

1 Q. But you don't know of anything in his  
2 testimony that said that?

3 A. I don't know.

4 Q. You cite Lt. Col. Horstman for other  
5 answers in this answer, this answer 34. Do you  
6 have any other basis for those numbers?

7 MR. SOPER: Other than what appears in  
8 the answer, you mean? There's other references in  
9 the answer.

10 Q. Yes, other than the numbers that are --  
11 that have specific references tied to them, for the  
12 numbers other than that you cite Lt. Col. Horstman,  
13 and I was wondering whether you had any other basis  
14 for that.

15 A. I don't believe so.

16 Q. In question and answer 36 of your  
17 prefiled testimony you calculated an effective area  
18 for the proposed facility with respect to  
19 jettisoned ordnance, and you say you assumed a skid  
20 distance similar to that of an F-16 aircraft. Have  
21 you ever seen ordnance dropped or jettisoned from  
22 an F-16?

23 A. No.

24 Q. Have you ever seen ordnance dropped or  
25 jettisoned from any military aircraft?

1 A. No.

2 Q. Did the Air Force provide data to you  
3 that indicated that the ordnance would skid the  
4 same distance as a crashing F-16?

5 A. This again, there are two pieces to this  
6 statement, the skid distance and the impact angle.

7 Q. Well, I was asking about the skid  
8 distance.

9 A. Oh, okay. This involved again a  
10 discussion with Col. Horstman.

11 Q. Did he testify to that?

12 A. I don't know.

13 Q. Do you know of anything in his testimony  
14 that indicates that jettisoned ordnance will skid  
15 as far as a crashing F-16?

16 A. I don't know.

17 Q. Do you know what Lt. Col. Horstman's  
18 basis for that statement was?

19 A. I don't. I can relate to you the  
20 discussion that took place with Col. Horstman. It  
21 involved, when we first saw that PFS was assuming  
22 simply the facility footprint, we had to get  
23 further information about, you know, whether there  
24 was a shadow, whether there was a skid distance,  
25 because all of those would enlarge the area, the

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1 effective area. And so therefore we had --  
2 therefore we called him up and said -- we asked him  
3 the question about it, and this is the way that it  
4 resulted.

5 Q. And you say "we." Did you speak to  
6 Lt. Col. Horstman?

7 A. Yes.

8 Q. Was that --

9 A. Well, myself and my associate were on  
10 the phone.

11 Q. And what did he say you should use for a  
12 skid distance?

13 A. The same as the aircraft.

14 Q. Is that documented anywhere, in e-mail  
15 or anything like that?

16 A. I don't believe so. This was a  
17 telephone conversation. I can check my e-mails,  
18 which we don't often retain incoming e-mails, but I  
19 can check.

20 Q. Some we've received in discovery.  
21 That's why I was asking. I didn't recall seeing  
22 one like that.

23 JUDGE FARRAR: What's this science  
24 underlying this? Is this just a matter of physics  
25 that the ordnance has the same initial velocity as

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1 the airplane?

2 THE WITNESS: The same initial velocity,  
3 that's right. It has a different configuration.

4 JUDGE FARRAR: Right, but I --

5 THE WITNESS: So we needed to ask him  
6 about that.

7 JUDGE FARRAR: But the path the ordnance  
8 would take, isn't that a matter within your -- as  
9 much within your competence with elemental physical  
10 principles as it is what a pilot would know, or  
11 not? In other words, when I have a phone call with  
12 somebody and they tell me something, I usually try  
13 to figure out, is that, you know, what's their  
14 basis for telling me, or does that square with what  
15 I think I know rather than just say they told me  
16 that. I mean, somewhere in there, either in his  
17 end of the conversation or yours, should be  
18 something that allows us, or allows you to say to  
19 us it made sense to you.

20 THE WITNESS: I think the calculation  
21 would be quite complicated to actually do it.  
22 These have different configurations. You know, one  
23 has wings. You could think of 101 reasons why they  
24 would be different.

25 JUDGE FARRAR: Okay.

1 THE WITNESS: But the short part of it  
2 is, well, just call up Col. Horstman and ask him.

3 JUDGE FARRAR: I mean, if there's 101  
4 reasons why it's different, then I need at least  
5 one reason why it's similar, because that's what  
6 you said. Now, maybe the Air Force has a manual  
7 that lists all this so that pilots can be aware  
8 when they jettison something that they have some  
9 idea where it's going.

10 THE WITNESS: That's exactly what  
11 happened in our conversation is he described what  
12 happened when ordnance was dropped, having done  
13 that, you know, in the bombing range.

14 JUDGE FARRAR: Well, okay, fine.

15 MR. BARNETT: Your Honor, that's all we  
16 have.

17 CROSS-EXAMINATION

18 BY MS. MARCO:

19 Q. Hello. My name is Catherine Marco and  
20 I'm the attorney for the NRC Staff on this issue.  
21 Good afternoon?

22 A. Good afternoon.

23 Q. Have you ever prepared an estimate of  
24 the probability that an aircraft would crash into a  
25 nuclear facility?

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1 MR. SOPER: I assume you mean other than  
2 the instant case?

3 MS. MARCO: Prior to this case.

4 A. Prior to this case, no. Since this  
5 case, yes. I mean, that is in addition to this  
6 case.

7 Q. Prior to this case have you prepared an  
8 estimate of the probability that a truck would  
9 crash into a facility?

10 A. No.

11 Q. And prior to this case have you prepared  
12 an estimate of the probability that a train would  
13 crash into a facility?

14 A. No.

15 Q. Have you performed studies or work  
16 pertaining to probability of estimates of external  
17 impacts to facilities?

18 A. More recently, yes. I mean, in addition  
19 to this case, yes.

20 Q. And by more recently, do you mean after  
21 the one you did for this case?

22 A. That's right. After September 11th, to  
23 be more precise.

24 Q. Now, you performed -- in your testimony  
25 you state that you performed a linear regression

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1 analysis on the data points from fiscal year 1995  
2 to fiscal year 2000, correct?

3 A. Yes.

4 Q. And that regression analysis, did it  
5 demonstrate to you that the F-16 crash rate was  
6 increasing?

7 A. Yes.

8 Q. And it's true that you selected only the  
9 last six years for the purpose of that regression  
10 analysis, correct?

11 A. That's true. More recently I included  
12 fiscal year 2001 to see how that would change the  
13 numbers.

14 Q. And when you used the fiscal year 2001,  
15 that was for seven years, correct?

16 A. Yes.

17 Q. All right. Have you performed a linear  
18 regression analysis on the data points for fiscal  
19 year '91 to fiscal year 2000?

20 A. I don't remember whether I took that  
21 period or not, to be frank.

22 Q. Have you performed linear regression  
23 analysis for any of the other time periods beyond  
24 '95 to 2000 or 2001?

25 A. Other than what's in our testimony?

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1 Q. Correct.

2 A. For what period are you asking?

3 Q. Well, for -- you said you did it for '95  
4 to 2000 and 2001, and I'm asking if you did it for  
5 any other time frames.

6 A. I can't remember. I might have.

7 Q. You don't remember?

8 A. I don't remember. I've done a bunch of  
9 calculations since that time just incorporating  
10 fiscal year 2001.

11 Q. Now, you said that you did your  
12 five-year linear regression analysis to test the  
13 hypothesis that the crash rate is dependent on  
14 fiscal year, and hypothetically now, if you  
15 performed a linear regression analysis for the  
16 years 1990 to 2000 and you were to find that the  
17 results no longer showed an increasing trend, would  
18 that change your conclusion?

19 MR. SOPER: Which conclusion are you  
20 talking about?

21 MS. MARCO: His conclusion for his  
22 hypothesis that the crash rate is dependent on the  
23 fiscal year.

24 A. No.

25 Q. Did you perform a Spearman rank

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1 correlation test to the entire data base from 1978  
2 to 2001?

3 A. I didn't.

4 Q. And I think I heard this but I don't  
5 know, so I'm asking it again. Did you perform a  
6 Spearman rank test to the data point starting with  
7 fiscal year 1996 and going to 2000 or 2001?

8 A. From '95 to 2001.

9 Q. But did you do it for '96 to 2001 or  
10 2000?

11 A. I don't believe so.

12 Q. Okay. What about '94, fiscal year '94  
13 to 2000 and 2001?

14 A. No, no. I just added that additional  
15 year into the calculations we had already done.

16 Q. Okay. So you're not aware of what the  
17 results might have been for those other  
18 calculations, fiscal year '96 to 20, 2001 or fiscal  
19 year '94 to 2000, 2001?

20 A. That's right.

21 Q. And when you performed a Spearman rank  
22 correlation test for fiscal year '89 to fiscal year  
23 2000, isn't it true that you did not find that the  
24 crash rate was increasing?

25 A. I didn't do the Spearman rank

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1 correlation for '89 to 2000. Did I say I did that?

2 Let me check.

3 Q. Referring to question and answer 17.

4 A. Excuse me. What was your question? I  
5 erred.

6 Q. When you performed that test, that one  
7 for the '89 to 2000, isn't it true that you did not  
8 find the crash rate was increasing?

9 A. That's right. There seemed to be no  
10 correlation.

11 Maybe I should explain why this is  
12 happening, why there's no correlation. And it  
13 comes back to this diagram that counsel had on the  
14 table. This is for destroyed aircraft, but it  
15 could just as well hold for class A plus class B.

16 Counsel pointed out that these numbers  
17 in the early 90's were high, then it declined, then  
18 it went up again. So you're not going to see a  
19 trend. That's what the point of this was, that  
20 there is no trend over that longer period.

21 Q. Then if the correlation changes from an  
22 increasing trend to no correlation, what would be  
23 your opinion of that?

24 A. What time periods are we looking at?  
25 What years?

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1 Q. I would use that same --

2 A. How many years are we looking at?

3 Q. I would say just in general.

4 A. Just in general? If we add another year  
5 to the data, in other words, is it changing or are  
6 we moving the five-year period --

7 Q. And expand --

8 A. -- to the next five-year period --

9 Q. Right, take that --

10 A. -- or one year further down the road.

11 Q. Right.

12 A. If it went to -- became indeterminate, I  
13 would say there's no correlation. That's not what  
14 we did. We took from '95 to year 2000, and then I  
15 added another data point to account for fiscal year  
16 2001 once that became available. And then looked  
17 at that correlation, and that seemed to be an even  
18 sharper correlation than the one that we had  
19 previously calculated.

20 Q. And for how many years? That was for  
21 six years?

22 A. That was for seven years.

23 Q. That was for seven. If you were to use  
24 the years '98 to '99, and I think it was -- well,  
25 we could use Exhibit -- that was State's Exhibit

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1 52. If you were to use just those two years, you  
2 would get an even greater increase and even  
3 stronger showing, wouldn't you?

4 A. Which years are those, Counsel?

5 Q. That would be '98 to '99.

6 A. I'd have to do the numbers. There's no  
7 question that the increase is steeper, okay, but  
8 when you only have two data points, whether it's  
9 statistically significant is another issue.

10 Q. Well, what criterion did you use to  
11 select six over two or three?

12 A. I looked at the period starting in '95  
13 when there was a trough and then followed that to  
14 now, from '95 to now. So that's a seven-year  
15 period, or six years it appears in the prefiled  
16 testimony. I didn't have a criteria, I just used  
17 the bottom point to see whether the trend was  
18 continuing to increase -- was increasing or from  
19 '95 was continuing to decrease. Looks like for '95  
20 on it was continuing -- it was an increase.

21 The Applicant has claimed there's a  
22 decline in trend, and that's mainly the purpose why  
23 we were looking at it.

24 Q. So is it fair to say that the basis for  
25 selecting that time frame was that there was an

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1       apparent increase?

2           A.       From '95 on there was an apparent  
3       increase.

4           Q.       And that was your reason for selecting  
5       it?

6           A.       Yes. We wanted to see whether that was  
7       statistically significant.

8           Q.       Okay. In question and answer 14 of your  
9       testimony you talked about the Three Mile Island  
10      proceeding, and in particular the legal memorandum  
11      that was prepared by NRC Staff. Are you familiar  
12      with the Three Mile Island proceeding as referenced  
13      in your testimony?

14          A.       Somewhat. I've read -- I've read  
15      several of the staff exhibits.

16          Q.       And I see from State's Exhibit 71 that  
17      you indicated that you looked at testimony of  
18      Darrell Eisenhut. Is that correct, item No. 6?

19          A.       I did.

20          Q.       And you looked at testimony of R. Moore  
21      and L. Abramson, No. 4?

22          A.       I did.

23          Q.       In addition to item No. 5, which is the  
24      NRC Staff memorandum?

25          A.       Yes.

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1           Q.       And in the testimony that you indicated  
2           in there, did you find anywhere where a technical  
3           staff member stated that it was not reasonable to  
4           quantify improvements in safety for limiting the  
5           data base to establish the current accident rate?

6           MR. SOPER: Well, I object as to  
7           foundation. I don't know if he has a basis to  
8           answer that.

9           MS. MARCO: Well, he said that these are  
10          the documents that he listed in State's Exhibit 71.

11          MR. SOPER: Well, aren't you asking him  
12          who drafted them, who prepared them?

13          MS. MARCO: I'm asking if he has seen a  
14          reference to this in any other place other than in  
15          a legal memorandum. That's where I'm going.

16          MR. SOPER: I didn't understand that  
17          question.

18          JUDGE FARRAR: Can we hear the question  
19          back?

20               (The record was read as follows: "And in  
21               the testimony that you indicated in there, did  
22               you find anywhere where a technical Staff  
23               member stated that it was not reasonable to  
24               quantify improvements in safety for limiting  
25               the data base to establish the current accident

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1 rate?" )

2 JUDGE FARRAR: And you understand the  
3 question deals with references to what a staff  
4 member, a technical staff member said somewhere or  
5 other in a hearing, in deposition somewhere as  
6 opposed to a memorandum that might have had  
7 technical staff input that was signed by the  
8 lawyers. Those are kind of the two categories of  
9 places you could have found them, and you can  
10 answer as to either one. The question dealt with  
11 testimony of technical staff, but feel free to  
12 answer it either way.

13 THE WITNESS: Well, short of going back  
14 and looking at all these again, which I have with  
15 me, my recollection is the staff used this 22-year  
16 period, the entire operating period, the entire  
17 accident data base, and they didn't make  
18 accommodations for any decreasing crash trends.  
19 That's my best recollection. But I'd really have  
20 to review it to --

21 JUDGE FARRAR: You don't have a specific  
22 reference in mind, either a legal brief or a piece  
23 of testimony?

24 THE WITNESS: No. I have all the -- I  
25 have all of these memoranda with me, but I can't

1 really recall.

2 MR. SOPER: There might be some  
3 confusion on the question. In his answer he's  
4 actually cited exact language and specifies exactly  
5 where it came from in answer to 14. I don't know  
6 if the question with respect to that is what's the  
7 name of the technical person that that came from.  
8 I don't -- not trying to make this difficult, but  
9 I'm not sure if there's different understandings  
10 around the room on what's being asked here.

11 MS. MARCO: I figured it was very  
12 straightforward, and I was asking about whether  
13 there was testimony that he had looked at when he  
14 listed out the testimony in State's Exhibit 71 or  
15 elsewhere that also stated this, so it's not just  
16 merely from the legal counsel.

