  
6 referenced to document was  
7 marked as Staff Exhibit No. 60  
8 for identification.)

9 MR. TURK: And, for the record, let me  
10 indicate that this exhibit consists of four pages from  
11 the PFS SAR, pages 2.1-1 through 2.1-4.

12 And let me indicate, before I start with  
13 this, that this comes from my own personal copy of the  
14 SAR, which I have not updated for the last nine months  
15 or so. I believe that this is a correct version, but  
16 if it is not I will substitute pages, Your Honor, or  
17 I will ask for some modification of the record so we  
18 have a correct latest version of these four pages in  
19 the record.

20 BY MR. TURK:

21 Q Mr. Waters, do you recognize these pages?

22 A Yes.

23 Q And you mentioned section 2.1.3 of the  
24 SAR. Do you see that located on the third page of  
25 this exhibit?

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1 A Yes.

2 Q And, in fact, there is a description of  
3 the number of residents on the reservation, and in the  
4 vicinity of the site, as well as the nearest  
5 residence?

6 A Yes.

7 MR. TURK: Your Honor, I would ask that  
8 this exhibit be admitted at this time, subject to  
9 possible correction if, in fact, any of these pages  
10 have been modified since I updated my SAR most  
11 recently.

12 MS. CHANCELLOR: No objection, Your Honor.

13 MR. GAUKLER: No objection, Your Honor,  
14 with that understanding.

15 CHAIRMAN FARRAR: With that understanding  
16 it will be admitted.

17 (The document referred to,  
18 having been previously marked  
19 for identification as Staff  
20 Exhibit No. 60 was received in  
21 evidence.)

22 MR. TURK: I have nothing further, Your  
23 Honor.

24 (Pause.)

25 CHAIRMAN FARRAR: Before we excuse the

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1 witness where, precisely, do we stand with that  
2 document? It has been copied, or not?

3 MR. TURK: It has been copied, and we can  
4 distribute it.

5 MR. GAUKLER: And I also have a couple  
6 additional points, myself, in terms of this witness.

7 CHAIRMAN FARRAR: Mr. Gaukler, what  
8 happened to convergence? You started out by asking no  
9 questions, and you have -- but you have been good so  
10 far, so go ahead.

11 But first, before you start, let's get  
12 this document distributed.

13 MR. TURK: Let me indicate, for the  
14 record, that we are distributing a copy of a document  
15 dated June 11, 2002, entitled: Tipover Thermal  
16 Analysis for Holtec HI-STORM Ventilated Concrete Spent  
17 Fuel Storage Casks.

18 It bears the names, at the bottom,  
19 indicating that it was performed for Tom Michener, and  
20 Jim Thort at PNNL, and Chris Bajwan, and Jack Gutman,  
21 at the NRC spent fuel project office.

22 CHAIRMAN FARRAR: Actually it was  
23 performed by those first two for the second two.

24 MR. TURK: Thank you.

25 CHAIRMAN FARRAR: Okay. Then this

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1 document is being distributed just because the State  
2 asked for it, and it has no status in the Proceeding  
3 at this time, is that correct?

4 MR. TURK: That is correct. And I don't  
5 think we distributed copies to the Reporter, we are  
6 merely giving courtesy copies to the Judges and  
7 parties present.

8 CHAIRMAN FARRAR: All right.

9 MR. GAUKLER: Your Honor, really my -- it  
10 is going to be very brief. I just thought it would be  
11 appropriate to have this witness identify ISG 13,  
12 which we were going to introduce, in any event, and I  
13 would just have him identify it for purposes of the  
14 record.

15 CHAIRMAN FARRAR: Yes, go ahead, Mr.  
16 Gaukler.

17 MR. GAUKLER: And have it admitted. Would  
18 you please distribute -- I'm distributing what I  
19 understand to be a draft of Interim Staff Guidance ISG  
20 number 13, which should be marked as PFS exhibit 239.

21 (Whereupon, the above-  
22 referenced to document was  
23 marked as PFS Exhibit No. 239  
24 for identification.)

25 FURTHER CROSS EXAMINATION

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1 BY MR. GAUKLER:

2 Q Do you recognize what has been marked as  
3 PFS exhibit 239?

4 A Yes, this is a draft ISG 13.

5 Q And this is, you were talking about  
6 Interim Staff Guidance number 13, this is a copy of  
7 that, is that correct?

8 A Yes.

9 Q And this concerns guidance that the Staff  
10 has provided with respect to a real individual for  
11 purposes of dose calculations?

12 A Yes.

13 Q Under 10CFR Part 72?

14 A Yes, 72.104, yes.

15 MR. GAUKLER: I would request that this be  
16 admitted as PFS exhibit 239.

17 MS. CHANCELLOR: No objection, Your Honor.

18 MR. TURK: No objection.

19 CHAIRMAN FARRAR: All right. It will be  
20 admitted.

21 (The document referred to,  
22 having been previously marked  
23 for identification as PFS  
24 Exhibit No. 239 was received in  
25 evidence.)

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1 MR. GAUKLER: Nothing else, Your Honor.

2 CHAIRMAN FARRAR: That is it? Okay, thank  
3 you, Mr. Gaukler.

4 Does that, then, wrap up this witness?

5 MS. CHANCELLOR: A couple of questions,  
6 Your Honor.

7 CHAIRMAN FARRAR: Okay.

8 FURTHER RECROSS EXAMINATION

9 BY MS. CHANCELLOR:

10 Q Mr. Waters, you are not suggesting that  
11 the nature of the population at a -- that a less  
12 populated area at a nuclear site would call for a less  
13 stringent safety design than in a populated area, are  
14 you?

15 A No, I'm not.

16 Q And with respect to Staff Exhibit 60,  
17 revision 0, that was in 1997, correct?

18 MR. TURK: May I ask that the examiner  
19 look at the different pages? They bear different  
20 revision dates.

21 MS. CHANCELLOR: That is right.

22 BY MR. TURK:

23 Q On the first page revisions there would be  
24 in 1997, correct? The SAR?

25 A I believe that is when it was submitted to

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1 the NRC.

2 Q And the latest revision in here is the  
3 last page revision 10, which talks about nearby land  
4 and waters, and there is also a revision 6, the  
5 population distribution and trends, correct?

6 A Correct.

7 Q Are you aware that Tooele County has the  
8 highest population growth and land use in the state of  
9 Utah, in recent years?

10 A I do not know if that is true or not.

11 Q Do you know whether the Staff Exhibit 60  
12 takes into account data from the most recent census?

13 A I do not know.

14 Q With respect to PFS exhibit 239, on page  
15 A-3, it states that to satisfy section 72.106b, dose  
16 evaluation should be determined at a minimum of 100  
17 meters distance to the closest boundary of a  
18 controlled area. However, the Applicant may use a  
19 distance, a longer distance, provided that the longer  
20 distance is made a condition of use.

21 Do you know whether the 600 meters that we  
22 have been referring to --

23 A I lost you. Which exhibit, please?

24 Q ISG 13, Staff Exhibit 239, page A-3.

25 A Okay. Page A-3.

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1 Q In the second full paragraph, next to the  
2 last sentence, where it states: To satisfy 72.106B,  
3 the minimum distance should be 100 meters, unless the  
4 Applicant -- the Applicant may use a longer distance  
5 provided the longer distance is made a condition of  
6 use.

7 Do you know whether at the PFS site the  
8 600 meters has been made a condition of use?

9 A I believe it is defined in the SAR. I  
10 don't know if it is made a condition of use. But this  
11 page refers to the ISG for dry cask storage systems,  
12 not for facilities.

13 Q I'm confused. Isn't this a dry cask  
14 storage facility, the PFS site?

15 A Yes, it is. The amended, the revised  
16 recommended text on page A-3, if you look on page A-1  
17 it says: This attachment includes recommendations for  
18 changes to NUREG 1536, standard review plan for dry  
19 cask storage systems. It is not the recommended text  
20 change of 1567.

21 Q That is fine, thank you.

22 MS. CHANCELLOR: That is it, Your Honor.

23 CHAIRMAN FARRAR: Then I think we've  
24 concluded with this witness, Ms. Chancellor, unless  
25 you need time to review the document that was just

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1 provided you.

2 MS. CHANCELLOR: If we could, Your Honor,  
3 we will review it over lunch. I don't expect we will  
4 have anything. But if I could --

5 CHAIRMAN FARRAR: Mr. Waters is not  
6 leaving the jurisdiction, I assume?

7 MR. TURK: No, he will be here during Dr.  
8 Resnikoff's testimony.

9 CHAIRMAN FARRAR: Okay. Then why don't we  
10 excuse him now? Thank you, Mr. Waters, for your  
11 testimony. And, Ms. Chancellor, after lunch if you  
12 review it and want to ask him any questions, we will  
13 bring him back for that purpose.

14 MS. CHANCELLOR: Thank you, Your Honor.

15 MR. TURK: May I note that if Ms.  
16 Chancellor does decide she wants to pursue this  
17 document I may ask that Mr. Waters be joined by  
18 another staff member who conducts thermal reviews.

19 MS. CHANCELLOR: That is a small reason  
20 not to bring him back, Your Honor.

21 CHAIRMAN FARRAR: That is not --

22 MR. TURK: If we are going to go into  
23 thermal analysis I would add a reviewer, probably, to  
24 the panel, if necessary.

25 CHAIRMAN FARRAR: Until that question is

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1 raised I don't even want to think about it. Then all  
2 we have left is Dr. Resnikoff. Are we ahead of when  
3 we had hoped to get him on the stand, or are we just  
4 on target, noontime today?

5 MR. TURK: I think we are on target.

6 MS. CHANCELLOR: Depends on how long the  
7 cross is.

8 CHAIRMAN FARRAR: No, but this is where we  
9 had hoped to be in terms of the week's activities.

10 Well, why don't we, Ms. Chancellor, if it  
11 is all right, we will put him on now, get started, and  
12 then --

13 MS. CHANCELLOR: Ms. Curran will be doing  
14 that. Maybe we could just introduce the testimony, at  
15 least.

16 CHAIRMAN FARRAR: Right. Ms. Curran, go  
17 ahead.

18 MS. CURRAN: Okay.

19 CHAIRMAN FARRAR: Ms. Curran, I can't  
20 remember if yesterday, when Ms. Chancellor introduced  
21 you I said what I had planned to, that we are glad to  
22 have you with us.

23 MS. CURRAN: Thank you.

24 CHAIRMAN FARRAR: And after nine weeks  
25 with the usual suspects, it is nice to have --

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1 MS. CURRAN: You may not be glad to be  
2 here, but you are glad to see another face.

3 MS. CHANCELLOR: We are too, Your Honor.

4 CHAIRMAN FARRAR: Dr. Resnikoff, I think  
5 you never got to testify on seismic before, even  
6 though you waited a long time, but you did testify on  
7 aircraft a long long time ago.

8 Then if you would consider yourself, even  
9 though it is a different issue, consider yourself  
10 still under oath.

11 THE WITNESS:

12 Whereupon,

13 DR. MICHAEL RESNIKOFF  
14 was called as a witness by Counsel for the State and,  
15 having been previously duly sworn, assumed the witness  
16 stand, was examined and testified as follows:

17 DIRECT EXAMINATION

18 BY MS. CURRAN:

19 Q Dr. Resnikoff, do you have before you the  
20 amended State of Utah testimony of Dr. Martin  
21 Resnikoff, regarding Unified Contention Utah L/QQ,  
22 dated June 21st, 2001?

23 A I do.

24 Q Was this testimony prepared by you, or  
25 under your supervision?

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1 A It was.

2 Q Do you believe the facts in this testimony  
3 to be true and correct, and is it based on your best  
4 professional judgement?

5 A I do, it is.

6 Q Do you adopt this testimony as your  
7 testimony in this Proceeding?

8 A I do.

9 Q And I believe you were in the room when I  
10 made some very minor corrections to question 3 of your  
11 testimony. Do you recall that? Is question 20 the  
12 one question in this testimony in which you have  
13 changed your answer?