17 THE WITNESS: Well, as we sit here I  
18 can't recall. I'd have to go back and review.

19 Q. (By Ms. Marco) Okay. Now, does the  
20 legal memorandum and the quotes that you have in  
21 there state any basis at all for why it is not  
22 reasonable to quantify improvements in safety for  
23 the purpose of limiting the data base?

24 A. Could I just take a quick look at that  
25 page again?

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1 I don't believe they cite a reason.

2 MS. MARCO: Okay. I don't have any  
3 more. Thanks.

4 JUDGE KLINE: Dr. Resnikoff, did your  
5 mathematics training include formal training in  
6 statistics?

7 THE WITNESS: No, it didn't.

8 JUDGE KLINE: No, it did not?

9 THE WITNESS: As I mentioned before,  
10 half the courses I took at school, undergraduate  
11 and graduate, were math courses, but none were  
12 statistics.

13 JUDGE KLINE: Would you say you're a  
14 self-taught statistician, then?

15 THE WITNESS: Yes.

16 JUDGE KLINE: Okay.

17 THE WITNESS: We've used it a lot in --  
18 this kind of elementary statistics we've used a lot  
19 in our work, in a lot of the assignments we've had.

20 JUDGE KLINE: You're generally familiar,  
21 would you say, with the principles of statistics,  
22 for example, random sampling, biased sampling,  
23 things like that? You would know the difference?

24 THE WITNESS: Well, certainly when I've  
25 gone out to the field to make measurements, you

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1 know, a bias sampling is --

2 JUDGE KLINE: Okay, that's good. Okay.  
3 Are you familiar with the notion that statisticians  
4 normally frown on selection of data prior to the  
5 performance of any kind of hypothesis testing on  
6 it?

7 THE WITNESS: Yes.

8 JUDGE KLINE: Okay. So if you're going  
9 to do that, you need a good reason, right, other  
10 than inspecting the data?

11 THE WITNESS: Yes.

12 JUDGE KLINE: So if on the curves that  
13 have been in controversy here are the crash rates  
14 over ten or more years, can you think of a way  
15 where you could have analyzed the entire data set  
16 and yet tested the hypothesis that you have in  
17 mind, that is, that there's a bathtub curve or an  
18 upslope in the later years?

19 THE WITNESS: Well, not as we sit here.  
20 I mean -- no.

21 JUDGE KLINE: Are you familiar with  
22 common concept of second order analysis in  
23 statistical curve fitting?

24 THE WITNESS: No.

25 JUDGE KLINE: Okay. Let's turn to

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1 another subject, then. On page 8 at the top of the  
2 page you have a sentence that says, and it's  
3 referring to pilot guidance that the PFS has done,  
4 "This change dramatically alters the NUREG 0800  
5 methodology." Could you tell us what you have in  
6 mind there?

7 THE WITNESS: In no previous proceeding  
8 had the pilot's state of mind been taken into  
9 account. They simply went from the crash rate data  
10 without modifying it. That's what I really had in  
11 mind there. And that accounted for this 86, 85-1/2  
12 percent reduction.

13 JUDGE KLINE: Have you inquired into the  
14 analytical basis for the NUREG 0800 equation, that  
15 is to say, the underlying assumptions and the  
16 underlying physical model that's used to formulate  
17 that equation?

18 THE WITNESS: Somewhat, somewhat. And  
19 that's why also we did this search of all NR -- of  
20 NRC proceedings, to see whether this had ever been  
21 done before within the NRC.

22 JUDGE KLINE: Does the NUREG 0800  
23 equation apply to a physical situation or a  
24 physical model wherein we visualize a corridor with  
25 more or less random distribution of aircraft

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1 distributed equally across the corridor? Is that a  
2 physical picture of what the equation is telling  
3 us?

4 THE WITNESS: That's right.

5 JUDGE KLINE: Okay. Elsewhere in your  
6 testimony you comment that the NUREG 0800 equation  
7 in effect gives you a conservative upper bound  
8 numbers, but there's a caveat there in your  
9 testimony that says, yeah, but it has to be used  
10 prudently or it has to be used with some -- with  
11 some degree of care in terms of the input  
12 parameters. Do you recall making that --

13 THE WITNESS: I don't recall my making  
14 it, but I do remember it --

15 JUDGE KLINE: But it's in there.

16 THE WITNESS: -- in the actual NUREG  
17 0800 wording.

18 JUDGE KLINE: For example, when we speak  
19 of a corridor, a corridor width, in your mind does  
20 the corridor placement relative to the site have  
21 any bearing on the risk that's calculated by the  
22 equation?

23 THE WITNESS: Judge Kline, I was here  
24 when you asked this question before of other --

25 JUDGE KLINE: I told you you'd get your

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1 chance.

2 THE WITNESS: -- of other witnesses.

3 JUDGE KLINE: I promised Mr. Soper that  
4 you would.

5 THE WITNESS: And I think where you're  
6 heading is, obviously if an aircraft is further  
7 away from the facility, you should somehow lower  
8 the probability in comparison to, in other words,  
9 you shouldn't simply assume a uniform distribution.

10 JUDGE KLINE: Well, all I'm trying to do  
11 is probe the model. I'm not trying to tell you  
12 what model you should use. But let me ask you  
13 another question. If we had a ten-mile corridor  
14 for commercial aircraft say from San Francisco to  
15 Los Angeles, could you calculate the risk of the  
16 PFS site based on that corridor, under the  
17 assumptions that underlie the NUREG 0800 equation?

18 THE WITNESS: I don't think -- you don't  
19 mean that. You mean a corridor between perhaps San  
20 Francisco and Salt Lake City.

21 JUDGE KLINE: No, I'm talking about a  
22 north-south corridor far offset from anywhere near  
23 the vicinity of PFS.

24 THE WITNESS: Well, how would that  
25 impact the PFS facility?

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1 JUDGE KLINE: I don't know. That's the  
2 answer I'm looking for. That when one selects --  
3 I'm looking to the limits, or what I want to do is  
4 test the limits of how much flexibility you have in  
5 determining the corridor. And apparently there's  
6 some outside limit beyond which it doesn't make any  
7 sense to use the NUREG 0800 equation; isn't that  
8 right?

9 THE WITNESS: Well, in that example,  
10 yes.

11 JUDGE KLINE: All right. So that if we  
12 get closer, there must be some boundary beyond  
13 which we wouldn't use it.

14 THE WITNESS: But in this particular  
15 example you have -- you have planes flying down a  
16 valley with mountains on each side.

17 JUDGE KLINE: Yeah, I understand.

18 THE WITNESS: And that somewhat bounds  
19 the area. Any plane within that valley could  
20 strike the facility. If it were in, you know, a  
21 slight turn of a plane could send it right into the  
22 facility. In that sense there's -- the geography  
23 is not the --

24 JUDGE KLINE: Okay, now we're getting  
25 somewhere, because, as you say, your statement just

1 invoked the random distribution assumption in the  
2 NUREG 0800 equation, right?

3 THE WITNESS: Right.

4 JUDGE KLINE: And then if you use the  
5 value R, that assigns deterministic significance to  
6 pilot steerage, doesn't it?

7 THE WITNESS: It does.

8 JUDGE KLINE: Now, if R is contained in  
9 the same equation with a random assumption, don't  
10 those two assumptions clash, in a sense? I mean,  
11 on the one hand NUREG 0800 is calculating a risk  
12 based on a random assumption; on the other hand,  
13 the R value introduces a new deterministic  
14 assumption. And the question is, does the NUREG  
15 equation still work after you did that?

16 THE WITNESS: I think that's a fair  
17 question to ask.

18 JUDGE KLINE: Do you have any idea --

19 THE WITNESS: I don't know if you'll  
20 have the data to analyze that question.

21 JUDGE KLINE: Well, I don't know if you  
22 need data. It's a theoretical construct. And what  
23 I'm really trying to see, I mean, one way of  
24 testing an equation is simply to pursue its own  
25 implications and see if it leads you to a

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1 consistent or inconsistent result. Isn't that a  
2 way of looking at the validity of equations,  
3 especially after you modify them? So if we pursue  
4 this reasoning, when we say on the one hand we've  
5 got to preserve our random distribution assumption;  
6 on the other hand we introduce a factor that's  
7 contrary to that that says, well, we're going to  
8 take deterministic credit for pilot steerage, and  
9 can you see a way of reconciling those two in the  
10 same equation? That is, without doing violence to  
11 the original assumptions in the NUREG equation.

12 THE WITNESS: I think it would be a much  
13 more complicated problem to do that.

14 JUDGE KLINE: Once one takes credit for  
15 pilot steerage, say, in an emergency, is there any  
16 analytical distinction between that particular  
17 pilot steerage and any pilot steerage? That is to  
18 say, the pilots who steer on a nonintersecting  
19 course in the first place.

20 THE WITNESS: From San Francisco to Los  
21 Angeles?

22 JUDGE KLINE: Let's just take it down  
23 Skull Valley.

24 THE WITNESS: Yeah.

25 JUDGE KLINE: Yes what? Is there -- I

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1 mean, the way it fits into the equation, is there  
2 any distinction to be made? I mean, if a pilot can  
3 steer the plane when he's in trouble and save the  
4 site, why isn't all of his -- why isn't all 7,000  
5 flights that are steered also significant in the  
6 analytical construct?

7 THE WITNESS: I don't know the answer to  
8 this.

9 JUDGE KLINE: That's fair enough.

10 THE WITNESS: It would be a much more  
11 difficult problem.

12 JUDGE KLINE: Let's go to a different  
13 subject, then. It's on the same page, page 8. You  
14 indicate that the result from using the R factor I  
15 assume is that it's an extremely subjective  
16 assessment of how -- and this has to do with how  
17 the R factor was formulated. Even if true that  
18 it's an extremely subjective assessment, what's  
19 wrong with that? Why can't we have a subjective  
20 assessment?

21 THE WITNESS: Well, I have to take a  
22 step back to -- we first looked at these accident  
23 report descriptions and it was clear to us that it  
24 required an F-16 pilot. So we beseeched  
25 Col. Horstman to really get involved in looking at

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1 this data.

2 The data, from the data one is trying to  
3 draw certain conclusions which seem to me the data  
4 doesn't provide. I'm not an F-16 pilot.

5 JUDGE KLINE: I understand.

6 THE WITNESS: And it was clear to us  
7 that we couldn't do this, and we, you know,  
8 implored Col. Horstman to do it. But you have to  
9 be an F-16 pilot to know what is happening, and  
10 there has to be enough information in the report to  
11 read the pilot's mind.

12 JUDGE KLINE: Which I take it you didn't  
13 find?

14 THE WITNESS: We didn't. But as I said,  
15 we are not F-16 pilots, so we asked Col. Horstman  
16 to look into this. And so we are relying on, you  
17 know, what his judgment is.

18 JUDGE KLINE: Did you or he or both  
19 together attempt to reconstruct an R value for  
20 yourself from the same data base?

21 THE WITNESS: No. I assumed this is  
22 what may or may not happen next when Col. Horstman,  
23 you know, goes through each of these and reviews  
24 them. I shouldn't put words I think in the State's  
25 mouth.

1 JUDGE KLINE: Okay, thank you. That's  
2 enough for that.

3 JUDGE LAM: Dr. Resnikoff, during the  
4 first week of this proceeding I gave Mr. Soper my  
5 assurance that I would provide you and  
6 Col. Horstman the same courtesy which I gave Gen.  
7 Jefferson, Gen. Cole and Col. Fly by asking you  
8 basically the same question that I asked the  
9 General. The question I asked the General was,  
10 just let me know why we should accept the  
11 Applicant's analyses. Now, my question to you is,  
12 Dr. Resnikoff, what is wrong with the Applicant's  
13 analyses here?

14 THE WITNESS: Well, I knew you would ask  
15 me this question, Judge Lam.

16 JUDGE LAM: You read my mind.

17 THE WITNESS: There are five factors, as  
18 I see it, that have become important as I witness  
19 the proceeding. One is this factor which was just  
20 discussed by Judge Kline, which is the crash rate  
21 and this R factor. And that reduces the  
22 Applicant's estimates by -- it reduces the  
23 estimates by 85 percent.

24 The width of the flight path is another  
25 issue. If you go from ten miles to five miles,

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1 that essentially reduces all the calculations by 50  
2 percent. The number of flights, whether you take  
3 19 -- average 1999 and the year 2000 versus just  
4 taking the year 2000 and escalating it up for the  
5 number of additional aircraft that have been used  
6 is an important consideration.

7 The Moser recovery route is another  
8 issue. Whether the Air Force is changing their  
9 training pattern to include many more night flights  
10 because of the new threats that exist around the  
11 world, that changes the numbers, at least those  
12 parts of the numbers from 5 percent using Moser  
13 recovery route to 33 percent.

14 And finally, the crash rate, the issue  
15 that we've been talking a lot about, whether the  
16 lowest ten-year period should be used versus the  
17 lifetime. And that essentially is a 20 percent  
18 difference. But when you put it all together,  
19 you're coming up to on the order of two orders of  
20 magnitude. And those are the main issues that I  
21 see as problems with the Applicant's analysis.

22 JUDGE LAM: Okay. Dr. Resnikoff, were  
23 you here on April 12th when Dr. Campe testified?

24 THE WITNESS: I was here.

25 JUDGE LAM: I had the impression after

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1 having him answer my questions that he seems to  
2 acknowledge that he now had endorsed the use of  
3 pilot avoidance as an acceptable, somewhat like a  
4 natural evolution of the application the NUREG 0800  
5 methodology. Do you agree with that approach or do  
6 you not?

7 THE WITNESS: No, I do not. Have you  
8 and Judge Kline been talking to each other? You  
9 seem to have conflicting views. But this -- no, I  
10 regard it as a subjective assessment, not a  
11 conservative calculation.

12 JUDGE LAM: Yes, indeed. My question to  
13 Dr. Campe at that time, I was just reading the  
14 transcript on that day, specifically has something  
15 to do with I was asking Dr. Campe if he considered  
16 the use of the avoidance, the pilot avoidance  
17 factor as a deviation. Dr. Campe's response was,  
18 well, yes and no, it's -- he would consider it like  
19 a minor example of slicing and dicing the data. He  
20 gave me a couple examples, one of which was how one  
21 would use the number of flights.

22 Now, let us assume you disagree with  
23 him, which you already said you are in  
24 disagreement. Let me ask you this. Earlier Gen.  
25 Jefferson and Gen. Cole and Col. Fly testified to

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1       how the 95 percent success probability was chosen  
2       for the pilot's ability to avoid a land target.  
3       There were three reasons given. One is the  
4       training of the U.S. Air Force pilot; two, the  
5       facility would be the most visible structure within  
6       the valley; three, there would be sufficient time  
7       to take action. Do you have an opinion as to this  
8       95 percent success assessment probability?

9               THE WITNESS: Again, I would just repeat  
10       what I've previously said, that it seems like a  
11       subjective assessment. I would add that the  
12       training that Col. Fly talks about is taking place  
13       also at Hill Air Force Base. Not all the pilots  
14       that are going down are experienced pilots,  
15       according to Col. Horstman.

16              JUDGE LAM: Would you have an opinion as  
17       to what the appropriate value would be? If not 95  
18       percent, what would be the appropriate value?

19              THE WITNESS: Yes. I would take R=1.

20              JUDGE LAM: You mean there would not be  
21       no success?

22              THE WITNESS: Right. That would be the  
23       conservative, and that's what has been done up to  
24       this time.

25              JUDGE LAM: Right. But if you were

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1 asked to perhaps allow some credit to be given to  
2 the pilot's ability to avoid, you have another  
3 opinion as to what that value may be?

4 THE WITNESS: I don't have an opinion.

5 JUDGE LAM: And based on what you have  
6 heard so far in this proceeding, do you think we  
7 have enough operational data to make an assessment  
8 if one wants to go that way?

9 THE WITNESS: Absolutely not.

10 JUDGE LAM: Why?

11 THE WITNESS: Because they're trying to  
12 go from these accident reports to read the pilot's  
13 state of mind. And I know the Board has tried to  
14 come to grips with this by having some pilots who  
15 have ejected discuss what their frame of mind was,  
16 you know, in that process. But I don't think  
17 there's sufficient data to -- in these reports to  
18 actually come to these conclusions to read the  
19 pilot's mind. That's why I said it seems  
20 subjective.

21 Col. Horstman perhaps, I don't know what  
22 the State is going to do, will look over these  
23 reports and there will be I assume a conflict. You  
24 know, you may get into nitty-gritty of looking at  
25 each report and deciding whether there's sufficient

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1 information in each report to come to those  
2 conclusions. I would just take R=1 as the  
3 conservative approach.

4 JUDGE LAM: And assuming I read and  
5 heard Dr. Campe's testimony correctly, since he is  
6 the major contributor to the NUREG 0800  
7 methodology, do you think the Board should give  
8 deference to his opinion? If so, yes -- why, and  
9 if not, why not?

10 THE WITNESS: I'm sure the Board should  
11 listen to all the evidence, as you will.

12 JUDGE LAM: And?

13 THE WITNESS: I was at the proceeding  
14 where he testified, and I wasn't persuaded by any  
15 argument as to why one should do other than take  
16 R=1.

17 JUDGE LAM: Now, Dr. Resnikoff, if I may  
18 ask you to look at page 16 of your prefiled  
19 testimony, answer to question 26. I see that the  
20 contribution on Moser recovery alone would exceed  
21 10-6. Is that correct?

22 THE WITNESS: Yes.

23 JUDGE LAM: Now, flying over one area,  
24 this seems to us a smaller, in terms of all the  
25 contributions to aircraft hazard, one of the

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1 smaller ones relative to Skull Valley. If I were  
2 to ask you to redo some of the conservatism in your  
3 analysis, where would you do that? I see the major  
4 contribution to  $1.36 \times 10^{-6}$  crashes per year come  
5 from the number of flights. Am I correct?

6 THE WITNESS: Yes.

7 JUDGE LAM: Now, to come up with the  
8 number of flights of 3,436 flights per year, you  
9 seem to ratio it up by a factor of  $7,040/3,871$ .  
10 Can you explain to me why that ratio was applied?

11 THE WITNESS: Because we looked at the  
12 data for 1998 and we took a ratio of the projected  
13 number of flights in the year 2001, 7,040. That's  
14 where that ratio comes from.

15 JUDGE LAM: Is there conservatism  
16 allowed here?

17 THE WITNESS: Excuse me, Judge Lam. Is  
18 there conservatism in --

19 JUDGE LAM: In allowing -- in this  
20 particular ratio. Could this ratio be smaller? If  
21 you were to go to fiscal '97 or '99, could that  
22 ratio change?

23 THE WITNESS: This is simply an  
24 escalation in the number of sorties, and then in  
25 fiscal year '98 we have the number of sorties that

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1 occurred over the south range. And rather than the  
2 5 percent we took 33 percent, which is the maximum  
3 number that Col. Horstman said it would be. So we  
4 did take the maximum number there as a conservative  
5 estimate.

6 JUDGE LAM: I see. I was going at  
7 perhaps, you know, there is a more realistic number  
8 instead of the maximum number, and what may the  
9 more realistic number be. Well, let me rephrase  
10 it. I don't think I should use the term  
11 "realistic." This maximum increase here, could it  
12 be a more -- I would say could it be a lesser  
13 increase if you average out the ratio over a  
14 two-year period or three-year period? Would that  
15 be something meaningful to do?

16 THE WITNESS: I don't think so, because  
17 there seems to be a reason why this is happening  
18 that Col. Horstman has discussed, which is there's  
19 more emphasis on night flying as a way to -- the  
20 Air Force seems to be emphasizing that. So there's  
21 a rationale for using -- for increasing that  
22 number.

23 JUDGE LAM: Okay. Then also let me go  
24 back to page 8 and follow up on a question Judge  
25 Kline had asked you. On page 8 of your direct

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1 testimony, Judge Kline earlier asked you about  
2 dramatically altering the nature of NUREG 0800.  
3 The last paragraph to your answer No. 10, you also  
4 talk about this pilot avoidance factor compromises  
5 objective and conservative approach intended by  
6 this methodology. I certainly understand what you  
7 mean by compromises a conservative approach. What  
8 about objectivity that you referred to here? Would  
9 you explain to me, why do you think this  
10 compromises objectivity?

11 THE WITNESS: That's part of the same  
12 sentence that we regarded this assessment of how a  
13 pilot may react as subjective. So that's what we  
14 meant by compromise is the objective approach.

15 JUDGE LAM: Would this concern be  
16 removed if the Applicant can demonstrate the  
17 successful avoidance of a land target by the pilot  
18 is based on some objective assessment, perhaps like  
19 operational data, perhaps experimentation with  
20 human factors?

21 THE WITNESS: All of that would be  
22 helpful.

23 JUDGE LAM: That may be helpful? Thank  
24 you, Dr. Resnikoff. That's all I have.

25 JUDGE FARRAR: Dr. Resnikoff, let me ask

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1 you about double blind studies and their  
2 implications here. And I may -- I'm only a layman  
3 on this, so if some later witness, either you or  
4 some later witness wants to straighten me out, you  
5 can. But as I understand drug testing or testing  
6 new drugs, you do double blind studies to eliminate  
7 any statistical bias in your results, and as I  
8 understand double blind studies, you have a  
9 researcher and you want to see how patients react  
10 to a drug and to a placebo, but you don't tell the  
11 doctors which patients are getting it and you don't  
12 tell the patients which patients are getting it.  
13 So then the data point you're looking for, did the  
14 patient get better, you're going to get the right  
15 answer uninfluenced by the doctor consciously or  
16 subconsciously trying to slant it and the patient  
17 trying to slant it. So in effect both the doctor  
18 and the patient are disinterested, and that may be  
19 the wrong statistical word, but they don't know  
20 what's going on so they have no reason to shade  
21 their results one way or the other.

22 As people look at these aircraft  
23 accident reports to try to decide about pilot  
24 avoidance capability or willingness, it seems to me  
25 both sides have this built-in statistical bias.

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1 That's not bias in terms of their character or  
2 integrity, it's just that one side knows when they  
3 start looking at them that they'd like to prove the  
4 following, and the other side knows they'd like to  
5 prove the opposite.

6 THE WITNESS: That's why we have a  
7 hearing panel.

8 JUDGE FARRAR: Well, what do we do to  
9 eliminate that statistical bias? Ideally we would  
10 have hired somebody to go, you know, not tell them  
11 why we wanted to know the answer, say, go look at  
12 these accident reports and tell us the following.  
13 We're not telling you why we want to know that. I  
14 know you can't replicate the double blind nature of  
15 the drug tests, but there's some concern here that  
16 as you, as Judge Lam says, as you slice and dice  
17 these results you're doing them with an ulterior  
18 motive. May be the best motive in the road, but  
19 it's not blind, it's not statistically unbiased.  
20 What do we do with that? And that was a nice try,  
21 saying, oh, we should just decide it, but we like  
22 to decide things based on the best analysis of the  
23 evidence that the parties can put forward rather  
24 than us saying, gee, we know better than everybody  
25 else so we'll just decide it ourselves.

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1 THE WITNESS: I'm not sure I like your  
2 analogy.

3 JUDGE FARRAR: You or anyone else is  
4 free to tell me why it's bad.

5 THE WITNESS: Well, what's bad is I  
6 don't think you know what kind of pills you're  
7 giving the patients, either, in this case. Because  
8 you're starting with these reports which may not  
9 have the information that you need to get out then.

10 JUDGE FARRAR: When I ask a question  
11 that long, I can't take an answer that short.

12 MR. SILBERG: Judge Farrar, may counsel  
13 provide some of their thoughts?

14 JUDGE FARRAR: Let's finish with the  
15 witness first, and then -- and you can tell that  
16 we're all struggling with this, and so we'll take  
17 the thoughts of anybody, witness or counsel, on  
18 this. But it strikes me it could be a very key  
19 question.

20 THE WITNESS: Well, it's definitely the  
21 largest part of the puzzle in estimating what the  
22 probability is, but not the only piece. There are  
23 all these other pieces that I mentioned.

24 JUDGE FARRAR: Yeah, but the other  
25 pieces pale by comparison with this one, don't

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1       they?

2               THE WITNESS:  No, they're about the same  
3       magnitude when you get them all together, but they  
4       are more quantifiable, the other pieces, than this  
5       issue that you've raised.  All I can say is we have  
6       searched the literature looking for some answers to  
7       this.  We did more than search the NRC data base.  
8       We've looked -- we looked for where this has been  
9       quantified, and we have not been able to identify  
10      any articles.  And that's a longer answer.  I hope  
11      it satisfies you.

12             JUDGE FARRAR:  Okay.  Judge Kline will  
13      follow up.

14             JUDGE KLINE:  The point of discussing  
15      the double blind experiment is not to suggest that  
16      it should have been used here, but simply to  
17      illustrate the fact that properly designed  
18      experiments have safeguards against bias built into  
19      the experimental design.  So really the relevant  
20      question here is, in your review of what the  
21      Applicant did, did you find similar built-in  
22      safeguards against statistical bias in the -- in  
23      the selection protocol that the Applicant used?

24             THE WITNESS:  We're going to go into  
25      this in much greater depth at some later time.

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1 Obviously when you go from 126 accidents down to  
2 121, down to 50 some, there's going to be a  
3 discussion about all the 126 accidents and why they  
4 were reduced to this certain number to finally get  
5 a -- these probability estimates which have been  
6 made. So there will be a longer discussion at some  
7 later time. I'm not really prepared to talk about  
8 that right now.

9 JUDGE KLINE: That's fine.

10 JUDGE LAM: Or could it be this,  
11 Dr. Resnikoff. The Applicant has certain biases  
12 and you have another set of biases, and in the end  
13 the truth will come out? Could it work that way?

14 THE WITNESS: Yes, I'm sure the truth  
15 will come out, and the truth will be that R is 1.

16 JUDGE FARRAR: We may have taken this as  
17 far as we can at this point, but hopefully not at a  
18 later point.

19 Mr. Silberg, you had indicated maybe it  
20 would be appropriate to hear from counsel.

21 MR. SILBERG: I just have two fairly  
22 short points. First, I agree with Dr. Resnikoff  
23 that this is an adversarial proceeding to some  
24 extent, and like judicial proceedings, the purpose  
25 of those is to bring the truth out. And there is

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1 in Anglo-Saxon judicature certainly the philosophy  
2 that that process will tend more often than not to  
3 bring out the truth.

4 Here, though, we have a somewhat  
5 different process in that un,like the normal  
6 judicial process, there is a third party, and that  
7 third party does not have the biases of either the  
8 applicant or the intervenor, whatever those biases  
9 may be. It may be that they have their own biases.  
10 But certainly it is another party, and their role  
11 is quite different from either the applicant or the  
12 opponent of the facility. And I think that role  
13 has to be taken into account when the Board decides  
14 on how to evaluate conflicting evidence.

15 JUDGE FARRAR: I can probably safely  
16 assume that the Staff would agree with that  
17 characterization --

18 MS. MARCO: Right.

19 JUDGE FARRAR: -- of its role?

20 MS. MARCO: That's quite right. We do  
21 view our role as the neutral party that looks at  
22 it, develops its analysis, its report, its safety  
23 evaluation report which is in evidence, and coming  
24 to the conclusions on our own and providing it to  
25 you what our evaluation was.

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1 JUDGE FARRAR: And you would take that  
2 view even though, for all that appears to observers  
3 at the hearing, you're on the side of the  
4 applicant, that's because you, in your mind you've  
5 already fulfilled, you've carried out that role to  
6 get here?

7 MS. MARCO: Correct.

8 MR. TURK: And I would point out, your  
9 Honor --

10 JUDGE FARRAR: Who's that?

11 MR. TURK: This is the voice from the  
12 past. We don't take all of the applicant's  
13 assumptions that we've modified them in the SER, so  
14 when we've thought something was more appropriate  
15 than what the applicant did, we modified it to come  
16 up with what we believe to be the proper outcome.

17 MR. SILBERG: And of course we've been  
18 dealing with the Staff for almost five years now,  
19 during which we have been induced to adjust our  
20 processes or methodology or data to satisfy them.

21 MR. GAUKLER: And the reason for the  
22 huge Exhibit N and Exhibit O is the results of that  
23 long process.

24 JUDGE FARRAR: Mr. Soper, you probably  
25 would like to be heard on this?

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1 MR. SOPER: I think it would be only  
2 fair I had a short crack at it as well, and I will  
3 make it short. My observation is that I think it's  
4 exactly right that we have competing parties here  
5 and, more importantly, lawyers who have a duty to  
6 represent the client to the fullest, not to be  
7 independent and unbiased.

8 Until science reaches a certain level of  
9 assurance and reliability, courts throughout the  
10 history of courts have treated scientific  
11 improvements such as radar, blood testing, DNA now  
12 in the fashion of disregarding it until it reaches  
13 a level of reliability and certainty that can be  
14 included in judicial proceedings. Lie detectors  
15 have not reached that level, for example. And  
16 great disjustice -- injustice is done by giving  
17 science that's not mature the credibility of  
18 science that has become reliable and proven and  
19 repeatable.

20 I think the same thing here, we have no  
21 studies independent from this proceeding. Why are  
22 we looking at 126 accident reports from the lowest  
23 ten-year period in the crash history is a good  
24 point that Dr. Resnikoff looked at. Where is the  
25 peer review; where are the studies from the Air

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1 Force, from other bodies that are subject to  
2 publication and scrutiny by others; where are the  
3 history of repeating the studies to show that they  
4 prove out. We have none of that. We have the most  
5 elementary grappling with history of accident  
6 reports not prepared for this purpose where we try  
7 to glean what a pilot was doing and try to assume  
8 what we would do, depending now which effort we're  
9 talking about in the pilot's shoes, and we don't  
10 know if this works or not. We just don't know.  
11 It's just not the time. We don't have science to  
12 back up a decision. And I think what Dr. Resnikoff  
13 is saying, for the largest nuclear waste storage in  
14 history, we're going to be stuck with this for a  
15 long, long time, and it's one of the most important  
16 decisions this country is going to make. Are we  
17 going to base it on a study that does not have the  
18 reliability that's required for this sort of  
19 decision? That's how the State views it.