14 A Yes.

15 Q And if we refer back to question 3, I  
16 believe at the time it was -- the testimony was  
17 submitted on June 25th, that it incorrectly said in  
18 the last sentence that there were also changes to  
19 questions, the answers to questions 11 and 13.

20 That is incorrect, right?

21 A That is right.

22 Q Okay.

23 MS. CURRAN: I would add that I would like  
24 to move Dr. Resnikoff's testimony into evidence.

25 MR. GAUKLER: Your Honor, Mr. Nelson will

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1 be conducting this witness for us.

2 CHAIRMAN FARRAR: All right. Any  
3 objection to -- Mr. Turk?

4 MR. TURK: We had objected in limine.  
5 There was a Board ruling, we abide with that ruling  
6 with respect to qualifications on portions of the  
7 testimony.

8 CHAIRMAN FARRAR: All right, then, Dr.  
9 Resnikoff's written testimony will be bound into the  
10 record at this point, as if read.

11 (Dr. Resnikoff's prefiled testimony to be  
12 bound into the record at this point.)

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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket No. 72-22-ISFSI
	)	
PRIVATE FUEL STORAGE, LLC	)	ASLBP No. 97-732-02-ISFSI
(Independent Spent Fuel	)	
Storage Installation)	)	<del>June 21, 2001 April 1, 2002</del>

**AMENDED STATE OF UTAH TESTIMONY OF DR. MARVIN RESNIKOFF  
REGARDING UNIFIED CONTENTION UTAH L/QQ  
(Seismic Exemption - Dose Exposure)**

Q. 1: Please state your name, affiliation, and qualifications.

A. 1: My name is Marvin Resnikoff. I am the Senior Associate of Radioactive Waste Management Associates ("RWMA"), a private technical consulting firm based in New York City. I hold a doctorate degree in high-energy theoretical physics from the University of Michigan. I have researched radioactive waste issues for the past 28 years and have extensive experience and training in the field of nuclear waste management, storage, and disposal. Our work at RWMA includes matters covered in this testimony: (i) safety issues related to the storage of irradiated fuel, and (ii) the calculation of radiation exposure. I previously prepared a declaration (January 30, 2001) for the State of Utah in response to the summary disposition motion on contention Utah L, part B. I am also testifying as a witness in the April hearing on Contention Utah K. My curriculum vitae is included as State's Exhibit 134.

During the past 28 years I have researched and evaluated technical issues related to the storage, transportation, and disposal of radioactive waste, including spent nuclear power plant fuel. I am extremely familiar with the general characteristics of spent nuclear power plant fuel, as well as the designs of spent fuel storage systems that are now in use or proposed for future use in the United States. My experience includes technical review and analysis of numerous dry cask storage designs, including proposed independent spent fuel storage installations ("ISFSIs") at the Point Beach, Palisades and Prairie Island reactors, as well as Holtec's HI-STORM and HI-STAR casks for the proposed Private Fuel Storage, LLC ("PFS") facility. I have prepared comments for the States of Utah and Nevada on the Nuclear Regulatory Commission ("NRC") Staff's preliminary Safety Evaluation Reports ("SERs") for the HI-STAR/HI-STORM systems. I have also reviewed Topical Safety

Analysis Reports ("TSARs") for transportation casks, including the IF-300, NLI-1/2 and casks used for plutonium transport.

Since 1975 I have worked on transportation issues, including cask safety, for the States of Utah, Nevada (including Churchill, Clark and White Pine Counties), Idaho, New York, New Mexico and Alaska. This work began with work for the New York Attorney General's office on the safety of transporting plutonium by plane out of John F. Kennedy International Airport. My role in the case was to determine whether the plutonium shipping container could be punctured and the amount of plutonium that could be released. I was an invited speaker at the 1976 Canadian meeting of the American Nuclear Society to discuss the risk of transporting plutonium by air. On behalf of the State of New York, I also reviewed and provided comments on NUREG-170, "Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes." Continuing this work, I am presently preparing testimony for the Earthjustice Foundation on transportation of Pu from Rocky Flats to Lawrence Livermore lab in DT-22 casks. On behalf of the State of Nevada and Clark County, Nevada, I provided comments on the transportation cask safety studies and transportation risk assessments, such as the Modal Study and references, and more recently NUREG/CR-6672. RWMA has conducted transportation risk assessments for the State of Nevada and has employed various computer codes and formulas to estimate the amount of radioactivity released in and the health and economic consequences of a severe accident, including the computer models RADTRAN, RISKIND, RESRAD, and HOTSPOT. In addition, in hearings before state commissions and in federal court, I investigated proposed dry storage facilities at the Point Beach (WI), Prairie Island (MN) and Palisades (MI) reactors. For the Council on Economic Priorities, I have written a book on the transportation and storage of irradiated fuel.

I have considerable training and experience in the field of radiation dose exposure involving nuclear and hazardous facilities, serving as an expert witness in numerous personal injury cases in which I estimated radiation doses and the likelihood these exposures caused cancer. These cases involved uranium mining and milling, oil pipe cleaning, X-rays, thorium contamination and other issues. This work involved the use of computer codes, such as MILDOS, to estimate radiation doses and spreadsheets employing dose conversion factors. Under my oversight, the staff at RWMA and I have reviewed risk assessment studies and evaluated radiation dose exposures for proposed low-level radioactive waste facilities at Martinsville (Illinois), Boyd County (Nebraska), Wake County (North Carolina), Ward Valley (California) and Hudspeth County (Texas).

Q. 2: What has been your involvement in assisting the State with respect to PFS's seismic exemption request?

A. 2: I was designated as one of the State's testifying experts for Contention Utah L part B on September 28, 2001 – Utah L, Part B has now been unified as Utah L/QQ. My testimony relates to Section E of the unified contention. I assisted in the preparation, in part, of State of Utah's Request for Admission of Late-Filed Modification to Basis 2 of Utah

Contention L, filed on January 26, 2000 ("First Modification to Basis 2"), and have reviewed another request by the State for Admission of Late-Filed Modification to Basis 2 of Utah Contention L, filed November 9, 2000 ("Second Modification to Basis 2") and submitted Declarations in support thereof. I also participated in the preparation of discovery against the Applicant and the NRC Staff with respect to Utah L part B.

Q. 3: What is the purpose of your testimony?

A. 3: My testimony relates to whether the PFS design basis for the Holtec International Inc. ("Holtec") HI-STORM 100 cask system provides reasonable assurance that the health and safety of the public and onsite workers will be protected if the casks are subjected to the peak ground accelerations from a 2,000-year mean annual return period earthquake at the PFS site. My amended testimony makes corrections to dose calculations that I provided previously. The new dose calculations are found in Exhibit 141a, which is attached herewith. Corrections to my April 1, 2002, testimony can be found in responses to Questions 11, 13, and 20.

Q. 4: Are you familiar with the PFS license application filed in this proceeding and the proposed storage and transportation casks PFS plans to use?

A. 4: Yes, I have been assisting the State in the Private Fuel Storage, LLC ("PFS") proceeding since 1997 and have reviewed the original PFS license application and the various revisions thereto. I am familiar with PFS's Safety Analysis Report and Environmental Report, as well as the Staff's Safety Evaluation Report and Environmental Impact Statement.

PFS plans to transport spent nuclear fuel to the Skull Valley site in Holtec HI-STAR transportation casks and store the fuel on-site in Holtec HI-STORM 100 storage casks. I am familiar with Holtec's applications for the storage and transportation casks (HI-STORM and HI-STAR) PFS plans to use. I am also familiar with NRC regulations, guidance documents, and environmental studies relating to the storage and transportation of spent nuclear power plant fuel, including NUREG-0800, NUREG-1536, 10 CFR Parts 72 and 100, EPA's Protective Action Guide, and Federal Register Notice dated December 4, 1996 (61 Fed. Reg. 64257).

Q. 5: What is your familiarity, if any, with the Holtec Certificate of Compliance for the HI-STORM 100 cask?

A. 5: NRC issued a certificate of compliance ("CoC") for the HI-STORM 100 cask

effective May 31, 2000. 65 Fed. Reg. 25241 (2000). By issuing a CoC, NRC determined that the "HI-STORM 100 cask system, as designed and when fabricated and used [for general licenses] in accordance with the conditions specified in its CoC, meets the requirements of 10 CFR Part 72." *Id.*

Q. 6: How does the CoC relate to the use of the HI-STORM 100 cask at the proposed PFS facility?

A. 6: The site-specific conditions at the PFS facility are outside the bounds of the generic CoC for the HI-STORM 100 cask system. Therefore, in order to use the HI-STORM 100 system, PFS must conduct a site-specific analysis to determine whether the performance of the casks at the PFS site are adequate to protect health and safety. There are serious shortcomings in PFS's site-specific analysis. *See* State's Testimony of Dr. Steven Bartlett and Dr. Farhang Ostadan (dynamic analysis) and State's Testimony of Dr. Ostadan and Dr. Mohsin Khan (cask stability), filed concurrently.

Q. 7: What are these serious shortcomings in PFS's site specific analysis?

A. 7: In my opinion, PFS has not shown that unanchored HI-STORM 100 casks will "reasonably maintain confinement of radioactive material" under off-normal and credible accident conditions at the proposed PFS site as required by 10 CFR § 72.236. Further, PFS and cask designer, Holtec, have not quantified the consequences of a potential 2,000-year mean annual return period, 10,000-year return period, or deterministic earthquakes that could take place at the proposed PFS site.

Q. 8: Why is the CoC unable to reflect the facts and conditions at the proposed PFS site?

A. 8: There are significant differences between the facts and conditions used to support the HI-STORM CoC and those at the PFS site; for example:

a. The calculated ground motions at the PFS facility for a 2,000-year return period earthquake are 0.711 g horizontal and 0.695 g vertical (SAR at 2.6-107, Rev. 22). As described below, the bounding ground motions in the CoC for the purpose of determining the maximum zero point acceleration that will not cause incipient tipping are bounded by a horizontal acceleration of .445 g and vertical acceleration of .16 g.

In its HI-STORM CoC<sup>1</sup> analysis, Holtec treated a loaded cask as a rigid body and set up the following inequality,

$G_H + \mu G_V \leq \mu$  (where  $\mu$  is 0.53,  $G_H$  is the resultant horizontal acceleration, and  $G_V$  is the resultant vertical acceleration),

stating that the maximum g loading a cask could take without tipping would occur when the horizontal force acting at the center of gravity of the cask just balances the vertical force acting at the pivot point. Any horizontal force greater than this would cause tipping in this rigid body assumption. In the above formula  $\mu = r/H$ . In the HI-STORM CoC Holtec reduced the value of  $r/H$  from 0.56 to 0.53, thereby giving a bounding horizontal acceleration of .445 g (with .16 g as the corresponding vertical acceleration). CoC, Appendix B at 3-8, State's Exh. 135.

As can be seen from the above, the design basis earthquake ("DBE") ground motions for the PFS site are significantly higher than those specified in the CoC for the HI-STORM 100 cask.

b. There is an inconsistency between the occupancy time at the controlled area boundary used in the Holtec CoC and that used at the PFS site. The Holtec CoC used a duration time of 8,760 hours per year whereas at the PFS site only 2,000 hours per year was used to compute dose exposure at the fence post. *See* ¶ 10 below.

c. Holtec calculated the dose consequences in a non-mechanistic single cask tip over event, whereas at PFS the entire field of casks could tip over under the accelerations caused by the DBE. *See* State's Testimony of Drs. Bartlett and Ostadan (dynamic analysis) and Testimony of Drs. Ostadan and Khan (cask stability).

Q. 9: How have these differences affected PFS's and Holtec's analyses?

A. 9: Failure to quantify the consequences of a potential 2,000-year return period, 10,000-year return period, or deterministic earthquake is fatal to PFS' and Holtec's conclusions because the calculated ground motions for a 2,000-year return period earthquake (of 0.711 g horizontal and 0.695 g vertical) at the PFS facility are so far outside the bounds of those used to support the Holtec CoC that it is fair to conclude that there is no quantification of the consequences of what will occur at ground motions of

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<sup>1</sup> Excerpts from the Holtec HI-STORM 100 Cask Certificate of Compliance for Spent Fuel Storage Casks (effective date May 31, 2000), docket number 72-1014, included as State's Exhibit 135.

approximately 0.7g.