20 JUDGE FARRAR: Would you go so far --  
21 hadn't thought of this until hearing your  
22 argument -- would you go so far to push that  
23 argument to say that given the nature of these  
24 reports, accident reports that weren't written with  
25 the purpose we have in mind, given the way they've

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1       been analyzed, that the whole batch of evidence  
2       fails the Daubert gatekeeping test?

3               MR. SOPER: I know the case you're  
4       talking about, and I think that's exactly right.  
5       In fact, I think that was the basis of the State's  
6       motion to exclude testimony that relied on this was  
7       the -- I'm not sure how to pronounce it either,  
8       your Honor, Daubert. Looks like "Dowbert."

9               JUDGE LAM: And isn't it true that two  
10      key ingredients in that test is peer review and  
11      scientific publication? Is that where you're  
12      going, Counsel?

13              MR. SOPER: Exactly, your Honor, and I  
14      think that's very important, to have that subject  
15      matter looked at by somebody who not only is  
16      independent and highly qualified but can do it in a  
17      vacuum, so to speak, with no other purpose than to  
18      test the theory, is this a reliable science or a  
19      reliable hypothesis.

20              JUDGE FARRAR: Mr. Silberg? I assume  
21      that when the Board mentions Daubert -- do you want  
22      to -- And this is, you know, there's going to be no  
23      ruling today or anytime soon on this, but as long  
24      as, Mr. Silberg, you had suggested we here from  
25      counsel, Mr. Soper's thoughts had triggered --

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1 MR. SILBERG: I believe that we had  
2 moved to strike evidence in this case based on  
3 Daubert. And the Board rejected that, probably  
4 because, as I recall the discussion, you were not a  
5 jury. Certainly in this case where we're talking  
6 about peer review --

7 JUDGE FARRAR: Can you remind me when --  
8 I remember a footnote that said we didn't  
9 suggest -- it didn't appear to us that either side  
10 was suggesting that the evidence, or the other  
11 side's evidence failed the test, but was there -- I  
12 don't recall a specific motion.

13 MS. MARCO: I think there was a specific  
14 motion. I think the specific motion came from the  
15 state on the very issue R in an in limine motion to  
16 have it excluded based on Daubert principles.  
17 That's what I recall. And I believe that --  
18 obviously we're here, we argued it so it was  
19 denied.

20 MR. SILBERG: I believe we also cited  
21 the Daubert case in some of our motions to strike  
22 probably with regard to Dr. Resnikoff's, some of  
23 Dr. Resnikoff's testimony.

24 MS. MARCO: That's right. I recall  
25 that.

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1 MR. SILBERG: And we have raised that  
2 issue with respect to intervenor witnesses going  
3 back -- I can recall a motion I made in 1975 to  
4 exclude Dr. Sternglass's testimony based on  
5 continual rejection of his theories in every  
6 international and national scientific body you can  
7 think of. Those motions unfortunately were  
8 uniformly rejected by both the licensing board and  
9 the appeal board in some cases.

10 JUDGE FARRAR: Here I was focusing less  
11 on the witness's qualifications than the -- and  
12 their views, but the fact, as Mr. Soper mentioned,  
13 that the underlying reports are in many cases not  
14 helpful. They weren't written with our particular  
15 problem in mind, and it's the underlying  
16 evidence --

17 MR. SILBERG: But there are many cases  
18 in the scientific literature where the underlying  
19 reports were written for different purposes. I can  
20 think of the seismic world where the whole  
21 classification of what historic earthquakes are is  
22 based on newspaper reports of how many dishes fell  
23 off the shelves. Certainly not scientific, but the  
24 scientific community has looked at those and has  
25 considered those and now that's a well-accepted

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1 process.

2 In this case our reports were  
3 independently reviewed by three independent  
4 experts, obviously consultants to Private Fuel  
5 Storage, but people with distinguished and highly  
6 relevant careers. Those conclusions were reviewed  
7 by the NRC Staff and the reports themselves  
8 reviewed by the NRC Staff, and reviewed by the  
9 State and its witnesses. And if that's not enough  
10 testing, I guess I'm not sure what is.

11 JUDGE FARRAR: That's a fair comment.  
12 Mr. Gaukler, did you want to --

13 MR. GAUKLER: I was just going to add  
14 also the basic principle involved here, to avoid a  
15 site has been agreed to by basically all the  
16 witnesses, and we're talking about what's the  
17 percentage or what's the probability of that  
18 happening as opposed to some new scientific  
19 principle that we're trying to develop, entirely  
20 different from other principles. So the basic  
21 principle here is established, and we're talking  
22 about how you determine the appropriate R factor,  
23 so to speak.

24 JUDGE FARRAR: Ms. Marco?

25 MS. MARCO: Yes. Again, the Staff has

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1 looked at it Dr. Campe, Dr. Ghosh has looked at it  
2 and determined that it's accessible for use here.

3 JUDGE FARRAR: Mr. Soper, you've been  
4 outnumbered three or four to one. I'll give you  
5 one more.

6 MR. SOPER: What a surprise.

7 JUDGE FARRAR: One more shot.

8 MR. SOPER: Well, outnumbered for the  
9 very reason of the nature of this proceeding. What  
10 we should have is aviation experts not tied to a  
11 position looking at this. That is exactly right.  
12 Like Mr. Silberg says, the fact of china falling  
13 off cupboards has been reviewed by various  
14 authorities, and they've taken it after that review  
15 to mean a certain thing. I suppose that has been  
16 subject to this claim and that claim, and because  
17 of that sort of review, they have resolved it in  
18 we're going to take it to mean this and only this.

19 We don't have that here. And that's  
20 what we need. It certainly is -- the NRC Staff,  
21 while they may be accorded deference in these  
22 matters to the extent that they've had experience,  
23 they certainly are not qualified experts in an area  
24 that not even the experts in that area have done  
25 studies on. So I don't see, because they happen to

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1 agree with the Applicant doesn't mean that there's  
2 been qualified, independent peer reviewed studies.  
3 There simply haven't.

4 JUDGE FARRAR: As usual, all your  
5 arguments are very informative and helpful.  
6 Obviously there's no steps to be taken now, but  
7 when you -- some months now when you write your  
8 proposed findings of fact and conclusions of law,  
9 we'll assume you'll all want to address not  
10 precisely the gatekeeping test but the weight, the  
11 problems and the weight inherent in this testimony  
12 or evidence.

13 MR. TURK: Is it possible to make one  
14 more comment? I think the Board's initial ruling  
15 on the matter was a correct one in which you ruled  
16 that you would admit the evidence and it would be  
17 subject to cross-examination to test its  
18 reliability.

19 The development of this R factor has  
20 been known to all parties for several years  
21 already. It's been a basic premise of the  
22 Applicant's approach to aircraft crash hazard. And  
23 through cross-examination and through the  
24 development of expert testimony and expert  
25 assistance, all parties have had an opportunity to

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1 try to evaluate whether the principle itself was  
2 valid and to what extent it should be applied here.

3 The State has availed itself of  
4 Col. Horstman. They had an opportunity to go to  
5 the Air Force directly if they wanted to, and there  
6 was an opportunity to try to test the evidence.  
7 And I think once we conclude the record, the Board  
8 will have sufficient information before it to judge  
9 how reliable is the use of the R factor and where  
10 is the proper pegging of the avoidance factor.

11 JUDGE FARRAR: I think in light of what  
12 I'm suggesting is that this is a subject that  
13 parties will want to pay particular attention to in  
14 their briefs in the matter of the weight to be  
15 given to it, so forth.

16 Aren't you glad, Mr. Silberg, you  
17 suggested we listen to counsel at this point?

18 MR. SILBERG: I did, and I think it's a  
19 very, very helpful discussion.

20 JUDGE FARRAR: No, seriously, it takes  
21 us a little away from the witnesses, but we've  
22 tried to do that as we go along, make sure we have  
23 a comprehension of what all the parties are  
24 thinking. So your suggestion was in fact --

25 MR. SILBERG: It also might be an

1 appropriate time for a break.

2 JUDGE FARRAR: Oh, yes. Next step will  
3 be redirect, Mr. Soper. Then let's -- it's twelve  
4 after, let's be back at 25 after 3:00.

5 (A recess was taken.)

6 JUDGE FARRAR: All right. We're ready  
7 then for the State's redirect of Dr. Resnikoff.

8 MR. SOPER: Thank you, your Honor.

9

10 REDIRECT EXAMINATION

11 BY MR. SOPER:

12 Q. Dr. Resnikoff, you were shown an Exhibit  
13 that was not introduced into evidence but was a  
14 page from the Data Development Technical Support  
15 Document for the Aircraft Crash Risk Assessment  
16 Methodology standard. It consisted of the first  
17 page and page 4-5. Do you have that in front of  
18 you, sir?

19 A. I do.

20 Q. You were asked about the one sentence  
21 that appears in there that reads as follows: "For  
22 some facilities, particularly hardened structures,  
23 a more appropriate estimate of a crash frequency  
24 may be one based on only considering impact mishaps  
25 in which the crashing aircraft was destroyed." Do

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1 you remember that, sir?

2 A. I do.

3 Q. In some of your analysis you did not use  
4 only destroyed aircraft crashes; is that correct?

5 A. That's correct.

6 Q. Could you explain a little bit how this  
7 sentence affects your choice of aircraft crash  
8 statistics, that is, Class a, Class B, Destroyed,  
9 if it affects your choice at all?

10 A. Well, the term "hardened structures" in  
11 this sentence isn't really defined. The casks have  
12 a certain amount of concrete, 28 inches or so, but  
13 nuclear reactors have five feet, four feet of  
14 concrete in the containment dome. So it's not  
15 clear what exactly was being referred to here.

16 We used all classes, all mishaps, Class  
17 A and B mishaps. The sentence says, "A more  
18 appropriate estimate of crash frequency may be one  
19 based on only considering impact mishaps." So it  
20 implies that one could consider other than impact  
21 mishaps. And we have used Class A and B mishaps  
22 together.

23 Q. And what's your purpose on using A and B  
24 mishaps?

25 A. Well, we considered it a more

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1 conservative approach to use A+B. And the  
2 Applicant at times, I tried to point this out in  
3 its August 10, 2000, Revision 4 discusses using  
4 Class A and B mishaps, even though they acknowledge  
5 that crash B mishaps rarely involve a crash.

6 Q. Now, are you referring to the Aircraft  
7 Crash Report that was submitted by PFS?

8 A. Yes, I am.

9 Q. That's the Revision 4, the August 10,  
10 2000 edition?

11 A. Yes, that's right, counsel.

12 Q. For convenience, we're going to pass out  
13 a copy. Dr. Resnikoff, do you have a copy of the  
14 Aircraft Crash Report of August 10, 2000 before you  
15 there?

16 A. Yes, page 10.

17 Q. And would you read the third full  
18 paragraph, the first sentence?

19 A. "In developing aircraft crash rates,  
20 DOE used both Class A and Class B mishaps even  
21 though crash B mishaps rarely involve a crash," I  
22 guess that's a typo, "even though Class B mishaps  
23 rarely involve a crash, and Class A mishaps may not  
24 involve a crash."

25 Q. And the following sentence?

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1           A.       "Thus for our purposes here, the DOE  
2 crash data would be conservative since we are only  
3 interested in aircraft crashes which could  
4 potentially impact the PFS facility."

5           Q.       And it was your testimony just now that  
6 your intent was to be, in fact, conservative; isn't  
7 that right?

8           A.       That's right.

9           Q.       And so for that reason you did use Class  
10 A and Class B mishaps on many of your calculations?

11          A.       That's right.

12                 MR. SOPER: I'm handing out an Exhibit  
13 now, your Honor, that I would like to have marked.  
14 It would be State Exhibit 187.

15                 JUDGE FARRAR: All right. The reporter  
16 will mark it.

17                 (STATE'S EXHIBIT-187 MARKED.)

18                 MR. SOPER: May I proceed, your Honor?

19                 JUDGE FARRAR: Yes. I'm sorry, go  
20 ahead.

21          Q.       (By Mr. Soper) Dr. Resnikoff, do you  
22 have before you what's been marked as Utah 187?

23          A.       I do.

24          Q.       Can you identify that for us, please?

25          A.       Yes. This is a graph I prepared which

1 is identical to 155 except that it has an  
2 additional line on it, which is the lifetime crash  
3 rate.

4 MR. SILBERG: Excuse me. For the  
5 record, that's a line that you put on there, Dr.  
6 Resnikoff?

7 THE WITNESS: Yes.

8 Q. (By Mr. Soper) By that you mean that  
9 the remainder of the graph was computer-generated  
10 and you added the lifetime rate to it as an  
11 illustration, is that right, or what?

12 A. Well, actually, it's all  
13 computer-generated, but I didn't make the line dark  
14 enough so I darkened it by hand.

15 Q. I see. So you retraced it just for  
16 visibility, but this entire thing is  
17 computer-generated?

18 A. Yes.

19 Q. Is there anything else about this graph  
20 that you need to explain or is it self-explanatory,  
21 Doctor?

22 A. The point that I raised earlier, which I  
23 would like to underline, is that the linear  
24 trendline and the fiscal year 2001 and the lifetime  
25 crash rate all seem to be converging at a similar

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1 point.

2 Q. Now, this is, as appears at the top,  
3 Class A Crash Rate. I think that's supposed to be  
4 FY95 through FY01; is that right?

5 A. Yes, that's right.

6 Q. And the lifetime rate that appears on  
7 there, is that also the lifetime Class A crash  
8 rate?

9 A. Yes.

10 Q. As opposed to Class A and Class B, this  
11 is not a Class A and B graph; is that right?

12 A. That's right.

13 MR. SOPER: I would move the admission  
14 of State Exhibit 187.

15 JUDGE FARRAR: Any objection?

16 MS. MARCO: No.

17 MR. BARNETT: No objection.

18 JUDGE FARRAR: 187 will be admitted.

19 (STATE'S EXHIBIT-187 ADMITTED.)

20 MR. SOPER: And as a matter of  
21 housekeeping, I would move the admission of State  
22 155 which has been used in this proceeding, but I  
23 believe some time ago the introduction into  
24 evidence was asked to be delayed until Dr.  
25 Resnikoff could identify it. So I would now move

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1 the admission of 155.

2 JUDGE FARRAR: You're correct, we did  
3 hold off on that. Any objection?

4 MR. BARNETT: No objection, your Honor.

5 JUDGE FARRAR: All right. That will be  
6 admitted also.

7 (STATE'S EXHIBIT-155 ADMITTED.)

8 MR. SOPER: And that's the end of our  
9 redirect.

10 JUDGE FARRAR: All right. Does that  
11 trigger any need for recross?

12 MR. BARNETT: No, your Honor, nothing  
13 for us.

14 JUDGE FARRAR: Ms. Marco?

15 MS. MARCO: No, your Honor.

16 JUDGE FARRAR: All right. Then, Dr.  
17 Resnikoff, you're excused. We thank you for your  
18 testimony on this and we look forward to your  
19 testimony on seismic at some future date.

20 THE WITNESS: Thank you.

21 JUDGE FARRAR: Next order of business?  
22 Okay. That concludes the State's direct case  
23 except for bringing back Colonel Horstman?