Q. 10: Has PFS appropriately calculated the dose rate?

A. 10: PFS calculated a 5.85 mrem/year dose for a 2,000 hour/year occupancy time at the controlled area boundary under normal operating conditions.<sup>2</sup> The Holtec dose calculation at the PFS controlled area boundary is inconsistent and less conservative than other Holtec dose calculations which likely used an occupancy rate of 2,080 hour/year.<sup>3</sup> PFS has significantly underestimated the dose rate. To assure that the public is protected, PFS must calculate a radiation dose assuming a hypothetical individual is located at the site boundary the entire year or 8,760 hours/year because PFS cannot control who is at the site boundary or for what length of time. Although PFS does not control property beyond the site boundary, it calculated a dose rate at a distance of 2 miles from the site boundary.<sup>4</sup> In the CoC for the HI-STORM 100 System, NRC Staff agreed with my position in response to comment B.18, stating: "The NRC agrees that 8,760 hours/year should be used [for estimating the dose at the site boundary]." *See* 65 Fed. Reg. 25241, 25245 (2000). Thus, using an 8,760 hour/year assumption is consistent with the NRC Staff position in approving the HI-STORM 100 CoC.

Q. 11: What is a more appropriate calculation of the dose rate?

A. 11: I calculated the correct annual dose rate assuming a hypothetical individual remained at the site boundary for 8,760 hours. The dose rate is  $5.85 \text{ mrem/year} * 8,760 \text{ hours/year} \div 2,000 \text{ hours/year} = 25.6 \text{ mrem/year}$ , which is in excess of the allowable 25 mrem/year specified in 10 CFR § 72.104(a). This is the dose rate under normal operating conditions, absent a seismic event.

Q. 12: How does your calculation of the dose rates differ from PFS's calculation?

A. 12: In addition to PFS's selection of 2,000 hour per year exposure duration being at odds with the Holtec CoC, it is also unjustified. The PFS facility is expected to have an operational life of at least 40 years. PFS SER (2002), Table 4-3, p.4-8. The site is located on the northwestern edge of the Skull Valley reservation abutting privately owned property. In my opinion it is nonconservative and unrealistic to analyze dose exposure for 40 hours per

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<sup>2</sup> PFS EIS Commitment Resolution Letter #13 (September 25, 2001), included as State's Exhibit 136.

<sup>3</sup> *See* Deposition Transcript of Everett Lee Redmond II (November 15, 2001) ("Tr."), excerpts included as State's Exhibit 137, at 40.

<sup>4</sup> PFS Consolidated Safety Evaluation Report ("PFS SER") (2002) at 7-6.

week for 50 weeks a year (*i.e.*, 2,000 hours per year). There should be an expectation that residential housing will abut the PFS site boundary. Moreover, by definition an “uncontrolled” area is an area not controlled by PFS.

Q. 13: How does PFS’s and Holtec’s tip over analysis impact PFS’s dose rate calculation?

A. 13: Holtec and NRC Staff considered the HI-STORM tip over analysis as a non-mechanistic event. “In the absence of an identified [cask tipover] hazard” NRC allows a non-mechanistic cask tipover analysis.<sup>5</sup> See HI-STORM 100 Safety Evaluation Report<sup>6</sup>, State’s Exhibit 138, at § 11.2.4.1; HI-STORM 100 Topical Safety Analysis Report, State’s Exhibit 139,<sup>7</sup> at § 11.2.3. However, a non-mechanistic tipover analysis is no longer acceptable because the HI-STORM 100 casks will likely tipover under peak ground accelerations for a 2,000-year mean annual return period earthquake. Because the dose at the controlled area boundary is already slightly greater than 25 mrem/year assuming an exposure duration of 8,760 hours/year, any further increase will put this dose that much higher than the limits allowed in 10 CFR § 72.104(a).

Q. 14: What has PFS calculated as the dose rate in the event of a tip-over accident?

A. 14: PFS acknowledges that a tip-over accident could “cause localized damage [including crushing of the concrete and associated micro-cracking] to the radial concrete shield and outer steel shell where the storage cask impacts the surface.” See PFS Joint Dec.<sup>8</sup> ¶ 25. Holtec in fact states that the “overpack surface dose rate . . . could increase due to the [tipover] damage.” HI-STORM 100 TSAR at 11.2-7. Contrary to the HI-STORM 100 TSAR and without any quantified analysis, PFS claims that no “noticeable increase” in radiation dose would occur at the site boundary. PFS Joint Dec. ¶ 25. PFS’ radiation dose expert is unaware of any calculations that estimate the radiation consequences of concrete cracking. Redmond Tr. at 46, 47, State’s Exh. 137.

Q. 15: What is your opinion of PFS’s dose rate calculation in the event of a tip-over accident?

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<sup>5</sup> NUREG-1536, *Standard Review Plan for Dry Cask Storage Systems*, at 2-9.

<sup>6</sup> HI-STORM 100 Safety Evaluation Report (“HI-STORM SER”), excerpts included as State’s Exhibit 138.

<sup>7</sup> HI-STORM 100 Topical Safety Analysis Report, HI-951312 (“TSAR”) (February 4, 2000), excerpts included as State’s Exhibit 139.

<sup>8</sup> Joint Declaration of Krishna P. Singh, Alan I. Soler, and Everett L. Redmond II (November 9, 2001) (“PFS Joint Dec.”), filed with Applicant’s Motion for Summary Disposition of Part B of Utah Contention L (November 9, 2001).

A. 15: In my opinion, there is no support for PFS's claim.

Q. 16: How is PFS's dose rate calculation insufficient?

A. 16: To determine whether fuel assemblies would be damaged in a tipover event, Holtec calculated the deceleration of the top edge of the canister as the cask struck the cement pad. *See, e.g.,* HI-STORM 100 TSAR, Section 3.A. In its hypothetical tipover analysis, Holtec identified "a center of gravity over pivot point" configuration as its starting point, assuming that the initial angular velocity was zero. HI-STORM 100 TSAR, Section 3.A.6, State's Exh. 139. There are numerous problems with Holtec's analysis and the conclusion PFS draws from it.

a. PFS's witnesses conclude that during an earthquake, "the initial linear velocity of the cask centroid in the plane of precession . . . would not be significantly increased over the [hypothetical] tip-over condition already studied." PFS Joint Dec. ¶ 20. PFS again provides no supporting calculations and in my opinion, PFS's starting premise of zero initial angular velocity is unfounded.

b. If cask tip over results from earthquake accelerations, the initial angular velocity may be greater than zero. From this you can conclude that the top of the canister will decelerate at greater than 45 g, in exceedence of the 45 g design basis, thereby damaging the fuel assemblies; also the HI-STORM 100 cask will flatten more than contemplated by PFS. Claims that the "MPC has a very substantial margin built into it" are unsubstantiated; PFS has again failed to support its site specific use of the HI-STORM cask with any calculations or test data. *See* PFS Joint Dec. ¶ 20. Therefore, PFS has not substantiated whether or not the confinement boundary would be breached in a 2,000-year earthquake or a 10,000-year earthquake. *See id.*

Q. 17: What is your opinion of PFS's analysis of the potential consequences of a HI-STORM 100 cask tipover?

A. 17: Since the initial angular velocity may be greater than zero as the cask center of gravity passes the pivot point, the HI-STORM 100 cask will also flatten more than contemplated by PFS. Although PFS claims that the "MPC has a very substantial margin built into it," it again fails to support its claim with any calculations or test data. *See* PFS Joint Dec. ¶ 20. Furthermore, PFS also acknowledges that the "roundness" of the casks could be reduced following cask tipover. PFS Joint Dec. ¶ 26. However, in the event of cask tipover, PFS has not correctly quantified the amount of concrete flattening or the

resultant reduction of gamma and neutron shielding. Thus, the potential consequence of a HI-STORM 100 cask tipover is another unresolved critical safety issue that must be addressed prior to determining or justifying the appropriate site specific design basis earthquake.

Q. 18: What is your opinion of PFS's assertion that in the event of cask tipover, the roundness of the cask could only be reduced in the radial area of the impact?

A. 18: If a HI-STORM 100 cask tips over, PFS further states that the roundness of the storage cask could only be reduced in the radial area of the impact. PFS Joint Dec. ¶ 26. PFS witness, Dr. Redmond, then implies that any increase in dose from the reduction in radiation shielding caused by the flattening or localized deformation is inconsequential because the increase in dose will occur between the cask and the ground.<sup>9</sup> First, PFS has performed no analysis to show that the deformation will be in contact with the ground. During a seismic event, the cask could roll and the flattened end may not remain facing the ground.

Second, when the HI-STORM 100 casks are in fact uprighted, the flattened area of the cask (localized deformation) will not face the ground. PFS has failed to calculate the potential increase in dose at the site boundary or to workers from such casks.

Q. 19: What, if any, are the flaws in Holtec's analysis of the HI-STORM 100's stability in a tipover event?

A. 19: Under a HI-STORM 100 cask tipover event, Holtec has also not quantified the amount of stretching of the metal outer surface, and the amount of cracking of the cement. Cracking will lead to an increased gamma dose at the fence post and an increased neutron and gamma dose to PFS workers since gamma rays and neutrons will pass more easily through this less shielded region. The potential increase in radiation dose at the fence post must be quantified before the design basis earthquake is specified. Also, the analysis performed by Holtec in the HI-STORM TSAR does not bound cask tip-over resulting from an earthquake affecting the PFS facility because the Holtec analysis evaluates only one cask being tipped over. At a facility with up to 4,000 casks, it is highly unlikely that only one HI-STORM 100 cask will tipover as a result of peak ground accelerations from a 2,000-year mean annual return period earthquake affecting the PFS facility. *See e.g.* Utah Joint Dec. ¶ 74.

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<sup>9</sup> Redmond Tr. at 48, State's Exh. 137; PFS Joint Dec. ¶ 26.

Q. 20: What would happen if the HI-STORM 100 cask were to tipover such that bottom of a row of casks faces the fence post?

A. 20: If the HI-STORM 100 casks tipover such that the bottom of a row of casks faces the fence post, the direct gamma dose at the fence post will increase. As seen in RWMA's drawing, included as State's Exhibit 140, a ring or torus of the bottom of the HI-STORM 100 cask has reduced shielding. This is not a region where the fuel is located, but indirect gamma rays and neutrons will stream through the bottom of the cask. PFS has not calculated the dose at the boundary from the bottoms of tipped over HI-STORM 100 casks. Redmond Tr. at 50, State's Exh. 137. In collaboration with my colleague, Matthew Lamb, I performed preliminary rough calculations for the reduced shielding caused by exposure from the bottom of the casks at the site boundary. I am unaware of any dose calculations performed by Holtec. See RWMA's dose calculations, included as State's Exhibit 141a. My calculations show the dose rate due to neutrons and gamma rays will increase by 5 between 1.8 and 18 times that calculated by PFS at the site boundary assuming a 2,000 hour year, and between 7.7 and 77 times that calculated by PFS assuming an 8,760 hour year, but the dose may also be 1/2 the PES calculated dose. Because of the likelihood that HI-STORM 100 casks will tipover during a 2,000-year mean annual return period earthquake, in order to justify that there will be no effect to health and safety from using a 2000-year DBE, in my opinion PFS must calculate a bounding radiation dose at the fence line and to workers.

Q. 21: In a tipover event, do you expect any additional damage to the cask other than flattening?

A. 21: I have further concerns about the modeling of the Holtec cask in a tipover event. HI-STORM TSAR Fig. 3.A.18<sup>10</sup> shows the structural details. The concrete overpack is topped with a metal lid plate about 3 3/4 inch thick, and a concrete lid bottom plate or plug that fits within the concrete cylindrical side walls of the HI-STORM cask. In a tipover event, discussed in TSAR Appendix 3.B, the cask walls at the top of the cask are expected to flatten slightly (0.11 inch, p. 3.B-5<sup>10</sup>) when the cask top strikes the ground. On the other hand, the cask lid plate is expected to be displaced as much as 4.9 inches in a tip over event (TSAR, p. 3.A-15<sup>10</sup>). This indicates to me that the 3 3/4 inch thick lid plate is going to strike the ground in a tipover event and send a strong dynamic impulse to the cask wall and canister. It does not appear that this cask detail, that may affect the canister welds, has been modeled.

Q. 22: In addition to the cracking of the concrete cask, are there any other issues

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<sup>10</sup> See State's Exh. 139.

that need to be addressed by PFS?

A. 22: In addition to cracking of the concrete cask, the issue of cask heat-up and loss of concrete shielding must be addressed by PFS. The HI-STORM 100 cask is designed to be cooled by a "chimney effect." Cooler air enters the bottom vent and rises and is released from the top vent. If the casks tip over, the chimney effect is reduced dramatically and this is equivalent to the intake vents being blocked. Holtec calculations show that after 33 hours of 100% air inlet blockage, the concrete temperature will exceed the short-term limit of 350\_F specified in the CoC for the HI-STORM 100 cask.<sup>11</sup> The CoC temperature limit is established to ensure the continued effectiveness of the neutron shielding by ensuring the water does not evaporate from the concrete, reducing the amount of hydrogen available for neutron capture.<sup>12</sup> PFS has not analyzed the effects of an increase of neutron dose to on-site workers from the prolonged tipover of HI-STORM 100 casks.

Q. 23: In the event of a cask tipover, could PFS upright all of the casks, and if not, what would be the potential dose consequences?

A. 23: At the PFS site there is the likelihood that the HI-STORM 100 casks will tip over during a 2,000-year return period DBE. Testimony of Drs. Khan and Ostadan (cask stability). In my opinion PFS could not upright all the casks within the time limits imposed by the CoC and this will result in the potential increase in neutron dose to workers.

a. The HI-STORM casks are approximately 20 feet high, 11 feet in diameter and weigh about 175 tons.<sup>13</sup> In restoring the casks to their original and upright position, the configuration of the casks on the pad dictates that a crane would have to work from the outside perimeter of the pads towards the center of the pads. Obtaining a crane capable of lifting 175 tons and transporting it to the Skull Valley site, maneuvering around other casks, then uprighting and re-positioning each 175 ton cask on the pad would result in only a few casks, if any, being restored to their original pad position within 33 hours. Casks remaining horizontal for extended periods of time would result in the increased temperature of the concrete overpack past the 350°F short-term temperature limit specified by the HI-STORM 100 CoC. If the temperatures resulted in the evaporation of water from the concrete, workers would then have to operate in an increased neutron dose environment.

b. The CoC temperature limit is established to ensure the continued effectiveness of the neutron shielding by ensuring the water does not evaporate from the concrete, reducing

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<sup>11</sup> See HI-STORM 100 TSAR, p. 1.D-4, Table 1.D.1 (Rev 10), State's Exh. 139.

<sup>12</sup> See Redmond Tr. at 60-61, State's Exh. 137.

<sup>13</sup> State's Exhibit 142, PFS SAR, Table 4.2-2, Rev. 12.

the amount of hydrogen available for neutron capture. See Redmond Tr. at 60-61, State's Exh. 137. In collaboration with my colleague Matthew Lamb, I performed calculations, included as State's Exhibit 143<sup>14</sup>, that show increased neutron dose due to reduced shielding. These calculations estimate an increase in dose to workers due to neutrons of up to 57.3 times greater than the value calculated by Holtec of 1.88 mrem/hour 1 meter from the cask mid-height if all of the water evaporates from a HI-STORM cask. This would result in a worker dose of approximately 108 mrem/hour. A worker exposed to this for just over 46 hours would exceed the 5 rem/year occupational dose rate specified in 10 CFR Subpart C § 20.1201.

Q. 24: What would be the effect on the dose rate if the casks do not tipover, but slide as the Altran Report suggests that they would?

A. 24: The Altran Report, State's Exhibit 122<sup>15</sup> concludes that the HI-STORM 100 casks will tipover under peak ground accelerations induced by a 2,000-year earthquake at the PFS facility. Even if the casks do not tipover, the casks may still slide approximately 370 inches in the x direction and 230 inches in the y direction and be uplifted 27 inches.<sup>16</sup> Contrary to PFS's claims, the casks will not move in phase with each other.<sup>17</sup> Under these conditions the casks will slide and collide with each other. PFS has not evaluated the damage nor calculated dose increase from colliding casks.<sup>18</sup> Also, the HI-STORM 100 cask will likely be lifted up to 27 inches if subjected to peak ground accelerations induced by a 2,000-year earthquake at the PFS facility.<sup>19</sup> The HI-STORM 100 cask was analyzed and determined capable of withstanding only a drop of 11 inches.<sup>20</sup> PFS has not demonstrated that its requested design basis ground motion exemption will not result in potential damage to the canister or cask. It is important to mention that a cask drop greater than 11 inches implies fuel assembly deceleration greater than 45g and therefore potential fuel damage.

Q. 25: Have you reviewed the cask drop calculations supplied by Holtec?

A. 25: Yes, I have reviewed the cask drop calculations supplied by Holtec, HI-2002572, *Evaluation of the Confinement Integrity of a Loaded Holtec MPC Under a Postulated Drop Event* (Nov. 30, 2000).

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<sup>14</sup> Calculation of Neutron Dose at Elevated Concrete Temperatures.

<sup>15</sup> Testimony of Drs. Khan and Ostadan (cask stability).

<sup>16</sup> See Testimony of Drs. Khan and Ostadan(cask stability).

<sup>17</sup> Id..

<sup>18</sup> See PFS Joint Dec. ¶¶ 14, 17.

<sup>19</sup> See Testimony of Drs. Khan and Ostadan(cask stability).

<sup>20</sup> See HI-STORM 100 CoC at 5.0-4, State's Exh. 135.

Q. 26: What is your opinion of these calculations?

A. 26: Actually there are two cask drop calculations: a 25 foot drop of the HI-TRAC transfer cask containing the fuel canister, and a 10 inch drop of the HI-STORM cask containing the inner fuel canister. Both calculations assume the cask drops vertically downward, from either a 25-foot or 10-inch height, onto a concrete base. My criticism of these calculations is that neither assumes the cask would drop at an angle. If that occurred, the shear stresses, particularly on the welds, would then be considerably more severe than in a vertical drop. The NRC Staff admits that "the SAR drop analysis does not include examination of a corner drop."<sup>21</sup> If the canister experiences a "corner drop," then PFS has not evaluated whether the canister welds would be impaired, exposing the canister contents to the external environment. This issue must be addressed prior to establishing the design basis earthquake.

Q. 27: Overall, do you agree that the analyses performed by Holtec and PFS are conservative or bounding?

A. 27: Based on the above, I do not agree that the limited analysis performed by Holtec and PFS is conservative or bounding. In the instances discussed above, the HI-STORM cask would be operated under conditions that are outside the parameters analyzed in the SAR and SER, and would lead to doses at the fence post that exceed regulatory limits. Thus, PFS has not shown that its requested design basis ground motion will not endanger life or property or is otherwise in the public interest as required by 10 CFR § 72.7 or will not jeopardize the health and safety of on-site workers.

Q. 28: One final question, are you aware of the burn-up of fuel stored in the ISFSI at INEEL where the TMI-2 fuel is stored?

A. 28: The TMI-2 reactor went through low power testing for several months and then operated for a 3-month period before the reactor accident. As a result, the fuel burnup was 3,175 MWD/MTU, far less than the potential burnup of fuel that will be accepted at PFS, up to 45,000 MWD/MTU.

Q. 29: Does this conclude your testimony?

A. 29: Yes.

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<sup>21</sup> See HOLTEC SER at 3-10, State's Exh. 138.

1 MS. CURRAN: Now, there are a number of  
2 exhibits to Dr. Resnikoff's testimony. State Exhibit  
3 134 is his curriculum vitae; exhibit 135 is excerpts  
4 from the Certificate of Compliance for the HI-STORM  
5 100 spent fuel storage cask.

6 CHAIRMAN FARRAR: Ms. Curran, hold on a  
7 minute. These are the exhibits, same exhibits that  
8 the State prefiled with us some time ago?

9 MS. CURRAN: Yes. These exhibits were  
10 filed, most of the exhibits were filed on April 1st.  
11 There is one additional exhibit that was filed on June  
12 25th.

13 CHAIRMAN FARRAR: Does the Reporter, are  
14 you going to circulate new copies of these? We all  
15 have ours. Do you have some for the Reporter?

16 MS. CURRAN: I've handed a set of the  
17 testimony and exhibits to the Reporter. But we do  
18 need to make one correction to Answer 3 in the copy I  
19 gave the Reporter, and I'm going to retrieve that at  
20 lunchtime to delete references to questions other than  
21 question 20.

22 CHAIRMAN FARRAR: Right. But the Reporter  
23 has the exhibits?

24 MS. CURRAN: The entire set of exhibits,  
25 including 142A.

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1 CHAIRMAN FARRAR: All right, if you will  
2 continue going through those, Ms. Curran.

3 MS. CURRAN: Okay. Exhibit 136 is a  
4 letter from PFS to the NRC, dated September 25th,  
5 2001. That is a Commitment Resolution letter number  
6 13.

7 Exhibit 137 consists of excerpts from the  
8 November 15, 2001 deposition of Everett Licensee  
9 Redmond II. Exhibit 138 consists of excerpts from the  
10 Safety Evaluation Report for the HI-STORM 100 cask  
11 system.

12 Exhibit 139 consists of excerpts from the  
13 TSAR for the HI-STORM 100 cask system. TSAR stands  
14 for Topical Safety Analysis Report. Exhibit 140 is a  
15 schematic cross section of the HI-STORM 100 cask  
16 bottom.

17 Exhibit 141 is a document entitled Rough  
18 Calculations: Dose Emanating from Bottom of Tipped-  
19 Over Cask. Exhibit 141A, which was filed on June  
20 25th, and has been served on the Board and parties is  
21 entitled Amended Rough Calculations Dose Emanating  
22 from Bottom of Tipped-Over Cask.

23 CHAIRMAN FARRAR: That is the one you  
24 attached, or emailed when you sent the new testimony?

25 MS. CURRAN: That is right. Exhibit 142

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1 is table 4.2-2 from the PFS Safety Analysis Report,  
2 entitled: Physical Characteristics of the HI-STORM  
3 Storage Cask.

4 And exhibit 143 is a document by Dr.  
5 Resnikoff entitled: Calculation of Neutron Dose at  
6 Elevated Concrete Temperatures.

7 (Whereupon, the above-  
8 referenced to documents were  
9 marked as State Exhibit Nos.  
10 134-141, 141A, 142, and 143 for  
11 identification.)

12 MS. CURRAN: And I would like to move all  
13 these exhibits into the record.

14 CHAIRMAN FARRAR: Does the Applicant have  
15 any objection to any of them?

16 MR. NELSON: I have a conditional  
17 objection to exhibit 140, depending on the use they  
18 intend to make of it. And I will just state --

19 CHAIRMAN FARRAR: Hold on, let me take a  
20 look at that.

21 MR. NELSON: That is the cross, that is  
22 what purports to be a cross section of the cask.

23 CHAIRMAN FARRAR: Right.

24 MR. NELSON: The way Ms. Curran described  
25 it, I'm a little concerned. If they are merely using

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1 it for illustrative purposes, and they are not  
2 purporting that it actually represents any of the  
3 dimensions of the cask, and as long as it admitted for  
4 illustrative purposes only, I have no problem.

5 If it purports to be an accurate cross  
6 section it is woefully lacking, and there are  
7 documents, such as Staff Exhibit B, which is actually  
8 an engineering diagram, and other documents that  
9 accurately represent the dimensions of the cask.

10 CHAIRMAN FARRAR: Ms. Curran, is that --  
11 can we take it with that understanding?

12 MS. CURRAN: Yes, I thought that is what  
13 the word schematic meant.

14 CHAIRMAN FARRAR: Oh, okay. Well, it is  
15 good to have the -- if that is what you --

16 MS. CURRAN: This is not intended to be an  
17 engineering drawing of the cask.

18 CHAIRMAN FARRAR: Good. Then with that we  
19 will proceed with that understanding. Mr. Turk, any  
20 objection to any of these?