24 MR. SOPER: Yes, your Honor.

25 JUDGE FARRAR: So Applicant rebuttal?

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1 MR. BARNETT: Yes, your Honor. This is  
2 rebuttal to Dr. Resnikoff, not to Lieutenant  
3 Horstman.

4 JUDGE FARRAR: Go ahead.

5 MR. BARNETT: Your Honor, can we take  
6 about five minutes to talk to the witness?

7 JUDGE FARRAR: Sure. We'll all kind of  
8 stay here, I guess, and you can let us know when  
9 you're ready.

10 (A recess taken.)

11 JUDGE FARRAR: All right. Are we  
12 getting ready to go here?

13 MR. BARNETT: We have two more  
14 witnesses, your Honor.

15 MR. SOPER: Your Honor, before we begin,  
16 it was my understanding that only Colonel  
17 Jefferson -- or General Jefferson was going to  
18 rebut Dr. Resnikoff since he's the one, the only  
19 one that's done any calculations from this panel.  
20 We don't have our expert Colonel Horstman here to  
21 deal with noncalculation issues.

22 JUDGE FARRAR: Mr. Barnett?

23 MR. BARNETT: Your Honor, I have one  
24 question for Colonel Fly and one question for  
25 General Cole related to noncalculational issues

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1 that relate to assumptions made in Dr. Resnikoff's  
2 calculations and the data he used in his  
3 calculations. Other than that, they're all  
4 questions for General Jefferson.

5 JUDGE FARRAR: All right. Then let's  
6 bear Mr. Soper's possible objection in mind, but  
7 proceed with the entire panel. Mr. Soper, you can  
8 renew that if you think a question is inappropriate  
9 in light of your position. Gentlemen, you're back  
10 again, you're still under oath. You may proceed,  
11 counsel.

12  
13 GENERAL COLE, COLONEL FLY, GENERAL JEFFERSON,  
14 recalled as rebuttal witnesses for the Applicant,  
15 were examined and testified as follows:

16  
17 REBUTTAL DIRECT EXAMINATION

18 BY MR. BARNETT:

19 Q. General Cole, you heard the discussion  
20 today about Class B mishaps and Dr. Resnikoff's use  
21 of them in various calculations that he did to  
22 project F-16 accident rates and to look at trends  
23 for F-16 accident rates?

24 GEN. COLE: That's correct.

25 Q. I would like you to take a look at one

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1 of the Exhibits that's already in evidence. This  
2 is State's Exhibit 154, page 2. Do you have that  
3 in front of you now?

4 GEN. COLE: I do.

5 Q. You see that this is the F-16 history  
6 and it has Class A, Class B Mishaps, Destroyed  
7 Aircraft Rates for the various years?

8 GEN. COLE: That's correct.

9 Q. Now, if you look at the Class B column,  
10 and if you look at fiscal year 2000 and fiscal year  
11 2001, you see that the Class B rate in fiscal year  
12 2000 is 2.04 and in fiscal year 2001 the rate is  
13 2.67?

14 GEN. COLE: Correct.

15 Q. And now you see that the lifetime rate  
16 for the F-16 down there at the bottom is 0.77?

17 GEN. COLE: That's right.

18 Q. Do you have an explanation for why the  
19 Class B rates in fiscal year 2000 and fiscal year  
20 2001 appear to be significantly higher than the  
21 lifetime rate?

22 GEN. COLE: I do. Up until the year  
23 2000, engine contained mishaps were listed in a  
24 separate category, Category J. They were in the  
25 spectrum of accident data in categories, but they

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1 weren't included in flight mishaps.

2           At some point during the year 2000, the  
3 Department of Defense provided some guidance to the  
4 services that from then on engine mishaps or  
5 difficulties, even if they did not cause specific  
6 damage to the airplane in aggregate, would be  
7 included in the mishap categories. So what the Air  
8 Force basically did was, in the case of Category B,  
9 Class B mishaps, which are \$200,000 to \$1 million,  
10 if an engine problem reached that threshold,  
11 instead of putting it in the previous Category J,  
12 they would list it as a Class B.

13           And so from 2000 to 2001 the Air Force  
14 basically had to add one Class A, it was a  
15 paramobility command incident where they had an  
16 engine damage that exceeded a million, and they  
17 increased the total Class Bs in the entire Air  
18 Force to approximately 10 in addition to what they  
19 had because of engine-related things. So there was  
20 no difference in what was happening, it was simply  
21 a difference in which category you put those  
22 engine-related mishaps in.

23           Q.       Now, in those engine-related mishaps  
24 that you talked about that were added to the Class  
25 B category, do those represent cases where the

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1 aircraft actually crashed?

2 GEN. COLE: No, they do not.

3 Q. General Jefferson, in question 16 of Dr.  
4 Resnikoff's testimony, he used the Spearman Rank  
5 Correlation to assess whether the F-16 crash rate  
6 which he uses as the Class A+Class B mishap rate,  
7 increased from fiscal year 1995 to fiscal year  
8 2000. Could you explain what the Spearman Rank  
9 Correlation is?

10 GEN. JEFFERSON: Sure. The Spearman  
11 Rank Correlation is a measure of correlation of  
12 ordinal data. It's when you have data that's in  
13 ranks, but you don't have the interval scale with  
14 it. It's a lesser order, lesser quality of data  
15 than if you had interval data. You use that  
16 primarily in the behavioral sciences where you have  
17 data that's on the order of people like this better  
18 than that or when you fill out these tables that  
19 say rate your feelings, A, B, C, D or E, you use it  
20 for that kind of thing because you can't get the  
21 numerical data associated with that. If you use it  
22 on numerical data you run the risk of losing a good  
23 bit of information.

24 Q. Would you use the Spearman Rank  
25 Correlation, would you use numerical data for both

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1 variables that you are analyzing?

2 GEN. JEFFERSON: No, I would not.

3 Q. Could you provide an example of an  
4 appropriate statistical test that you would use to  
5 determine correlation between two numerical values?  
6 Variables, I'm sorry.

7 GEN. JEFFERSON: I think in the time  
8 series that we're looking at here a linear  
9 regression would be a good test.

10 Q. General Jefferson, in question 26 of his  
11 testimony, Dr. Resnikoff calculated a number of  
12 flights using the Moser Recovery that he calculated  
13 based on an assumed number of flights on the South  
14 Utah Test and Training Range. Do you have that in  
15 front of you?

16 GEN. JEFFERSON: Yes, I do.

17 Q. Do you see at the bottom of page 16  
18 there, the last sentence that says, "Thus, the  
19 number of flights per year using the MRR is 3436  
20 flights per year," and then it says, "Equals 5,726  
21 times 7,040 divided by 3,871 times 0.33"?

22 GEN. JEFFERSON: Yes, I do.

23 Q. Could you calculate out and say how many  
24 flights that is assumed for the South Utah Test and  
25 Training Range, that is, leaving off the 33 percent

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1 that would assume to use the Moser Recovery, that  
2 is, just give us the total for the South Utah Test  
3 and Training Range?

4 GEN. JEFFERSON: 10,412.

5 Q. Do you have information on how many  
6 flights, how many sorties there actually were on  
7 the Utah South Test and Training Range in the years  
8 since 1998?

9 GEN. JEFFERSON: I don't have that with  
10 me. I've seen it and it's less than 10,000, I know  
11 that, but I don't have it here.

12 Q. Do you recall if that's in information  
13 PFS has submitted in this proceeding?

14 GEN. JEFFERSON: I don't directly recall  
15 that.

16 MR. BARNETT: Your Honor, I'm showing  
17 the witness a copy of PFS Exhibit O. This is PFS  
18 Exhibit O. What tab is that?

19 MR. GAUKLER: Tab HH.

20 Q. (By Mr. Barnett) Tab HH and page 4.

21 GEN. JEFFERSON: Yes, I have that.

22 Q. Could you tell us how many sorties, F-16  
23 sorties there were on the South Utah Test and  
24 Training Range after 1998?

25 GEN. JEFFERSON: Yes. This was data

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1 from Hill, and FY00 it was 7,059, in '99 it was  
2 7,232.

3 Q. Now, you recall that there was  
4 discussion of the extra or additional F-16s that  
5 were coming to Hill Air Force Base in 2001?

6 GEN. JEFFERSON: Yes.

7 Q. Do you recall the percentage that that  
8 was, the percentage increase that that was?

9 GEN. JEFFERSON: I believe it was 17  
10 percent.

11 Q. If you were to increase those F-16  
12 sorties for the South Utah Test and Training Range  
13 by 17 percent for fiscal year 1999 and fiscal year  
14 2000, can you tell us what you would get?

15 GEN. JEFFERSON: For '00, for fiscal  
16 year '00 it would be 8,259.

17 Q. All right. Could you do it for 1999 as  
18 well?

19 GEN. JEFFERSON: It would be 8,461.

20 Q. Thank you.

21 Colonel Fly, in question 34 of his  
22 testimony, Dr. Resnikoff makes the statement that,  
23 "Although ordnance may be jettisoned on racks,  
24 there is the potential that each individual piece  
25 of ordnance jettisoned could strike the Private

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1 Fuel Storage facility." How do F-16s carry  
2 ordnance?

3 COL. FLY: With respect to the  
4 heavyweight training ordnance, the 500 and 2,000  
5 pound bombs, there are two ways that they can be  
6 carried. The large ones, the 2,000 pounders, are  
7 directly mounted to a wing pylon or station  
8 directly attached to the wing. They'll put one of  
9 those under each wing. For the 500 pound bombs,  
10 you can either do the same thing, pair them out to  
11 the pylon or you can put a triple ejector rack,  
12 referred to as a TER, T-E-R, under each wing and  
13 then you could put three bombs on the TER, on each  
14 TER for a total of six 500 pound bombs.

15 During the emergency procedure that we  
16 discussed previously in which Lt. Col. Horstman  
17 addressed also, the proper thing to do to jettison  
18 stores in accordance with procedures is just above  
19 the left knee on the console there's a button  
20 called the emergency stores jettison button or  
21 emergency stores jettison, I don't think it says  
22 button. When you hit that button then what it will  
23 do is it will release from the pylons, either -- if  
24 the bombs were directly attached to the pylons, the  
25 bombs will fall off. If the TER, if the bombs are

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1 attached to a TER then the TERs will fall off. So  
2 you would get, if you will, a single unit release  
3 of weapon under each wing for a total of two units,  
4 if you will.

5 Q. General Jefferson, in calculating a  
6 hazard to the PFSF from potentially jettisoned  
7 ordnance, if you have a case like Colonel Fly just  
8 described where the ordnance is jettisoned on  
9 the -- say it's carried on these triple ejection  
10 racks and you have a jettison of ordnance, what is  
11 the proper way to calculate the hazard to the  
12 facility on the ground? Is it to treat it as -- is  
13 it one event or is it two events or is it six  
14 events? How would you do that?

15 GEN. JEFFERSON: Well, since they come  
16 off together and they stay with the racks, which is  
17 what is likely to happen, then it will be one event  
18 because they will all come down together. And they  
19 will come down fairly steeply because it will have  
20 no aerodynamic capability at that time.

21 Q. General Jefferson, in question 36 of his  
22 testimony, Dr. Resnikoff states that a piece of  
23 ordnance jettisoned from an F-16 will skid when it  
24 hits the ground a skid distance similar to that of  
25 an F-16 aircraft. Is it correct to assume that

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1 when ordnance is jettisoned from an F-16 at the  
2 altitude and speeds at which they fly through Skull  
3 Valley strikes the ground, that that ordnance would  
4 skid a distance similar to the distance a crashing  
5 F-16 would skid?

6 GEN. JEFFERSON: No, it is not. The  
7 skid distance for the F-16 is taken from the DOE  
8 manual and it is -- it assumes about a 7-degree  
9 incidence angle, which is very shallow. Ordnance  
10 dropped in the fashion we've just described would  
11 come down very steeply, it would not be that  
12 shallow, they would be much more close to vertical,  
13 and I don't see how they could skid in that case.

14 Q. General Jefferson, Dr. Resnikoff has  
15 stated that PFS should use a lifetime crash rate  
16 for the F-16 when assessing the hazard to the  
17 Private Fuel Storage facility. Did you ever  
18 calculate a lifetime crash rate for the F-16?

19 GEN. JEFFERSON: Yes, I did and that was  
20 presented in our aircraft report. It's at page 11.  
21 That is where we looked at what rate to use. We  
22 examined the 10-year rate, the 5-year rate and the  
23 lifetime rate. We decided for the reasons we  
24 expressed there that the 10-year rate, 10-year  
25 average rate was the best one to use because it

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1 contained both recency of data, but enough data  
2 points that it wouldn't be subject to the  
3 fluctuations we have seen today between annual  
4 rates and what impact they make on that.

5 Q. What value did you get when you  
6 calculated the lifetime crash rate?

7 GEN. JEFFERSON: It's on page 11 and  
8 it's the lifetime rate, and this is for normal  
9 flight, was 3.372 times 10 to the minus 8th per  
10 mile.

11 Q. Okay. So that's a crash rate per mile?

12 GEN JEFFERSON: Yes.

13 Q. And what period data did you use to  
14 calculate that rate?

15 GEN. JEFFERSON: That was the F-16  
16 lifetime up to 1998, FY98.

17 Q. And what value did you get when you used  
18 a 10-year average?

19 GEN. JEFFERSON: I got 2.736 times 10 to  
20 the minus 8th per mile.

21 Q. How do those two values compare?

22 GEN. JEFFERSON: The lifetime rate is 23  
23 percent higher than the 10-year rate.

24 Q. Now, hypothetically if you were to use  
25 the lifetime rate in your hazard calculation

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1        instead of the 10-year rate, what would the effect  
2        be?

3                    GEN. JEFFERSON:    In the hazard  
4        calculation?

5            Q.        Yes.

6                    GEN. JEFFERSON:    Okay.    It would affect  
7        the transit, the risk from F-16s transiting Skull  
8        Valley, it would affect the Moser figures and it  
9        would affect the jettisoned ordnance figures.    It  
10       would not affect, naturally, commercial or general  
11       aviation.

12            Q.        I'll put the last question to the panel  
13        generally.    Dr. Resnikoff has said that in  
14        assessing whether a pilot would avoid a site on the  
15        ground in the event of an emergency or whether he  
16        could avoid a site on the ground in the event of an  
17        emergency was an issue of assessing the pilot's  
18        frame of mind.    Is that really what you're trying  
19        to do when you did your analysis of whether or not  
20        a pilot would be able to avoid the facility?

21                    GEN. JEFFERSON:    No, we were not looking  
22        at the pilot's frame of mind, we were looking at  
23        what he actually did.    And that's the difference,  
24        that we could see that in reports of what he was  
25        actually doing in the condition of going through

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1 this emergency up to ejection.

2 Q. Colonel Fly or General Cole, do you have  
3 anything to add to that?

4 COL. FLY: I would agree, we weren't  
5 trying to get inside of his mind. We were trying  
6 to understand what actions could the report  
7 demonstrate he took in terms of maneuvering the  
8 airplane.

9 Q. Gen. Cole?

10 GEN. COLE: I concur, behavior and  
11 actual performance.

12 MR. BARNETT: That's all I have, your  
13 Honor.

14 JUDGE FARRAR: Staff?

15 MS. MARCO: No, we do not.

16 JUDGE FARRAR: Mr. Soper?

17 MR. SOPER: Just a quick one.

18

19 REBUTTAL CROSS-EXAMINATION

20 BY MR. SOPER:

21 Q. Colonel Fly, you don't consider state of  
22 mind to be related to the stress that a pilot might  
23 be under in an emergency?