21 MR. TURK: Just one quick question in the  
22 way of a voir dire.

23 VOIR DIRE EXAMINATION

24 BY MR. TURK:

25 Q Dr. Resnikoff, there are certain

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1 calculations included among the exhibits that the  
2 State just mentioned. I just want to be sure I  
3 understand if this is a calculation that you prepared,  
4 specifically number 141, and 141A, those are your  
5 calculations?

6 A They are mine, and also under my  
7 direction, together with Matt Lam, who sits six feet  
8 away from me in the office.

9 Q The same question with respect to exhibit  
10 143.

11 A Yes.

12 Q Same answer?

13 A The same answer.

14 MR. TURK: I have no objection, Your  
15 Honor.

16 CHAIRMAN FARRAR: All right, then we will  
17 admit 134 through 141, 141A, and 142, and 143.

18 (The documents referred to,  
19 having been previously marked  
20 for identification as State  
21 Exhibits Nos. 134-141, 141A,  
22 142, 143, were received in  
23 evidence.)

24 MS. CURRAN: Judge Farrar, there is a  
25 clarification on the exhibits that maybe we should

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1 make right now.

2 CHAIRMAN FARRAR: Okay.

3 MS. CURRAN: And let me ask it of Dr.  
4 Resnikoff.

5 BY MS. CURRAN:

6 Q Dr. Resnikoff, when you prepared exhibit  
7 141A, which are your new calculations, did you intend  
8 those to replace the calculations in exhibit 141?

9 A Yes.

10 Q So, in effect, exhibit 141 is in the  
11 record for purposes of completeness, but has been  
12 superseded by exhibit 141A.

13 CHAIRMAN FARRAR: You can say yes.

14 THE WITNESS: Yes, Your Honor.

15 MR. NELSON: If I may ask for a  
16 clarification? 141 is still important, it is not  
17 completely superseded, because all the descriptions of  
18 his methodology and his calculations are contained in  
19 that document.

20 So only where the errors in the  
21 calculation are corrected in the tables, you are  
22 saying those supersede the data that is there, is that  
23 correct?

24 MS. CURRAN: Yes.

25 CHAIRMAN FARRAR: All right.

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1 MS. CURRAN: And then I have one further  
2 question to ask Dr. Resnikoff.

3 BY MS. CURRAN:

4 Q Dr. Resnikoff, am I correct that when you  
5 amended your testimony on, the testimony that we filed  
6 on June 25th, that the amended testimony addresses new  
7 issues and concerns that came to your mind, in the  
8 course of the Proceeding regarding neutron doses, is  
9 that correct?

10 A Yes, that is correct.

11 Q And do you have anything that you would  
12 like to add to that?

13 A Well, 141, when I calculated 141, it only  
14 had the gamma doses. And 141A has neutron doses.  
15 However, as I reviewed Dr. Redmond's testimony, I  
16 noticed that there was one component of neutron doses  
17 that I had omitted, and did not put into 141A.

18 And that is the photons that are produced  
19 by neutrons. I neglected to include that part, which  
20 is important when you get out to the fence post. It  
21 becomes more important than a direct neutron dose.

22 That component, I neglected to include  
23 that in 141A, unfortunately. And one needs to use  
24 Monte Carlo analysis to do that kind of analysis.

25 Q So you haven't calculated an additional

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1 dose for the photons?

2 A I have not.

3 Q But can you give us a sense of the  
4 significance of the contribution to the dose?

5 A Reviewing Dr. Redmond's testimony at the  
6 boundary it looks like that component is about double  
7 the direct neutron dose.

8 Q So, for instance, you have, I believe in  
9 exhibit 141A, you have a total estimated dose of 117  
10 milli-REMs per year?

11 MR. NELSON: Excuse me, Your Honor, I  
12 would just like to clarify whether this is part of the  
13 amendment to his direct pre-filed testimony, or  
14 whether this is a further amendment to the  
15 calculation?

16 I'm a little unclear, procedurally, what  
17 is going on.

18 MS. CURRAN: This is a further amendment  
19 to the testimony, which we felt it was appropriate to  
20 put in at this point, so that the other parties could  
21 question Dr. Resnikoff about it, instead of waiting  
22 until further on to bring it up.

23 CHAIRMAN FARRAR: That is fine, go ahead.

24 MR. NELSON: Is that reflected in the  
25 written testimony, what you are asking him about now?

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1 What you are asking him about now is it reflected in  
2 your written testimony that you filed on June 25th?

3 MS. CURRAN: No.

4 CHAIRMAN FARRAR: As I understood what she  
5 just said, this is a further amendment, beyond the  
6 written amendment.

7 MS. CURRAN: That is right.

8 BY MS. CURRAN:

9 Q So what I wanted to ask you, Dr.  
10 Resnikoff, was if you could give us some numerical  
11 sense of how that might change your dose estimate of  
12 117 milli-REMs per year?

13 MR. NELSON: Objection. He testified that  
14 he didn't calculate it, that he couldn't calculate it.  
15 This is purely speculation.

16 MS. CURRAN: Well, I think --

17 CHAIRMAN FARRAR: Well, let's --

18 MR. NELSON: She asked him a question, I  
19 apologize, she asked him a question about whether he  
20 had done the calculation, whether he could do it. He  
21 indicated he could not, because it was a Monte Carlo  
22 simulation, as I recall his testimony.

23 CHAIRMAN FARRAR: Well he indicated in his  
24 written testimony, or --

25 MR. NELSON: Right here on the stand.

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1 CHAIRMAN FARRAR: Just now, okay.

2 MR. NELSON: And then she said, well,  
3 basically could you estimate that? And he has already  
4 testified he has no quantitative basis for doing that.  
5 So it is clearly an answer that calls for speculation,  
6 that is beyond his area of expertise. He says he has  
7 not, and cannot calculate that.

8 CHAIRMAN FARRAR: Then let's ask that  
9 question first, let's clarify that if, in fact, there  
10 is a suggestion that he can't do this before we find  
11 out what the answer is, let's ask him how it is he now  
12 can do that.

13 BY MS. CURRAN:

14 Q Dr. Resnikoff, how is it that you are able  
15 to give us a sense of the significance of this dose  
16 contribution?

17 A I'm glad these questions are repeated  
18 twice, it gives me time to think about it.

19 I'm basing my answer on Dr. Redmond's  
20 calculations, which use Monte Carlo Analysis. That is  
21 how I would make a qualitative judgement as to what  
22 the increase would be if I had a neutron-to-gamma dose  
23 contribution.

24 MR. NELSON: So, as I understand what you  
25 are saying, you have no independent basis for making

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1 that assessment, you've done nothing yourself, is that  
2 correct?

3 THE WITNESS: I'm relying on Dr. Redmond's  
4 testimony for that, for his calculations, yes.

5 MR. NELSON: My objection still stands.

6 CHAIRMAN FARRAR: I understand, but it is  
7 overruled, we will permit the answer, with the  
8 understanding of how the answer about to be given was  
9 derived, we will overrule the objection.

10 And now, if you remember Ms. Curran's  
11 original question you may answer.

12 THE WITNESS: I do, Your Honor. The  
13 direct gamma dose that I calculated was 117,  
14 approximately 118 milli-REMs a year. The neutron  
15 contribution, direct neutron contribution that I  
16 calculated was on the order of 11 milli-REMs a year.

17 The additional contribution, looking at  
18 Dr. Redmond's ratio of direct neutron to neutron  
19 photon, I would estimate that component is an  
20 additional 22 milli-REMs a year.

21 In other words, that the dose I  
22 calculated, the 128, would be 150 milli-REMs a year,  
23 on that order. That is the total dose, adding in all  
24 the components.

25 MR. TURK: Bottom line number 150 milli-

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1 REMs per year?

2 THE WITNESS: Yes.

3 MS. CURRAN: Thank you. Dr. Resnikoff is  
4 available for cross examination.

5 CHAIRMAN FARRAR: Mr. Nelson, how long do  
6 you think you will need?

7 MR. NELSON: A couple of hours, Your  
8 Honor.

9 CHAIRMAN FARRAR: A couple of hours?

10 MR. NELSON: Yes.

11 CHAIRMAN FARRAR: Mr. Turk?

12 MR. TURK: Several hours, unless my areas  
13 are covered by the Applicant. I think we should be  
14 able to conclude by noon tomorrow, without any  
15 trouble.

16 CHAIRMAN FARRAR: Okay.

17 MS. CHANCELLOR: Could we get some  
18 clarification, conclude what by noon tomorrow?

19 MR. TURK: I think the witness, including  
20 -- well, I don't know how much redirect. Your Honors  
21 know that I have submitted a cross examination plan,  
22 you can see the scope of it.

23 CHAIRMAN FARRAR: If your expressions are  
24 an indication you think several hours is too long, my  
25 colleagues and I will be talking during lunch. But

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1 this is just trying to get an out of bound worse case  
2 analysis of the cross.

3 If we finish the witness by noon tomorrow  
4 where are we then?

5 MR. GAUKLER: We do have some rebuttal,  
6 limited rebuttal, but we do have some.

7 CHAIRMAN FARRAR: And that would be by?

8 MR. GAUKLER: That would be by Dr.  
9 Redmond, and also we may have some rebuttal by Mr.  
10 Donnell with respect to the many assertions made by --  
11 sort of lack of information of the site.

12 CHAIRMAN FARRAR: Mr. Donnell has been  
13 doing an excellent job of being here, and not being in  
14 the hot seat.

15 MS. CURRAN: We also expect to have some  
16 rebuttal.

17 MR. TURK: May I make a very limited  
18 observation?

19 CHAIRMAN FARRAR: Yes.

20 MR. TURK: I don't mean this in any  
21 negative way, but if Dr. Resnikoff's bottom line, as  
22 he just indicated, is 150 milli-REMs, if Your Honors  
23 are prepared to make a legal ruling on whether that  
24 establishes anything under the regulations, maybe we  
25 don't need to do any cross examination at all.

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1                   Because if we are not going to exceed the  
2                   5 REMs, then do we even need to go into depth in the  
3                   testimony?

4                   MS. CURRAN: We, of course, think that it  
5                   is not quite as simple as that, and would object.

6                   CHAIRMAN FARRAR: Before I answer that let  
7                   me -- so if we finish the witness by noon, that is  
8                   Wednesday, and that is when we were supposed to have  
9                   Dr. Stamatakos.

10                  So would we get Dr. Stamatakos and the  
11                  rebuttal done on Wednesday? The rebuttal of Dr.  
12                  Resnikoff, how long Stamatakos?

13                  MR. TURK: Eight pages of pre-filed, very  
14                  limited areas. Incidentally, I will hand you a copy  
15                  this afternoon, if that would help.

16                  CHAIRMAN FARRAR: Okay.

17                  MS. CHANCELLOR: As I mentioned, Your  
18                  Honor, it is going to take quite some time to go  
19                  through Dr. Stamatakos' testimony. I thought our goal  
20                  was to try and finish radiation doses by lunch time  
21                  tomorrow, but now we are suggesting that we are just  
22                  going to get through with Dr. Resnikoff by lunch time  
23                  tomorrow, and that is going to put the schedule, with  
24                  respect to Dr. Stamatakos behind.

25                  CHAIRMAN FARRAR: Then we want Bartlett on

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1 Thursday?

2 MR. GAUKLER: That is correct, Your Honor.

3 CHAIRMAN FARRAR: And what is Friday?

4 MR. GAUKLER: Right now some limited  
5 rebuttal by Dr. Cornell.

6 MS. CHANCELLOR: I'm not sure how long Dr.  
7 Bartlett will take on his issues. Do you have a  
8 sense?

9 MR. GAUKLER: My sense is that a couple of  
10 hours from me for cross examination of Dr. Bartlett.  
11 I don't think we should have any problem getting done  
12 with Dr. Bartlett on Thursday, in my sense. Which will  
13 leave Friday for whatever rebuttal there may be on E,  
14 which I don't expect that much.

15 And I'm going to try to pre-file something  
16 by Dr. Cornell, by Thursday, so it will make it go  
17 faster, too.

18 MS. CHANCELLOR: At this time we don't  
19 anticipate rebuttal by Dr. Bartlett.

20 CHAIRMAN FARRAR: Suppose we didn't get to  
21 Stamatakos and Arabasz Wednesday afternoon, are they  
22 available later in the week?

23 MR. TURK: Dr. Stamatakos has  
24 responsibilities at home that would keep him from  
25 staying here the whole week. Therefore we had tried

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1 to make it so that he can be examined Wednesday,  
2 possibly carry over to Thursday, and be able to go  
3 home Thursday evening.

4 CHAIRMAN FARRAR: He is not here, right?

5 MR. TURK: He is leaving Thursday, late  
6 afternoon.

7 CHAIRMAN FARRAR: He is from somewhere  
8 else?

9 MR. TURK: He is from Texas.

10 CHAIRMAN FARRAR: Right.

11 MR. TURK: And he is on the plane, right  
12 now, he will be here for testimony tomorrow.

13 MS. CHANCELLOR: That all seems to hinge  
14 on how long it is going to take with Dr. Resnikoff.

15 MS. CURRAN: We would just really ask that  
16 the Staff and the Applicant coordinate their efforts,  
17 because it seems to me that a couple of hours is  
18 sufficient here, as long as there is not a whole lot  
19 of repetition of the questions, we should be able to  
20 get a lot done.

21 MR. NELSON: Quite frankly my couple hour  
22 estimate is based on my concern about, it is a two way  
23 street, how the witness responds. If things go fast  
24 it could be an hour and a half.

25 CHAIRMAN FARRAR: All right, let me

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1 consult with my colleagues, here.

2 MR. GAUKLER: May I just make one  
3 suggestion, Your Honor? We will know much more by the  
4 end of the day. We will certainly be through with our  
5 cross, and Mr. Turk will know, based on our cross, how  
6 much he has left.

7 So I think we are going to be in a much  
8 better position, by the end of the day, exactly where  
9 we are at.

10 CHAIRMAN FARRAR: Right. Give me a minute  
11 here.

12 (Pause.)

13 CHAIRMAN FARRAR: We've thought about the  
14 suggestion that we do a legal argument, which might  
15 turn into a mini, partial summary disposition. And we  
16 are uncomfortable with our ability to be sure we get  
17 that right.

18 And Ms. Curran, on your representation  
19 that it is more complicated than it may seem, we will  
20 proceed on the basis of that representation, since you  
21 like being new to the case. You, unlike the other  
22 lawyers in front of us, have not made numerous  
23 representations.

24 MR. NELSON: I think that goes for me,  
25 too, Your Honor.

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1 CHAIRMAN FARRAR: Again, for the benefit  
2 of the audience, that has to do not with anything  
3 substantive, but with the woefully inadequate  
4 suggestions about how long this case would take.

5 So let's proceed on that basis. We will,  
6 my colleagues and I, will talk over lunch about the  
7 cross examination plans that have been sent to us,  
8 with an eye toward making sure we do our part to keep  
9 this on track, because we are going to finish seismic  
10 this week, because there is no coming back.

11 JUDGE LAM: I do want to urge Ms. Curran  
12 to keep Mr. Turk's theory in mind. If Mr. Turk is  
13 correct, I emphasize if, if he is correct, if 5 REM is  
14 what the regulation require, and with Dr. Resnikoff's  
15 latest revision to be 150 milli-REM, then the  
16 Proceeding should go quickly.

17 MS. CURRAN: Let me just throw one thing  
18 into the pot before you go to lunch which is, I think,  
19 the 64,000 dollar question, how long does the accident  
20 last. And that has not been established here.

21 JUDGE LAM: Okay, thank you.

22 CHAIRMAN FARRAR: All right. Then it is  
23 almost 10 after 12, let's come back at 1:15, and we  
24 will start with the Applicant's cross examination of  
25 Dr. Resnikoff.

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1 (Whereupon, at 12:08 p.m. the above-  
2 entitled matter was recessed for lunch until 1:18  
3 p.m.)

4 CHAIRMAN FARRAR: On the record.

5 This afternoon we had indicated, I think  
6 last week, that we had decided on the post-hearing  
7 filings, that that would be the eight weeks for the  
8 opening and five weeks for reply. The way we've  
9 worked that out, if you will take this down and let  
10 your colleagues know, we will give you this Friday  
11 off. We will start the clock ticking on Monday, July  
12 8th, which means that eight weeks would be up on  
13 Friday, August 30th. That's the Friday before Labor  
14 Day weekend. Then we would give you, start the  
15 replies on, in effect, Labor Day, would give you the  
16 extra day. So your replies would be due on Monday,  
17 October 7th. Then under the Commission's policy where  
18 they urge us to get our decisions out in 60 days, that  
19 would leave us looking at Thursday, December 5th as a  
20 date that we would strive mightily to reach.

21 MS. CHANCELLOR: Judge Farrar, have you  
22 set a date for oral argument? I was trying to plan  
23 vacation for October.

24 CHAIRMAN FARRAR: We had once talked about  
25 oral argument. We have not talked about since. I

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1 would anticipate, if we had it, it would, of course,  
2 be after October 7th.

3 As the record has gotten more and more  
4 fully developed, we are less enamored of the idea of  
5 oral argument than we once were. So, Ms. Chancellor,  
6 why don't you plan your vacation whenever you want.

7 MS. CHANCELLOR: Good. I think I'll  
8 collapse, Your Honor.

9 (Laughter.)

10 CHAIRMAN FARRAR: If we had to have oral  
11 argument on a narrow facet of the case, I would think  
12 that would be something we could do by a  
13 videoconference at a time that was convenient to  
14 everybody, rather than drag you out here or us there  
15 for a narrow purpose.

16 MS. CHANCELLOR: Thank you.

17 CHAIRMAN FARRAR: What happened with the  
18 document?

19 MS. CHANCELLOR: We've decided to forgo  
20 asking any questions, and there won't be any need to  
21 bring Mr. Waters back for that purpose.

22 CHAIRMAN FARRAR: Okay, thank you.

23 Then we are ready to begin the Applicant's  
24 cross examination of Dr. Resnikoff. Go ahead, Mr.  
25 Nelson.

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1 CROSS EXAMINATION BY MR. NELSON

2 MR. NELSON: Good afternoon, Mr.  
3 Resnikoff. My name is Blake Nelson, and I'm an  
4 attorney representing PFS in this proceeding. I will  
5 be asking you some questions today with respect to  
6 what has been identified as Section E of Utah  
7 Contention L/QQ on the radiological dose consequences  
8 of the seismic exemption.

9 But what I would like to start off with,  
10 and this will be deviating from my cross examination  
11 plan, just before broke Ms. Curran indicated that in  
12 her view the \$64,000 question for us was how long an  
13 accident would last. So I did a few calculations over  
14 lunch based on your testimony before we broke.

15 Isn't it right that if one were to assume  
16 that the 5 rem dose were the correct dose, the correct  
17 regulatory limit to apply, as an assumption, that even  
18 taking all factors that you put into your calculation,  
19 the neutron dose, the gamma dose, and the additional  
20 dose that you added today, that came up to 150  
21 millirem per year? If my math is correct, 5,000  
22 millirem, which is the 5 rem dose, divided by the 150  
23 millirem that you came up as your maximum amount in  
24 your rough calculation, that translates to 33.3 years,  
25 is that not correct?

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1 DR. RESNIKOFF: Under the premises under  
2 your assumptions, yes. I'm not agreeing that those  
3 are the only dose contributions.

4 MR. NELSON: Okay, I understand, but based  
5 on what you have presented, that's correct?

6 DR. RESNIKOFF: Yes.

7 MR. NELSON: In your Exhibit 141A on page  
8 4, just as a last follow-up question to that, you  
9 indicated that your concern was that the 50-year dose,  
10 based on your calculations would be 6.4 rem, which is  
11 above the EPA's Protective Action Guide of 5 rem, is  
12 that correct?

13 DR. RESNIKOFF: That's right, except for  
14 this addition --

15 MR. NELSON: Addition, okay, so it would  
16 go down a little bit, or it would go up a little bit?

17 DR. RESNIKOFF: That's right.

18 MR. NELSON: All right, thank you.

19 We're in the middle of the final week of  
20 seismic testimony in this proceeding. So there's been  
21 a fair amount of water in the bridge in terms of  
22 testimony presented on the seismic issues. I was just  
23 wondering, have you read all the prefiled testimony in  
24 this proceeding that relates to the concerns that you  
25 discuss in your testimony? That would include from

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1 any other State witnesses, from staff witnesses, from  
2 PFS witnesses.

3 DR. RESNIKOFF: I have primarily focused  
4 on radiation exposures, but I have looked at some of  
5 the other testimony. I have discussed it with some of  
6 the other State witnesses, but my focus has been on  
7 radiation dose consequences. I've also looked at, you  
8 know, the NRC testimony, of course.

9 MR. NELSON: Sure, I understand that, as  
10 it relates to radiological dose consequences. My  
11 question was a little bit broader in that you talk  
12 about tipover and those sorts of things. Have you  
13 read prefiled testimony relating to what's been called  
14 Section D. For example, on the State side, Dr. Kahn  
15 and Dr. Ostadan testified about cask stability. Have  
16 you read that prefiled testimony from the different  
17 parties?

18 DR. RESNIKOFF: I haven't read that  
19 testimony. As I said, I've discussed with them, and  
20 my assumption has been that the cask would tip over.

21 MR. NELSON: Okay, okay, that's fair  
22 enough. I also know you haven't been here on this  
23 issue until this week, but have you had an opportunity  
24 to review any of the hearing transcripts that relate  
25 to tipover issues or any of the issues that lead to

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1 your concerns about radiological doses?

2 DR. RESNIKOFF: I haven't reviewed any of  
3 the transcripts.

4 MR. NELSON: Okay, but you were here and  
5 you heard the testimony, the oral testimony, of Drs.  
6 Soler, Singh, and Redmond for PFS and Mr. Waters for  
7 the NRC?

8 DR. RESNIKOFF: Yes.

9 MR. NELSON: All right, and you filed  
10 amended testimony today on June 5th, is that correct?

11 DR. RESNIKOFF: Yes.

12 MR. NELSON: In that amended testimony you  
13 made some changes to your April 1st, 2002 prefiled  
14 testimony?

15 DR. RESNIKOFF: Yes.

16 MR. NELSON: Based on the discussions you  
17 have had with other witnesses, based on reading the  
18 testimony, the written testimony, and listening to  
19 what you heard here when you have been here, to the  
20 extent that you've heard about what else has gone on  
21 in the proceeding, are there any further changes that  
22 you think need to be made to your testimony in light  
23 of any evidence that's come out in this proceeding so  
24 far?

25 DR. RESNIKOFF: Yes, and that is the

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1 exposures that were mentioned in Exhibit 141A that are  
2 indicated there relate to the dose from the bottom of  
3 the cask. There's this other issue involving cask  
4 heatup of casks lying on their side and what effect  
5 that would have on radiation exposures. That hasn't  
6 been taken into account in Exhibit 141A, and I haven't  
7 taken it into account either in my calculations.

8 MR. NELSON: Okay, all right. But you  
9 did do, in your first Exhibit 141, you did a  
10 calculation of the effect just by itself of that  
11 heatup, isn't that correct?

12 DR. RESNIKOFF: Yes.

13 MR. NELSON: Just as curiosity, if you  
14 think that needs to be incorporated somehow into an  
15 overall dose, how come you didn't include that?  
16 Because I see you did, if I'm not mistaken, you did  
17 add in, when you redid your calculation, you did add  
18 in neutron doses, right, in 141A? You didn't have  
19 that in your original 141. So is that correct?

20 MS. CURRAN: Excuse me. I don't want to  
21 interrupt, but I don't think Dr. Resnikoff has the  
22 exhibits.

23 MR. NELSON: Oh, please, by all means.

24 DR. RESNIKOFF: I was gesturing.

25 (Laughter.)