24 COL. FLY: The question was, I believe,  
25 were we trying to evaluate his state of mind, and

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1 our answer was we were looking for indications of  
2 how he performed and what he did.

3 Q. My question to you, sir, is do you  
4 believe the stress that a pilot is under relates to  
5 his state of mind?

6 COL. FLY: I'm not sure that I  
7 understand the question well enough to formulate an  
8 answer. I'm sorry.

9 Q. Let me ask it again. You say that you  
10 did not consider the pilot's state of mind; is that  
11 correct?

12 COL. FLY: I believe what I said was we  
13 were attempting to evaluate the performance and  
14 what he was doing with the airplane and what  
15 actions he was taking. We weren't attempting to  
16 evaluate his state of mind.

17 Q. Okay. So, then, did you consider his  
18 state of mind or not is my question?

19 COL. FLY: As a specific sub item?

20 Q. In any manner.

21 COL. FLY: I don't think we directly  
22 said, what is the pilot's state of mind at this  
23 moment.

24 Q. Did you consider the stress the pilot  
25 was under?

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1 MR. BARNETT: I would object, your  
2 Honor. I think this is beyond the scope of  
3 rebuttal.

4 JUDGE FARRAR: It's close, but I think  
5 it's within. Go ahead.

6 COL. FLY: We appreciate -- I appreciate  
7 that a pilot in the event of an emergency is  
8 undergoing stress. How he reacts, what he does,  
9 etc., that stress is embedded in his actions, etc.  
10 So stress is compensated or considered, but not  
11 directly in terms of is his stress level a 6, is it  
12 a 9. It's inherent in the situation. It's  
13 embedded, if you will, but we didn't try to cull  
14 out what is his specific stress level at this time.

15 Q. In concluding that the pilots would  
16 perform in 95 percent of the cases where the  
17 airplane is controllable in such a manner as they  
18 would be able to avoid the facility, did you give  
19 any weight to the fact that the pilots were under  
20 stress during those times?

21 MR. BARNETT: Your Honor, I would renew  
22 the objection, beyond the scope.

23 JUDGE FARRAR: Same ruling.

24 COL. FLY: I believe I just answered  
25 that question in the sense that we understood, we

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1 understand that stress is inherent in these  
2 situations. The pilot is undergoing stress. We  
3 heard that in the direct testimony of the two --  
4 the one active duty and the one retired officer,  
5 they talked about the stress levels. So yes, we  
6 considered it in the fact that we acknowledge the  
7 fact that it is there.

8 MR. SOPER: That's all I have.

9 (The Board conferred off the record.)

10 JUDGE FARRAR: The Board has a couple of  
11 questions.

12 JUDGE KLINE: General Jefferson, it may  
13 be more than one.

14 MR. GAUKLER: Judge Kline is warning  
15 you, General Jefferson.

16 JUDGE KLINE: Did you hear our previous  
17 discussion with Dr. Resnikoff concerning the  
18 question of statistical bias?

19 GEN. JEFFERSON: Yes, I did.

20 JUDGE KLINE: Then you understand when  
21 we raise the issue of statistical bias that we are  
22 not raising issues of character or integrity; do  
23 you understand that?

24 GEN. JEFFERSON: Yes, sir.

25 JUDGE KLINE: Did you hear the analogy

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1 we used with double-blind experiments in medicine?

2 GEN. JEFFERSON: Yes, sir, I did.

3 JUDGE KLINE: And the indication that  
4 this was an illustration of how investigators may  
5 build safeguards against bias into their  
6 experimental protocol, that is, without to specific  
7 instances of bias, just generically. Do you agree  
8 with that, that they do things like that?

9 GEN. JEFFERSON: Yes.

10 JUDGE KLINE: Then in respect to the  
11 management of data that you performed on the  
12 accident reports, can you point to built-in  
13 safeguards against inadvertent bias that were part  
14 of your protocol in screening accident reports down  
15 to the level where you thought you could use them  
16 to estimate R?

17 GEN. JEFFERSON: Yes, sir. To begin  
18 with, the reports we got we had no control over  
19 them, they were strictly a forward to the Air Force  
20 and said, okay, give us what you have. So we got  
21 what they had. So we had no selectivity over that.

22 JUDGE KLINE: We understand that. We're  
23 really focusing on the subsequent screening and  
24 categorization that you did.

25 GEN. JEFFERSON: Then we analyzed those

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1 reports, the three you of us did individually and  
2 independently. We actually did look at five or six  
3 initially just as a sample to see what sort of data  
4 was there, what we ought to be extracting. We had  
5 a long, long list of stuff, but we decided that  
6 most of it wasn't pertinent.

7 And so we went back and listed what we  
8 were looking for and then we independently took a  
9 complete set of the reports and evaluated them.  
10 And when we were finished with that then we got  
11 together and went over them jointly to come up with  
12 what we had. I think that would be one of those  
13 things, for instance, to get over a particular  
14 person's bias about how they look at accidents,  
15 that sort of thing.

16 JUDGE KLINE: Did you produce three  
17 different estimates of R?

18 GEN. JEFFERSON: No, sir, we put that  
19 all together.

20 JUDGE KLINE: Suppose that you, as  
21 experts, wrote out the screening protocol and then  
22 turned it over to some impartial party to actually  
23 do the screening. Have you got any feel for  
24 whether they would come up with the same numbers  
25 that you did?

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1 GEN. JEFFERSON: We think so. What we  
2 tried to do was be very specific about what our  
3 categorical definitions were so that anyone coming  
4 along later could reproduce the results. If they  
5 were fair-minded about this they came put it  
6 together and come up with the same thing that we  
7 got. So we were very careful to give very clear  
8 definitions of what we did and what those  
9 categories were.

10 JUDGE KLINE: So in your view, then,  
11 your protocol is sufficiently explicit that it  
12 could be reproduced by an independent observer; is  
13 that your view of it?

14 GEN. JEFFERSON: I believe so, yes, sir.

15 JUDGE KLINE: Are there any other  
16 safeguards, in your mind, that are part of your  
17 screening protocol?

18 GEN. JEFFERSON: I can't think of one  
19 right now, sir.

20 JUDGE KLINE: All right. Thank you.

21 JUDGE LAM: General Jefferson, would you  
22 consider the work that you and General Cole and  
23 Colonel Fly had done, would you consider them  
24 having peer review? When one of you looked at the  
25 other's work, did you consider that as a peer

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1 review process?

2 GEN. JEFFERSON: I would not consider  
3 that in what I understand the definition of peer  
4 review. That was simply our way of getting, I  
5 think it's called a Delphi method or something,  
6 where you individually look at things and then you  
7 come and talk about them and through that you get a  
8 common understanding of what's there.

9 JUDGE LAM: So is it fair to categorize  
10 what you three gentlemen have done, it's basically  
11 reflecting your collective effort and wisdom?

12 GEN. JEFFERSON: Yes.

13 JUDGE FARRAR: If I were the editor of  
14 the Journal of Statistics, if there is such a  
15 thing, and I said, okay, nothing is coming in here  
16 unless it's demonstrated to be free of statistical  
17 bias like the double-blind, would your approach  
18 measure up?

19 GEN. JEFFERSON: I think the structure  
20 is. I suspect in that case, you know, an impartial  
21 group review would be in order. But I think it  
22 would stand up.

23 JUDGE FARRAR: If I were the editor,  
24 would I like it better if you had done what Judge  
25 Kline suggested, you set out the criteria and then

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1 hire somebody and don't tell them what result your  
2 client wants and have the person, that person apply  
3 your criteria in the blind, as it were? Would that  
4 be better?

5 GEN. JEFFERSON: I suppose if those  
6 people, you know, had the experience base and that  
7 sort of thing to look at it. But we did try to set  
8 the structure out to where that was possible, yes.

9 JUDGE FARRAR: Okay. That raises  
10 another question. That answer suggests you  
11 couldn't just hire a liberal arts grad student to  
12 do it because you need some expertise in  
13 interpreting the reports.

14 GEN. JEFFERSON: Well, the jargon to  
15 start with, and then some understanding or some  
16 feel of what's happening I think would be  
17 important.

18 JUDGE FARRAR: Okay. I guess that's an  
19 unsolvable problem, the fact that these reports  
20 were not written for this purpose. So it's not  
21 like you tell me what to look for and I go in and  
22 find that section and it will give us the answer.  
23 We just can't do that?

24 GEN. JEFFERSON: The reports themselves  
25 are standardized and there are certain sections

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1 that you would focus on, the medical section or  
2 whatever.

3 JUDGE FARRAR: But they don't have a  
4 section that gives us the answer to the --

5 GEN. JEFFERSON: No, it would be an  
6 interpretive process.

7 JUDGE LAM: And, General Jefferson,  
8 would all these discussions on statistical biases  
9 and safeguards only apply to your analyses on what  
10 you label Able to Avoid?

11 Let me be more specific. In your  
12 assessment of the pilot's avoidance success  
13 probability, the two elements in your analyses.  
14 The first one is what you label Able to Avoid. The  
15 second one is, given that opportunity of being able  
16 to avoid, the pilot in fact able to avoid a land  
17 target. In the first element of your analyses you  
18 have gone through three different studies, all well  
19 described in Tab H in the hazard report. Am I  
20 right to say all the statistical safeguards and  
21 biases we are talking about right now only apply to  
22 the first element?

23 GEN. JEFFERSON: They are most in  
24 evident there. I think setting forth the point  
25 that we're looking for in the second factor, I

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1 think that could be found there, but I don't know  
2 that I could specifically say there's a bias trap  
3 in there somewhere.

4 JUDGE LAM: Right. Because the way I  
5 understand your evaluation of the second factor,  
6 which you label, in fact, being able to avoid a  
7 land target, you and General Cole and Colonel Fly  
8 rely on your expert opinion of what that success  
9 probabilities is based on three considerations:  
10 The well-trained Air Force pilot, the most visible  
11 structure of this facility will be in the valley,  
12 and the sufficient time to take action. Based on  
13 these three consideration, you apply what I call  
14 expert opinion of what that success probability is,  
15 which is 95 percent. So all our statistical  
16 analysis, the biases, the safeguards, would not  
17 apply to this particular assessment; is that  
18 correct?

19 GEN. JEFFERSON: I think that's right.  
20 What we did was we have a perception of what pilots  
21 do. We did look at the reports to see is that in  
22 fact true, do they do that, and we found, as we've  
23 mentioned, there's support for that. We did not  
24 find any counter examples. And I think anyone else  
25 who reviewed the data would find that same thing.

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1 So I guess it's not as structured as the other  
2 part, I guess that's where I come up with that.

3 JUDGE LAM: Right. The first part you  
4 had three studies?

5 GEN. JEFFERSON: Yes.

6 JUDGE LAM: The 95 percent success, by  
7 which I mean the potential, the opportunity exists  
8 for being able to avoid, you came up with a 95  
9 percent probability based on three studies. The  
10 first studies you analyzed 121 events, you select  
11 61 events for further studies, and then among the  
12 61 you identify 59 events which is currently before  
13 us.

14 GEN. JEFFERSON: Yes.

15 JUDGE LAM: And then you refer to two  
16 more sensitivity studies.

17 GEN. JEFFERSON: Yes.

18 JUDGE LAM: To affirm that, indeed, the  
19 90 percent assessment is conservative,  
20 quote-unquote?

21 GEN. JEFFERSON: Yes.

22 JUDGE LAM: So I think all of the biases  
23 and safeguards should really be focused on this  
24 part of the assessment and not on the second part,  
25 which I call the 95 percent success probability for

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1 a pilot given the opportunity would be able to  
2 avoid the target.

3 GEN. JEFFERSON: Yes. Those structures  
4 are in the first part, I agree with that. I'm  
5 confident we did not look at the second part bias,  
6 but I don't know that there's a structure that  
7 would stand up to a review other than some other  
8 group taking a look at it and coming up with a  
9 conclusion on it. You know, with a similar  
10 experience level and understanding of the culture  
11 of pilots and that sort of thing.

12 JUDGE LAM: Did I describe my  
13 understanding well? I mean, does my understanding  
14 of what you had done conform to what you in fact  
15 did?

16 GEN. JEFFERSON: Yes, I follow that. I  
17 agree with that.

18 JUDGE LAM: Thank you, gentlemen.

19 JUDGE FARRAR: Does the Board's  
20 questions prompt anyone else to ask a follow-up?  
21 Ms. Marco?

22 MS. MARCO: No.

23 JUDGE FARRAR: Mr. Barnett?

24 MR. BARNETT: No.

25 JUDGE FARRAR: Mr. Soper?

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1 MR. SOPER: No, your Honor.

2 JUDGE FARRAR: All right. You're  
3 excused again. Thank you again for your brief  
4 testimony this time. Ms. Marco, does the staff  
5 have rebuttal?

6 MS. MARCO: Yes, your Honor. I would  
7 like to call back to the stand Dr. Amatavi Ghosh  
8 and Dr. Kazimieras Campe. Would you two gentlemen  
9 please go back to the stand.

10 MR. TURK: Can we take a few minutes in  
11 place to organize papers?

12 JUDGE FARRAR: Yes, certainly.

13 (A recess taken.)

14 JUDGE FARRAR: I understand we're ready  
15 to start the Staff's rebuttal.

16 MS. MARCO: Thanks.

17

18 AMITAVA. GHOSH AND KAZIMIERAS CAMPE,  
19 recalled as Staff Rebuttal witnesses, were  
20 examined and testified as follows:

21

22 REBUTTAL DIRECT EXAMINATION

23 BY MS. MARCO:

24 Q. Are you aware of the Spearman Rank  
25 Correlation test?

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1 JUDGE FARRAR: Wait a minute. I forgot  
2 to remind them that they're still sworn, still  
3 under oath from before.

4 DR. CAMPE: Thank you, your Honor.

5 DR. GHOSH: Yes.

6 Q. (By Ms. Marco) Good afternoon.

7 DR. CAMPE: Good afternoon.

8 DR. GHOSH: Good afternoon.

9 Q. Are you familiar with the Spearman Rank  
10 Correlation test?

11 DR. CAMPE: Yes.

12 DR. GHOSH: Yes.

13 Q. Are you familiar with the analysis  
14 presented by Dr. Resnikoff using the Spearman Rank  
15 Correlation test?

16 DR. CAMPE: Yes.

17 DR. GHOSH: Yes.

18 Q. What does Dr. Resnikoff conclude?

19 DR. CAMPE: I can answer that by  
20 referring to a specific time frame that Dr.  
21 Resnikoff used in analyzing the crash rates for  
22 F-16s, and specifically he had looked, I believe,  
23 in the time frame of FY95 to the year 2000, which  
24 was the data that was available at the time of the  
25 analysis that he performed. And he had then, as a

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1 result of the calculation, concluded that there was  
2 an increase in trend or a trend in the increase in  
3 crash rate for that time frame. And if one  
4 confines oneself to that particular sample of  
5 years, then as the test indicates, and I would get  
6 the same result.