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1 MR. NELSON: So I think my question was,  
2 you did add an additional neutron dose in your 141A,  
3 correct?

4 DR. RESNIKOFF: That's correct.

5 MR. NELSON: If you thought that there was  
6 an additional dose to be added due to the issues that  
7 you had already calculated in regard to your analysis  
8 of loss of shielding due to casks heating up, how  
9 come, along as you were filing an amended exhibit, you  
10 didn't tack that on as well?

11 DR. RESNIKOFF: Well, that's an excellent  
12 question. Essentially, I ran out of time.

13 MR. NELSON: Okay.

14 DR. RESNIKOFF: That's an excellent  
15 question.

16 MR. NELSON: Okay. So it is labeled as a  
17 rough calculation, so it's a little bit more rough  
18 than you would like it to be? Is that a fair  
19 characterization?

20 DR. RESNIKOFF: Yes, it's rough.

21 MR. NELSON: What I would like to do is  
22 start y having you look at Answers 11 and 13 of your  
23 amended direct testimony. Is it an accurate  
24 understanding of your testimony that you are concerned  
25 that the radiological dose consequences of a

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1 seismically-induced accident at the PFS site may  
2 exceed the regulatory requirements of 10 CFR Section  
3 72.104(a) and that is what raises the concerns that  
4 you addressed in Answers 11 and 13?

5 DR. RESNIKOFF: This contention has a long  
6 history. I'm, frankly, not familiar with all the  
7 nuances, but I was directed to estimate what the  
8 radiation consequences are, if there's an accident,  
9 and to do that, in view of 72.104(a).

10 MR. NELSON: Okay, so you were directed to  
11 --

12 DR. RESNIKOFF: By counsel to do that  
13 calculation.

14 MR. NELSON: So that wasn't your  
15 independent decision to compare that to 72.104(a)?  
16 You were directed by counsel to do that?

17 DR. RESNIKOFF: Yes, because it was my  
18 understanding that that's the initial contention that  
19 was filed. So I looked at with regard to 72.104(a),  
20 and -- okay, that's my answer.

21 MR. NELSON: Okay. Now is it your  
22 understanding, with that caveat, is it your  
23 understanding -- and I'm not asking you for a legal  
24 interpretation -- is it your understanding that 10 CFR  
25 Section 72.104(a) relates to dose limits for normal

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1 operating conditions at an ISFSI?

2 DR. RESNIKOFF: That's my understanding.

3 MR. NELSON: Okay.

4 DR. RESNIKOFF: That's my present  
5 understanding.

6 MR. NELSON: Okay, fair enough. Are you  
7 aware that the NRC has separate regulations that  
8 specifically address radiological limits in the event  
9 of an accident at an ISFSI?

10 DR. RESNIKOFF: Yes.

11 MR. NELSON: And do you know whether that  
12 regulation that discusses those radiological dose  
13 limits for an accident at an ISFSI is 10 CFR Section  
14 72.106(b)?

15 DR. RESNIKOFF: Yes.

16 MR. NELSON: That's, "Yes, that is."?

17 DR. RESNIKOFF: Yes, that is.

18 MR. NELSON: Okay. You heard Mr. Waters  
19 testify today and yesterday that the NRC staff  
20 evaluates the acceptability of radiological doses for  
21 a seismic event at an ISFSI, a Part 72 facility, using  
22 the standards in 10 CRF 72.106(b) because a seismic  
23 event is considered an accident condition, is that  
24 correct?

25 DR. RESNIKOFF: That's correct. That's

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1 what I heard.

2 MR. NELSON: Do you think that the NRC  
3 staff would be in the best position to determine the  
4 appropriate radiological dose standards to apply in a  
5 seismically-induced event?

6 MS. CURRAN: Objection. Asking for a  
7 legal conclusion.

8 MR. NELSON: I'm just asking what his view  
9 is. I'm not asking for a legal conclusion.

10 CHAIRMAN FARRAR: Overruled. You may  
11 answer.

12 DR. RESNIKOFF: Could you repeat that  
13 question?

14 MR. NELSON: I think I said, don't you  
15 think that the NRC staff would be in the best position  
16 to determine what the appropriate radiological dose  
17 standards would be in the wake of the seismically-  
18 induced event, or what would apply to that, the dose  
19 standards at an ISFSI that had experienced the seismic  
20 event?

21 DR. RESNIKOFF: Wait a minute. I'm not  
22 sure I have an opinion.

23 MR. NELSON: Well, perhaps I should have  
24 just had it read back because it was --

25 DR. RESNIKOFF: No, maybe I didn't hear it

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1 right the first time, but why wouldn't an applicant  
2 always ask that question of an intervenor that is on  
3 the staff who does this all the time? Aren't they the  
4 ones who are right? And then we wouldn't have to have  
5 hearings.

6 MR. NELSON: Sure, that's a very good  
7 point What I meant to say is -- I'll phrase it this  
8 way: You don't have any independent basis, your own  
9 opinion, for disagreeing with what Mr. Waters thinks  
10 the appropriate radiological dose limit should be?

11 DR. RESNIKOFF: I have an opinion about  
12 his interpretation of 72.106(b).

13 MR. NELSON: Do you disagree with his  
14 interpretation?

15 DR. RESNIKOFF: I do.

16 MR. NELSON: And in which regard? Do you  
17 disagree that 72.106(b) should apply to an earthquake?

18 DR. RESNIKOFF: No, I agree that that  
19 standard should apply. I just don't agree about his  
20 interpretation of it.

21 MR. NELSON: Okay, that's fair enough.

22 Now isn't it true that if you were to  
23 compare -- I sort of went through with you already,  
24 but if you were to compare the radiation doses that  
25 you generated, albeit they're rough doses, to the

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1 standard in 72.106(b), that is the 5 rem, that even  
2 from the scenario that you considered with the  
3 understanding that that might not take everything into  
4 account, but that in the scenario you considered in  
5 your Exhibit 141A your total dose was still less than  
6 5 rem set forth in 72.106(b), is that correct?

7 DR. RESNIKOFF: No, I don't agree with  
8 that. It depends on the length of the accident.

9 MR. NELSON: Okay. You agreed that,  
10 according to the 150 millirem, it would take you 33.6  
11 years to get up to 5 rem, correct?

12 DR. RESNIKOFF: I agree with that, except  
13 for that caveat that they may be other contributors.

14 MR. NELSON: Sure, but let's put it at one  
15 year. Let's say the accident lasts, however that's  
16 defined, lasts one year. Even with your dose rate  
17 that's calculated in Exhibit 141A, that would still be  
18 well under the 5 rem dose limit of 72.106(b), would it  
19 not?

20 DR. RESNIKOFF: If the accident lasted one  
21 year, would it be less than the 5 rem limit? That's  
22 likely.

23 MR. NELSON: Okay. All right, what I  
24 would like to go to is sort of understanding how your  
25 testimony fits in with other testimony that we have

1 heard in this proceeding. As I understand your  
2 testimony, your conclusions regarding what will happen  
3 at, or what may happen, I should say, at the PFS site  
4 are based, at least in part, on the State's testimony  
5 of Dr. Steven Bartlett and Dr. Ostadan on dynamic  
6 analysis and the State's testimony of Dr. Ostadan and  
7 Dr. Kahn on cask stability? Is that correct?

8 DR. RESNIKOFF: I'm not certain.

9 MR. NELSON: Okay.

10 DR. RESNIKOFF: I'm not intimately  
11 familiar with their testimony.

12 MR. NELSON: Okay, but you specifically  
13 reference their testimony explicitly in, if you could  
14 go along with me, look along and see if I'm correct  
15 here, Answer 6, Answer 8C, Answer 23, and Answer 24?  
16 Is that correct?

17 DR. RESNIKOFF: That's correct. My  
18 starting assumption was the casks tipover, and it is  
19 based on the discussion that we've had orally.

20 MR. NELSON: And in your testimony, when  
21 you calculate the dose rate increases due to a seismic  
22 event, as I read it, there are three mechanisms that  
23 you postulate can result in an increase in radiation  
24 dose rates, and those three are, one, cask tipover,  
25 which you just mentioned; two, casks sliding, and,

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1 three, cask uplift. Is that an accurate  
2 characterization? Actually, I should have said casks  
3 sliding and impacting one another, since otherwise  
4 there wouldn't be any effect to the cask from sliding.  
5 But are those the three mechanisms that you postulate  
6 can have adverse effects?

7 DR. RESNIKOFF: Yes.

8 MR. NELSON: Your concerns about these  
9 things occurring, the sliding with potential impact,  
10 the uplifting, and the tipover, those are all based,  
11 the idea that these things will happen or could happen  
12 are based on Dr. Kahn's testimony and analysis  
13 contained in the ALTRAN report, which has been  
14 previously marked as State Exhibit 122, is that  
15 correct?

16 DR. RESNIKOFF: I did look at the Kahn  
17 report. Again, my starting point is that the casks  
18 tip over, and I start from there. I've depended on  
19 the other State witnesses to affirm or deny that the  
20 casks tip over.

21 MR. NELSON: Okay. In regard to the  
22 ALTRAN report, I think perhaps you don't give yourself  
23 enough credit, and that you do a little bit more than  
24 just look at it. You specifically cite, Answer 24,  
25 "The ALTRAN report, State's Exhibit 122, concludes

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1 that the HI-STORM 100 casks will tip over under peak  
2 ground accelerations induced by a 2,000-year  
3 earthquake at the PFS facility. Even if the casks do  
4 not tip over, the casks may still slide approximately  
5 370 inches in the X direction and 230 inches in the Y  
6 direction and be uplifted 27 inches."

7 Did you write that?

8 DR. RESNIKOFF: Yes.

9 MR. NELSON: And that's your testimony?

10 DR. RESNIKOFF: Yes.

11 MR. NELSON: So that's based on the ALTRAN  
12 report, right?

13 DR. RESNIKOFF: Yes.

14 MR. NELSON: And so did you just -- it  
15 sounds like you did more than just look at it. How  
16 extensively did you look at the ALTRAN report?

17 DR. RESNIKOFF: I looked at it and cited  
18 it, but I'm not in a position to affirm or deny the  
19 conclusions. I simply used them in my analysis.

20 MR. NELSON: Do you know where -- well,  
21 actually, let's start with this simple question: So  
22 if your assumption that the casks will be subjected to  
23 that degree of sliding, 370 inches in the X direction,  
24 230 inches in the Y direction, and that they will be  
25 uplifted 27 inches, or that they will tip over, if

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1 those assumptions are incorrect, you have no basis for  
2 your analysis, is that correct?

3 DR. RESNIKOFF: That's right, I start from  
4 the assumption that the casks tip over.

5 MR. NELSON: And you have no independent  
6 basis for believing that the casks tip over other than  
7 the ALTRAN report, isn't that correct?

8 DR. RESNIKOFF: The ALTRAN report and our  
9 oral discussions, teleconferences that we've had.

10 MR. NELSON: Which would have been with  
11 Dr. Kahn, Dr. Bartlett and Dr. Ostadan?

12 DR. RESNIKOFF: Yes.

13 MR. NELSON: You don't have any  
14 independent basis of your own then, just what you've  
15 understood from other State witnesses?

16 DR. RESNIKOFF: That's right

17 MR. NELSON: Believe in them?

18 DR. RESNIKOFF: That's right.

19 MR. NELSON: In your testimony in Answer  
20 13 you state, "A non-mechanistic tipover analysis is  
21 no longer acceptable because the HI-STORM 100 casks  
22 will likely tip over under peak ground accelerations  
23 for a 2,000-year mean annual return period  
24 earthquake." Did I read that correctly?

25 DR. RESNIKOFF: Yes.

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1 MR. NELSON: And, again, as you said, this  
2 conclusion is based on the results of the ALTRAN  
3 report and discussions you've had with State  
4 witnesses?

5 DR. RESNIKOFF: Yes.

6 MR. NELSON: Are you aware of the various  
7 analyses and simulations that Holtec has performed to  
8 determine whether a cask would tip over during a  
9 2,000-year earthquake, a 10,000-year earthquake, under  
10 a variety of different conditions such as maximizing  
11 natural frequency responses in their models, looking  
12 at pad-to-pad interaction, those sorts of things? Are  
13 you aware of any of those analyses?

14 MS. CURRAN: Objection. I don't think Dr.  
15 Resnikoff is being asked to testify here on other  
16 portions of the case including the Holtec testimony.  
17 I guess I would like to know how far into that field  
18 we're getting because it seems to me to be beyond the  
19 scope of this hearing.

20 MR. NELSON: May I respond?

21 CHAIRMAN FARRAR: Sure.

22 MR. NELSON: Well, the simple response is  
23 I'm just exploring his basis, but, more importantly,  
24 this basis is essential to develop because, well,  
25 first of all, I just cited, I think, five answers

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1 where he specifically references the testimony of  
2 other people. Additionally, throughout his testimony  
3 there are assumptions based on the testimony of other  
4 witnesses. I'm exploring his basis for his  
5 understanding of how he should go about calculating  
6 the radiological dose.

7 Because what kind of radiological doses he  
8 comes up with depends on what happens to the casks.  
9 If they don't tip over -- I'm not going to ask him  
10 about these analyses to any degree simply because he  
11 doesn't have the expertise and has not been proffered  
12 as an expert in that area, but I think it's  
13 fundamental to understanding the basis of his  
14 testimony about radiological doses what he bases that  
15 testimony on.

16 MS. CURRAN: May I just respond briefly?

17 MR. TURK: And I'd like to be heard at  
18 some point also, Your Honor.

19 MS. CURRAN: I think Dr. Resnikoff stated  
20 quite clearly that he relied on the testimony and the  
21 opinions of the other State witnesses and that was the  
22 basis for his dose analysis. So I don't see what it  
23 benefits us to get into issues of whether he reviewed  
24 Holtec's testimony in Section D of the contention.

25 MR. NELSON: And if I may jump in, it goes

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1 to the basis of the opinion, whether the opinion is  
2 credible, whether the person actually looked at  
3 potential contrary views to determine whether or not  
4 his analysis was accurate and reflective of conditions  
5 that were likely to exist. If they want to stipulate  
6 that his analysis isn't reflective of anything that's  
7 likely to exist, that would be great.

8 (Laughter.)

9 CHAIRMAN FARRAR: I'll hear you in a  
10 minute, Mr. Turk, but the way I understand these  
11 things usually work, particularly on an issue this  
12 complicated, is one witness relies on what another  
13 witness says, particularly if the witness is not  
14 skilled in that area, and we assume that his opinion  
15 may stand or fall with the validity of those other  
16 witnesses' testimony. In other words, if the other  
17 State witnesses say the casks are going to fall down  
18 and he bases his calculation on that, and it turns out  
19 we hold that they're not going to fall down, then his  
20 calculations are out the window. So I'm not sure what  
21 it helps to get him to concede a great length what we  
22 would have assumed is the case already.

23 Before you respond, let me hear from Mr.  
24 Turk who's been watching the tennis match.

25 (Laughter.)

1 MR. TURK: And maintaining silence.

2 (Laughter.)

3 I think it is an important point. You may  
4 have noticed that my cross examination claimed there  
5 are numerous questions that go to the same line; that  
6 is: What's anticipated? What's the design basis?  
7 What's beyond the design basis? Does he make  
8 statements based on his own determinations or based  
9 solely upon the testimony of other witnesses for the  
10 State?

11 There are two issues. First, Dr.  
12 Resnikoff has today indicated that he starts with an  
13 assumption that the casks tipped over. That's not  
14 what his testimony says. His testimony talks about  
15 cask tipover being likely, and he cites to the ALTRAN  
16 report and to testimony of other people in that  
17 regard. I think it is very fair to establish with  
18 respect to credibility, is the testimony of this  
19 witness careful, thoughtful, and credible or not?  
20 That's the first question for which this relates. I  
21 think Mr. Nelson made that point, that credibility is  
22 an issue.

23 But, secondly, I think it's important that  
24 we establish what type of event are we looking at  
25 here. Is it an accident or is it a normal condition?

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1 Is it a reasonable accident to postulate will occur  
2 during the lifetime of the facility or is it something  
3 that's design basis or is it something beyond design  
4 basis?

5 Although today he seems to be indicating  
6 he's merely starting with a hypothetical assumption,  
7 his written testimony does not do that. I think,  
8 unless the State stipulates that any references in the  
9 testimony are meant to do nothing more than to  
10 establish an assumption on his part, we have to  
11 examine on it.

12 CHAIRMAN FARRAR: Ms. Curran?

13 MS. CURRAN: I'm just really amazed here  
14 because I guess you summed it up for me, Judge Farrar,  
15 that Dr. Resnikoff is entitled to rely on testimony by  
16 other State witnesses in areas where he doesn't have  
17 the expertise to reach an opinion. His job was to  
18 start with the assumption that the casks tipped over  
19 and then to do a radiation analysis. I don't think  
20 that affects his credibility.

21 All the discussion that we have had here  
22 about what's design basis and beyond design basis also  
23 to me seems like a lot of obfuscation because the  
24 issue, I think, in this contention is what earthquake  
25 is design basis. That is what we are trying to decide

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1 in this contention. So to say something is beyond  
2 design basis begs the question. That's what the  
3 purpose of this contention is, as I understand it.

4 MR. NELSON: If I may briefly be heard,  
5 first, credibility is always at issue. This is not  
6 going into his knowledge of how these things, how the  
7 other analyses were calculated. What it goes to is  
8 whether someone as a credible scientist looks at all  
9 available data or whether they only look at the data  
10 that they want to look at.

11 Second --

12 CHAIRMAN FARRAR: Well, now we've talked  
13 about the data he wants to look at. Is that in doing  
14 calculations of consequences or is that in doing the  
15 job the State I think hired him to do? In other  
16 words, if someone is a scientist, isn't it  
17 permissible, and not a challenge to the person's  
18 credibility, to say, "We're going to give you a  
19 situation and we want you to analyze it."?

20 And just like a lawyer asks a witness a  
21 hypothetical question, you say the State hires him and  
22 says, "We're going to have witnesses who are going to  
23 say the following. If that 'following' happens, we  
24 want you to tell us what the radiological dose  
25 consequences are." How does that impugn his

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1           credibility or his wisdom as a scientist to say, "Yes,  
2           pay me some money. I'll give you that answer, and  
3           I'll do my best in performing the calculation you ask  
4           me to perform."

5                       MR. NELSON: Here's the problem I have:  
6           Dr. Resnikoff goes well beyond the ALTRAN report in  
7           what he asserts will happen. In Answer 13 he says,  
8           "It's likely that casks will tip over." In another  
9           answer, if I can go through, I can give you three,  
10          four, five answers where he says specifically in at  
11          least two of those answers the casks will tip over.  
12          The ALTRAN report does not say that. Dr. Kahn's  
13          testimony did not say that. He makes that assertion.  
14          If they want to strike that testimony, that's fine.

15                      He also says they will likely turn over,  
16          tip over. The ALTRAN report does not say that. Dr.  
17          Kahn has not said that. Dr. Ostadan has not said  
18          that. Dr. Bartlett has not said that.

19                      He makes assertions well beyond anything  
20          that is contained in those reports. Now we don't want  
21          any discussion of his basis for making those  
22          assertions? I think that's patently unfair.

23                      Second of all --

24                      CHAIRMAN FARRAR: Let's look at that  
25          Answer 13 you just referred to, that sentence with the

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1 "likely tip over." You wouldn't be making your  
2 argument if that sentence said, "However, since  
3 according to the testimony of so-and-so, the casks  
4 might tip over. I, therefore, make the following  
5 calculation."?

6 MR. NELSON: He wants you to believe --

7 CHAIRMAN FARRAR: Is that what's likely --

8 MR. NELSON: But, yes, you're correct,  
9 there's a qualitative difference.

10 CHAIRMAN FARRAR: If that sentence were  
11 phrased otherwise, you wouldn't be making this  
12 argument?

13 MR. NELSON: Well, certainly not --

14 CHAIRMAN FARRAR: Ms. Curran, let's focus  
15 on that particular sentence which does not cite the  
16 testimony of other witnesses, but it appears to be  
17 stating his own conclusion.

18 MS. CURRAN: Dr. Resnikoff, would you be  
19 willing to stipulate in your Answer 13 that for your  
20 statement that the tasks will likely tip over you  
21 relied on testimony of other witnesses by the -- does  
22 that resolve that?

23 CHAIRMAN FARRAR: Dr. Resnikoff, don't  
24 answer until I hear from the other side whether they  
25 like Ms. Curran asking this question, which I can tell

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1 their prior language they don't.

2 MR. NELSON: Unfortunately, I don't like  
3 it for several reasons. First of all, there are  
4 numerous places -- if you turn to Answer 24, about  
5 midway through the paragraph, "Under these conditions  
6 the casks will slide and collide with each other." In  
7 other places he says the casks will tip over; the  
8 casks will uplift 23 inches. This testimony is full  
9 of these assertions.

10 CHAIRMAN FARRAR: How about --

11 MR. NELSON: I'm sorry.

12 JUDGE LAM: How about a stipulation  
13 regarding any sliding, any tipping over, any flying  
14 casks would be somebody else's opinion?

15 MR. NELSON: If he is saying that, if they  
16 will stipulate that the only thing he relied on was  
17 the State -- but here's the fundamental problem with  
18 that as well: The ALTRAN report does not say the  
19 casks will tip over. Dr. Kahn did not say -- he can't  
20 rely on anyone for that because they didn't make the  
21 statement. If they had, that would be simple, but  
22 they didn't. It's not on the record, and this would  
23 put it on the record.

24 CHAIRMAN FARRAR: I've been talking to you  
25 all for a long time. Let me talk to the people who

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1 really matter.

2 (Laughter.)

3 JUDGE LAM: I think we matter a little  
4 bit.

5 (Laughter.)

6 (Pause.)

7 CHAIRMAN FARRAR: Based on the examples  
8 that have been pointed to us, the objection is  
9 overruled. There is room for some questioning here  
10 since there are instances where the basis for the  
11 answer doesn't seem to be just the testimony of other  
12 witnesses.

13 But we don't want to belabor this point.  
14 Mr. Nelson, we'll give you 15 minutes on this type of  
15 question, and then we'll move on to something else.

16 MR. NELSON: All right. So to simplify  
17 this, Dr. Resnikoff, is it correct that you have not  
18 looked at any other analysis other than your looking  
19 at the ALTRAN report and talking to Dr. Kahn and Dr.  
20 Ostadan? Is that accurate?

21 DR. RESNIKOFF: And did you said Dr.  
22 Bartlett, too?

23 MR. NELSON: To include Dr. Bartlett.

24 DR. RESNIKOFF: Yes, that's correct.

25 MR. NELSON: So everything in your

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1 testimony is based on those four things: the ALTRAN  
2 report and discussions with Dr. Kahn, Dr. Bartlett,  
3 and Dr. Ostadan?

4 DR. RESNIKOFF: Yes, and then there's some  
5 parts of the Holtec report that are cited, yes.

6 MR. NELSON: Okay. So you didn't look at  
7 any of the other cask stability analyses that were  
8 done by the staff or PFS?

9 DR. RESNIKOFF: I did not.

10 MR. NELSON: Okay. So, hypothetically --  
11 actually, to clear something up, for example, in  
12 Answer 24, where you make statements such as, "Under  
13 these conditions the casks will slide and collide with  
14 each other," what's your basis for that? Where did  
15 you get that conclusion?

16 DR. RESNIKOFF: That was my understanding  
17 based on the conversations that we've had.

18 MR. NELSON: And is it fair to  
19 characterize that when you say, for example, at the  
20 beginning of Answer 24, "The casks will tip over" or  
21 where you say things like, "It's likely that the casks  
22 will tip over," when you make those sorts of  
23 conclusionary statements, that was your understanding  
24 of conversations you had with the State witnesses?

25 DR. RESNIKOFF: That's right.

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