7 Q. Do you believe that Dr. Resnikoff's  
8 selection of this data sample results in the best  
9 representation of F-16 crash rate trends?

10 DR. CAMPE: No, I don't believe so.

11 Q. Why is that?

12 DR. CAMPE: I say that because I feel  
13 that at any time when one is faced with evaluations  
14 involving use of data where there are things like  
15 statistical fluctuations in the data as a function  
16 of time in this case, that one should try to  
17 capture as much data as possible at the widest span  
18 of years while at the same time making sure that  
19 the data is meaningful and applicable. So from  
20 that perspective, isolating a small subset of that  
21 does not seem to be reasonable.

22 MS. MARCO: I would like to have this  
23 marked as Staff Exhibit KK, I believe we're at.

24 JUDGE FARRAR: You're right, it's KK.  
25 The reporter will mark that for identification.

1 (STAFF EXHIBIT-KK MARKED.)

2 Q. (By Ms. Marco) Did you perform a  
3 Spearman Rank Correlation test based on the crash  
4 rate for F-16 Class A and B Mishaps?

5 DR. CAMPE: I performed some preliminary  
6 calculations on looking at various different time  
7 periods for the data that were used by PFS and by  
8 Dr. Resnikoff and also the data that were available  
9 from the U.S. Air Force publications of crash data  
10 that have been offered as part of the Exhibits in  
11 these proceedings. On the basis of these  
12 preliminary calculations then in consultation with  
13 Dr. Ghosh, we -- he then picked up on that and  
14 produced, what I would say, a more complete and  
15 more detailed set of calculations. So in that  
16 sense I think we both were involved in doing that.

17 Q. Dr. Ghosh, I guess I will direct this to  
18 you. I have placed a document in front of you. Do  
19 you recognize what that is?

20 DR. GHOSH: Yes.

21 Q. Can you please describe what this  
22 document is?

23 DR. GHOSH: Yes. This is the plot where  
24 we tried to use the Spearman Rank Correlation  
25 Analysis. In the particle bars are the crash rate

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1 which came from the U.S. Air Force data and on the  
2 top of that a lot of text in there, negative mix,  
3 negative correlation. What we did is like to test  
4 the hypothesis when you do the Spearman Rank test,  
5 is that the results are statistically significant  
6 test. We did the statistically significant test  
7 which is quite common from the book and did it for  
8 every year.

9 For example, like if we take any data  
10 for any particular part, what we did is the data  
11 from that year to up to 2001. So we progressively  
12 used more and more data to see how does the results  
13 are statistically significant. When it said no,  
14 that means there is no correlation. That means  
15 that we can say that here then the crash data sort  
16 or independent. When it say positive, that is a  
17 positive correlation that the crash data is  
18 increasing. When it is negative, that means that  
19 the crash data decreasing with the year.

20 Q. And what significance does the positive  
21 correlation have with respect to Dr. Resnikoff's  
22 testimony?

23 DR. GHOSH: If we restrict our  
24 statistics to the year 1995 to 2001 that is a  
25 positive correlation. But if we take the 1996 to

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1 2001 that is no correlation, or 1994, that is no  
2 correlation.

3 Q. In fact, there is no other positive  
4 correlation?

5 DR. GHOSH: There is no other positive  
6 correlation.

7 MS. MARCO: Your Honor, I would like to  
8 introduce Staff Exhibit KK into evidence and move  
9 for its admission.

10 JUDGE FARRAR: Any objection?

11 MR. SOPER: Well, I object on the basis  
12 of relevancy. Dr. Resnikoff has used a seven-year  
13 period to disprove a claim that the trend is  
14 decreasing. He did not use Spearman to assess his  
15 calculations or claim anything for the entire  
16 history of the F-16s, but only to test the claim  
17 that the trend is continuing to decrease. So I  
18 don't see that this addresses anything that Dr.  
19 Resnikoff has done.

20 MS. MARCO: Your Honor, I believe that  
21 this directly addresses what Dr. Resnikoff has done  
22 because if you look at it, the only data selection  
23 that indicates the trend is the one he used, but  
24 every single other year it does not. And so,  
25 therefore, I think that this shows that his looking

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1 at that piece of data to show what he tried to  
2 prove was not a valid approach.

3 JUDGE FARRAR: I'm not sure I understood  
4 what you just said or what the witness has said. I  
5 assumed or I thought I heard them say they did the  
6 Spearman Rank Correlation for all these years.

7 MS. MARCO: Every single one.

8 JUDGE FARRAR: But I thought when you  
9 said only one, that's for all the years together?

10 DR. GHOSH: Yes, all the years together,  
11 say 1997 to 2000 and another one, '82 to 2001.  
12 There is all subject went in there.

13 JUDGE FARRAR: So you do all of them and  
14 then do all but one?

15 DR. GHOSH: Right.

16 JUDGE FARRAR: And all but two?

17 DR. GHOSH: Right.

18 JUDGE FARRAR: And all the way through?

19 DR. GHOSH: Right.

20 JUDGE FARRAR: And the only one where  
21 doing that comes out is the one beginning in '95?

22 DR. CAMPE: That is correct. We  
23 examined the entire database to see what it behaves  
24 as you go from year to year and recalculate the  
25 whole thing over.

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1 MR. SILBERG: We would agree that this  
2 is totally relevant to show the credibility of Dr.  
3 Resnikoff's analysis, and it clearly shows that  
4 only the period of years that he selected gives him  
5 the result that he wanted. Any other period of  
6 years would give him a result that would not  
7 support his theory. So it's clearly relevant to  
8 show the adequacy of his analysis.

9 JUDGE FARRAR: Mr. Soper? I have to  
10 tell you that I'm leaning that, while you may not  
11 like this evidence, it does seem on point.

12 MR. SOPER: Well, Dr. Resnikoff's only  
13 claim is in recent years the trend is no longer  
14 decreasing. I mean, we acknowledge that, in fact  
15 support the idea that it started out very high and  
16 decreased. So while we don't dislike this, we in  
17 fact believe it's true. It just does not run  
18 counter to anything that we believe.

19 JUDGE FARRAR: Well, I think we will  
20 admit the Exhibit and everyone will be free to make  
21 whatever arguments they want to based on it.

22 MR. TURK: Is it clear how the witness  
23 has developed this information, how they progressed  
24 what each part represents?

25 JUDGE FARRAR: Yeah, I think so.

1 JUDGE KLINE: Yeah.

2 JUDGE LAM: I think so.

3 (EXHIBIT-KK WAS ADMITTED.)

4 JUDGE FARRAR: Go ahead, Ms. Marco.

5 MS. MARCO: Okay, thanks.

6 Q. (By Ms. Marco) Turning to question and  
7 answer 10 of Dr. Resnikoff's testimony, do you see  
8 in question and answer 10 that Dr. Resnikoff refers  
9 to a quantitative approach in NUREG 0800. Do you  
10 see that?

11 DR. CAMPE: Yes.

12 Q. Do you see --

13 MR. SILBERG: Excuse me. Where are you  
14 pointing? Okay. This is the last paragraph in  
15 answer 10?

16 MS. MARCO: Yes.

17 MR. SILBERG: Thank you.

18 Q. (By Ms. Marco) Do you consider the  
19 NUREG 0800 methodology to be a quantitative  
20 approach?

21 DR. CAMPE: The NUREG 0800 methodology,  
22 as it is represented by the use of the formula for  
23 calculating the crash probability, is quantitative  
24 to the extent that the expectation is that when one  
25 uses the formula, whenever possible one will use

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1 any available data in order to do the calculation  
2 with the formula. The formula itself, per se,  
3 doesn't speak to whether something is quantitative  
4 or not until you provide the input data to be used  
5 with the formula. So it's quantitative in the  
6 sense that it is to the expectation of using actual  
7 data to do the calculation.

8 Q. Are input assumptions which are based on  
9 estimation or expert judgment acceptable as part of  
10 a NUREG 0800 methodology or are they part of a  
11 NUREG 0800 methodology?

12 DR. CAMPE: Yes, they are. There is a  
13 recognition that it isn't always possible to have  
14 all the data that you would like to have. And in  
15 recognition of that the guidelines are that, where  
16 data are lacking, other means such as engineering  
17 judgment can be used qualitatively to address the  
18 conservatisms or to do estimates.

19 Q. Why is the use of a 10-year database for  
20 crash rates acceptable?

21 DR. CAMPE: The 10-year database  
22 represents a form of a compromise, in my opinion,  
23 between capturing as much data as possible to make  
24 the trending meaningful and the constraint of not  
25 using data that are inappropriate.

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1                   For example, the very first year or two  
2                   are the beginnings of the database that has been  
3                   discussed so far has shown what looks like a very  
4                   high crash rates, but then when you think about  
5                   when the aircraft, the F-16s were introduced for  
6                   service at Hill, that puts a level of  
7                   inappropriateness for using the early years in  
8                   addition to the fact that those years represent  
9                   very few flight hours.

10                  So the crash of one or two aircraft and  
11                  a accumulation of a very low total flight base says  
12                  that it would be inappropriate to apply that rate  
13                  to 5,000 or 7,000 sorties flying through Skull  
14                  Valley when that condition is more representative  
15                  of the crash rates accumulated over the experience  
16                  of the plane in its operational lifetime.

17                  Q.       Turning to question and answer 14 in Dr.  
18                  Resnikoff's testimony in which he quotes from the  
19                  NRC's legal memorandum in the Three Mile Island  
20                  case, do you see that? Do you have that?

21                  DR. CAMPE: Yes.

22                  Q.       How do you reconcile the statement that  
23                  is quoted by Dr. Resnikoff in this case,  
24                  specifically that, "it is not reasonable to  
25                  quantify such improvements in safety for purposes

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1 of either limiting the database to establish the  
2 current accident rate or to develop a rate for  
3 further future projections" with your evaluation in  
4 this case?

5 DR. CAMPE: Our evaluation, to some  
6 extent, and it's I believe reflected in our safety  
7 evaluation report, does address or give thought to  
8 improvements in aircraft technology and what effect  
9 that would have on the anticipated crash rates.

10 The statement that is quoted in answer  
11 14, which is derived from -- or is taken from a  
12 memorandum issued by NRC staff in conjunction with  
13 the TMI hearings, I do not find in any sense that  
14 I'm bound by that memorandum as far as whether or  
15 not I can consider whatever available information I  
16 have in forming my judgments and evaluation. So in  
17 that sense if I see improvements in technology, I  
18 feel it's appropriate to give weight to that.

19 Q. Are you aware --

20 DR. CAMPE: I'm sorry. One other  
21 thought, one other item that I wanted to say to  
22 complete the answer, in any event, the  
23 consideration of improvements that I mentioned that  
24 we had considered, I don't believe were used, per  
25 se, in stipulating what the database itself should

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1 be, which is what I believe this quotation is  
2 focusing on. We simply characterized the  
3 expectation of the crash rates in terms of what the  
4 technological improvements would be, whereas, this  
5 talks about whether or not you should limit your  
6 database to certain time span and that you should  
7 not do this type decision on the basis of  
8 technological improvements.

9 JUDGE FARRAR: Ms. Marco, let me  
10 interrupt there. I think I understand part of your  
11 answer, but part of it seemed to go to whether you  
12 were bound by this. I can see several reasons not  
13 to be bound by this, one of which is it's 20 years  
14 old and a lot has happened and there's been new  
15 thinking, and that would seem to have some  
16 legitimacy. But I thought I heard you say that  
17 you're not bound by it in any event. I mean, if  
18 this brief had been filed last week, would you be  
19 bound by it? Would you consider yourself bound by  
20 it?

21 DR. CAMPE: I think it would be -- it  
22 would depend on the circumstances. If the more  
23 recent memorandum was brought up internally within  
24 the staff and there were guidelines discussed as to  
25 how we viewed this and whether or not we use it, I

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1 can't address that, but I would not be bound in  
2 the sense that if I'm using judgment on  
3 technological improvements in another part of my  
4 evaluation and not in the part which is involving  
5 selection of a database.

6 JUDGE FARRAR: Okay, right. And that's  
7 another ground for distinction. This deals with  
8 one area and you're dealing with another area.

9 DR. CAMPE: That's correct.

10 JUDGE FARRAR: No problem there. But I  
11 thought I heard you say that even if it were right  
12 on point you wouldn't be -- you wouldn't consider  
13 yourself bound by it. If it were right on point  
14 and issued very recently would you be bound by it?

15 DR. CAMPE: It would have to be taken in  
16 context of how that recent development found its  
17 way in the record, as it were. I don't normally  
18 recall -- I don't recall where before one does an  
19 evaluation one does a complete research of the  
20 entire proceedings of NRC findings in various cases  
21 and only then proceed with one's evaluation.

22 On the other hand, if this was something  
23 that gave a milestone condition which was then  
24 brought down by discussion and meetings and so on  
25 and say, well, from here on this is what we adhere

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1 to, that would be a different story.

2 JUDGE FARRAR: I guess my question goes  
3 perhaps more to the flip side, not whether you're  
4 bound by the briefs, but whether we can trust the  
5 briefs to come in to be reflecting what you're  
6 thinking. But that's a question for another day.

7 MR. TURK: Your Honor, one follow-up  
8 question?

9 JUDGE FARRAR: Sure.

10 MR. TURK: And this would go to Dr.  
11 Campe. Do you feel that the use of the 10-year  
12 database here provides you with an appropriate and  
13 good quality database upon which to make a judgment  
14 as to the crash rate applicable for this facility?

15 DR. CAMPE: I think it's the best shot  
16 at it.

17 JUDGE FARRAR: Ms. Marco, go ahead.

18 Q. (By Ms. Marco) Are you familiar with  
19 Dr. Resnikoff's test regarding his linear  
20 regression analysis?

21 DR. CAMPE: I'm familiar with Dr.  
22 Resnikoff including a mention of it in his prefiled  
23 testimony. I don't believe I have seen any  
24 detailed description of the analysis itself, just  
25 basically the results of the analysis.

1 Q. Do you know what his results were?

2 DR. CAMPE: I have read them in the  
3 prefiled testimony, yes.

4 Q. Do you agree with Dr. Resnikoff's  
5 conclusion?

6 DR. CAMPE: Well, in a similar way to  
7 the conclusion that was offered as a result of the  
8 Spearman Ranking Correlation. Here again, the  
9 linear regression -- excuse me. The linear  
10 regression analysis leads Dr. Resnikoff to the  
11 observation that there is a positive correlation  
12 for the years FY95 to 2000 and, as before, I would  
13 say that if one isolates oneself to that time  
14 period then, indeed, this is what the linear  
15 regression would produce as a result. In that  
16 sense I do agree.

17 Q. Do you believe that Dr. Resnikoff's  
18 selection of this data sample results in the best  
19 representation of F-16 crash rate?

20 DR. CAMPE: No.

21 Q. Did you perform a linear regression  
22 analysis based on the crash rate for F-16 Class A  
23 and B Mishaps for other years?

24 DR. CAMPE: I believe Dr. Ghosh actually  
25 did the calculations. We discussed it, talked

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1 about it, but the actual calculations were done by  
2 Dr. Ghosh.

3 Q. Okay. Dr. Ghosh, I have placed a  
4 document in front of you. Can you please identify  
5 what that is?

6 DR. GHOSH: Yes. This is a plot we  
7 prepared between crash rate of Class A and Class B  
8 mishaps with the fiscal years. And similar to the  
9 Spearman Rank Correlation Analysis, we did the  
10 linear regression analysis for each year and then  
11 took one year off individually and then did the  
12 hypothesis testing. With the slope we are getting  
13 is zero or negative or positive, and the result  
14 shows on the top of the chart.

15 Q. And the results, like you said, are on  
16 the top of the chart. What are these numbers  
17 indicating?

18 DR. GHOSH: Okay. It is indicating for  
19 the negative, for example, '79, the data is from  
20 '79 to 2001, and regression analysis shows that is  
21 a negative correlation that crash rate is  
22 decreasing with year from 1979 to 2001. If it is  
23 zero, say, for example, for 1985, that means data  
24 is from 1985 to 2001 and there is zero correlation  
25 that from this time is random phenomenon.

1 Say positive 1995, that means 1995 to  
2 2001, those seven years, and show the slope is  
3 positive that mishap crash rate is increasing only  
4 in that time period. And those R squared, those  
5 are the coefficient of determination with the twist  
6 like it is independent of the number of parameters  
7 that we are estimating. This is little bit of  
8 something we are representing.

9 MS. MARCO: I would like to have this  
10 marked as Staff Exhibit LL.

11 JUDGE FARRAR: All right. The reporter  
12 will do that.

13 (STAFF EXHIBIT-LL MARKED.)

14 JUDGE FARRAR: Ms. Marco, before you  
15 continue your examination, how are we looking for  
16 time here?

17 MS. MARCO: This is the last thing. I  
18 move to have this Staff Exhibit LL entered into the  
19 record.

20 JUDGE FARRAR: Let me ask you a question  
21 about it. Are the numbers in parentheses, that's  
22 the strength of the correlation?

23 DR. GHOSH: Yes, strength of the  
24 correlation.

25 JUDGE FARRAR: And the higher the number

1 the --

2 DR. GHOSH: Yes, should be close to 1.

3 But the rate it is promoted the R squared is  
4 adjusted coefficient of determination, it is  
5 independent of number of parameters we are  
6 estimating here. We are estimating two. We can  
7 compare with any other equation, four or five,  
8 still we can use this without any bias.

9 JUDGE FARRAR: Any objection?

10 MR. BARNETT: No objection.

11 MR. SOPER: No objection.

12 JUDGE FARRAR: Then the document will be  
13 admitted.

14 (STAFF EXHIBIT-LL ADMITTED.)

15 MS. MARCO: Thank you.

16 JUDGE FARRAR: The Board has some  
17 questions.

18 JUDGE KLINE: Dr. Ghosh, did you hear  
19 the PFS panel in their discussion of the safeguards  
20 against statistical bias that were built into their  
21 analysis?

22 DR. GHOSH: Correct.

23 JUDGE KLINE: And do you regard yourself  
24 as having performed the independent analysis that  
25 they anticipated or suggested?

1 DR. GHOSH: This we did independently.

2 JUDGE KLINE: Yes. When you did your  
3 analysis, did you just look at what they did and  
4 say, "Well, it looks all right to me," or did you  
5 reconstruct the segregation of data and calculate  
6 for yourself what the R value should be?

7 DR. GHOSH: Yes. We looked at  
8 independently to see taking each year at a time to  
9 have similar time intervals and see how the crash  
10 rate is behaving. So we independently  
11 reconstructed the scenario.

12 JUDGE KLINE: Okay, thank you. And then  
13 one question for Dr. Campe. You may have figured  
14 out by now that the Board is struggling with some  
15 questions fundamental to the model that you used.  
16 And we're not questioning the model as stated in  
17 NUREG 0800, what we're really questioning or we  
18 need answers to is whether when you introduce a new  
19 factor you violate or may violate some of the  
20 assumptions that went into the original construct.  
21 So that, for example, is it part of the original  
22 construct that the density of aircraft is sort of  
23 homogeneous in the corridor?

24 DR. CAMPE: Yes. The underlying  
25 assumption of uniformity of distribution across the

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1 entire width is embedded in the equation. It is  
2 associated with -- primarily with the N factor  
3 which speaks to the distribution of flights that  
4 you expect in the corridor.

5 JUDGE KLINE: All right. Now, when one  
6 introduces the R factor, which in a sense  
7 introduces deterministic consideration of flight  
8 paths, how do we reconcile the fact that at least  
9 the PFS witnesses believe that impact probability  
10 is sort of associated with flight paths? In other  
11 words, some flight paths are better than others  
12 with respect to the possibility of impact. And  
13 this is the underlying assumption in pilot  
14 guidance.

15 So that it takes -- flight path, it  
16 takes the impact probability outside of the more or  
17 less homogeneous distribution realm and sort of  
18 introduces deterministic consideration of flight  
19 paths one by one. And all we can say is that we've  
20 tracked it to this seeming impasse. And the  
21 question is, how do we know, having got this far,  
22 that the NUREG equation still works given that  
23 there's been violations or apparent violations of  
24 some of its underlying assumption?

25 DR. CAMPE: In answering this question

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1 perhaps I will be exhibiting one form of  
2 independence that we have exercised in what we did  
3 versus what the Applicant did.

4 JUDGE KLINE: Okay.

5 DR. CAMPE: Whether or not PFS thought  
6 of it this way I cannot tell, but my interpretation  
7 perspective of understanding the formula and its  
8 significance is element by element. I view the R  
9 factor as a modification of the factor C in the  
10 formula, which is the crash rate. So that one can  
11 -- I can visualize easily, let's say, a commonly  
12 done thing, you would rewrite the equation by  
13 redefining variables where I could redefine the  
14 crash rate, call it C', an effective crash rate,  
15 which would be C times R where R is now modifying  
16 the original. The original C is your raw database.  
17 Let's say you go to database and you see these are  
18 all the crashes for Classes A, B and whatever.

19 Then if one has a reason for attempting  
20 to dip into a subset of that base, one way is the  
21 way that the Applicant has done, they have formally  
22 included the factor to account for this. One  
23 doesn't necessarily have to do that. One could  
24 just simply go to the base and say, well, out of  
25 these crashes I will only consider the following on

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1       whatever the rationale was.

2               So in that sense the R factor does not  
3 necessarily conflict in any way with the other  
4 aspects, the random or the uniform distribution  
5 which speaks to the flight distribution. It, in  
6 essence, says that if I'm on the ground, what is my  
7 expectation that something will land on top of me?  
8 By considering the R factor, one is saying that of  
9 all those crashes in that database there were  
10 certain crashes that would have never hit me  
11 because of something that the pilot did or didn't  
12 do. So in that sense that you are affecting that  
13 formula. I don't know if that answers your  
14 question.

15               JUDGE KLINE: It's helpful because I  
16 attempted to do the same thing and thought that it  
17 appeared to modify the term N. And so I  
18 reformulated your equation in the form C times 0.5N  
19 or C times 0.15 and times the rest of the equation  
20 and came to another impasse, which we may not need  
21 to discuss now if it truly is a modification of  
22 crash rate.

23               Again, in our questioning of Dr.  
24 Resnikoff, we raised the issue that seems to be  
25 implicit somewhere that there is not only a

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1 corridor with the state, but the geometry of the  
2 corridor. That is to say, a corridor 1,000 miles  
3 away doesn't represent any kind of threat to the  
4 site, does it? Isn't there some sort of assumption  
5 that would say the corridor must be over the site  
6 or centered on the site or something in relation --  
7 something that establishes a relationship of the  
8 corridor to the site?

9 DR. CAMPE: Well, the NUREG 0800 chapter  
10 on that where the equation is described I believe  
11 does account for that effect in that it puts a  
12 qualifier on the factor W, which is the width, in  
13 that your target, your site is situated directly  
14 beneath and within the confines of the W width,  
15 then the denominator in the formula is simply W,  
16 the width of the corridor.

17 If, on the other hand, the site is  
18 situated such that the corridor is now offset by  
19 some distance, D, let's say, which goes to your  
20 example of the San Francisco/Los Angeles corridor,  
21 then you have to add to that W in the denominator a  
22 factor of 2D. So, in effect, then, the further you  
23 are offset from the corridor, the larger the  
24 denominator, and therefore the lower the  
25 probability.

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1 JUDGE KLINE: I see.

2 DR. CAMPE: So in the case of this Los  
3 Angeles flight, D would be measured --

4 JUDGE KLINE: Big D.

5 DR. CAMPE: A large number.

6 JUDGE KLINE: Thank you. I think I  
7 understand it better now.

8 JUDGE LAM: Dr. Campe, let me follow-up  
9 on the question Judge Kline asked you. Would you  
10 respond that the use of the pilot avoidance factor  
11 is a de facto modification of the crash rate?

12 DR. CAMPE: That is the way I interpret  
13 it.

14 JUDGE LAM: Let us assume your theory is  
15 correct, and let us further assume that the State  
16 of Utah's observation is also correct, then this  
17 particular C' that you just labeled it, now is  
18 reduce by a factor of 6 based on subjective  
19 judgment alone. Would you still -- well, first,  
20 you seem to endorse that approach; is that correct?  
21 You would not endorse a modification to the crash  
22 rate by a factor of 6 based on subjective judgment;  
23 is that a fair characterization?

24 DR. CAMPE: Well, the endorsement goes  
25 to at least two parts, from the way you've phrased

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1 it, Judge Lam. The conceptual phase of it, namely,  
2 the expression of the form factor R in the  
3 equation, I have no problem with understanding its  
4 appropriateness.

5 Then comes a much tougher job of how  
6 well do we know R and the fact that it is not  
7 something that's readily available and quantifiable  
8 and that there is a lot of work involved and  
9 judgment and interpretation of data before one  
10 arrives at an estimate of that factor.

11 We looked at that process and we looked  
12 for what -- the reasonableness in doing the  
13 interpretation, in examining the reports, the  
14 accident reports whenever there was the  
15 consideration of avoidance and what a pilot might  
16 or might not do. And we went through that process  
17 of evaluation and I believe we winnowed out or  
18 eliminated any bothersome parts that we saw that  
19 clearly did not make sense to us and what remained  
20 is what we found was reasonable. And it's on that  
21 basis that we then went with the value that was  
22 used in the calculation.

23 JUDGE LAM: So without addressing the  
24 merits of your assessment, the fact still remains  
25 that this reduction of C' relative to C, which is

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1 the crash rate or the new crash rate, amounts to a  
2 factor of 6 reduction and primarily coming out from  
3 a collective expert judgment of pilots success in  
4 avoiding the land target?

5 DR. CAMPE: That is correct.

6 JUDGE LAM: Now, if I may present the  
7 essence of the case as I see it, as advanced by the  
8 State of Utah, within the history of licensing  
9 aircraft hazards the four factor formula developed  
10 in NUREG 0800, of which you were a principal  
11 developer, has been used many, many times and the  
12 pilots avoidance factor, or if you label it the  
13 crash rate or the new crash rate, had they ever  
14 been done and now we have a case where this  
15 modification, either you call it C' or call it  
16 pilot avoidance factor R, rely on subjective  
17 judgment and without which this particular license  
18 application would not meet the Commission guideline  
19 of 6 crash per year. How do you justify your  
20 endorsement of the use of it?

21 DR. CAMPE: Well, there are many parts  
22 to this. The mere use of the factor in the sense  
23 that it hasn't been used by others is simply that  
24 the site is a lot more unique than others. The  
25 evaluation typically for screening out aircraft

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1 hazards at any facility proceeds, you might say, in  
2 stepwise. You do the easiest possible evaluation  
3 if you can afford to do it. If those -- if that  
4 first cut, let's say, doesn't make it, then you  
5 refine your calculation and see if you can still do  
6 it. So it can be a evolving process.

7 And the use of the R factor here was I  
8 believe necessitated by considering that you are  
9 sustaining conditions that are not typically found  
10 in other applications. You have flights of  
11 military aircraft in a close proximity of the  
12 proposed site.

13 But the -- I'm losing my train of  
14 thought here. I apologize. The use of the R  
15 factor we, I think, recognized throughout our  
16 evaluation was one of the parts of the evaluation  
17 that needs to be looked at more closer than any  
18 other part because of that, because of the way it  
19 was derived. It wasn't something that was hard  
20 data, it involved judgment and opinion.

21 But we also looked at what the result,  
22 what the effect is on the result if you do not have  
23 -- if you cannot in some sense justify the values  
24 that the Applicant has used. We have looked at the  
25 alternate value that I believe came out in Lt. Col.

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1 Horstman's testimony, I believe it was more like  
2 instead of a factor of .95 it was something on the  
3 order of .8 or .81, and that in itself did not  
4 produce precipitous changes in the final result.  
5 And we went so far as to consider what would happen  
6 if you do ignore that factor entirely, just simply  
7 assume 1 which, again, I don't think is entirely  
8 reasonable, but let's say we do. Again, I don't  
9 believe the results are -- fall in the category  
10 where now we no longer have an acceptable  
11 situation.

12 JUDGE LAM: Well, that's not the way I  
13 read the hazard report. The hazard report  
14 submitted by the Applicant gave me a number of  
15 aircraft crashes over Skull Valley alone due to  
16 F-16 of 2.05 times 10 to the minus 7. If I remove  
17 the R factor, which is .145, if I multiply this  
18 number by basically a factor of 6, I would see 1.2  
19 times 10 to the minus 6 that would exceed the  
20 conversion acceptance criteria.

21 DR. CAMPE: Well, I don't fully agree  
22 with that. The criterion itself is expressed as an  
23 order of magnitude criteria, it's expressed as an  
24 approximate value. And when you deal with numbers  
25 of this type, then I have no other way to interpret

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1 it. If I calculate something that's 1 times 10 to  
2 the minus 6 or 2 times 10 to the minus 6 or  
3 something within that order of magnitude, that  
4 still is not a significant departure from that  
5 criteria.

6 JUDGE LAM: Oh, I see. So what you're  
7 saying is 1.2 times 10 to the minus 6 may still be  
8 acceptable even though it numerically exceed the 1  
9 times 10 to the minus 6 acceptance criteria?

10 DR. CAMPE: Because the acceptance  
11 criterion is an order of magnitude criteria. If  
12 the value were -- let's, for example, say if the  
13 value was, I don't know, let's say 7 times 10 to  
14 the minus 6. Now in the order of magnitude basis  
15 you're talking about 10 to the minus 5 rather than  
16 10 to the minus 6. It's in that sense.

17 JUDGE LAM: Well, but where you would  
18 you have us accept -- well, where would you draw  
19 the line? Is 1.2 acceptable?

20 DR. CAMPE: Typically, order of  
21 magnitude lines are midpoints, 5, 5 times 10 to the  
22 minus 6 would be the dividing point between 10 to  
23 the minus 6 and 10 to the minus 5. At the same  
24 time I hasten to add, I'm not saying that R equals  
25 1 is what we view to be the value. I'm just saying

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1 that in the extreme case if that were -- where am I  
2 with that extreme case? I don't see a jump of  
3 orders of magnitude.

4 JUDGE LAM: I see. Let me then give you  
5 a hypothetical question. Assuming you hire another  
6 expert, another consultant to do the confirmatory  
7 analysis for you. And the Applicant say now this  
8 avoidance factor basically consists of two parts,  
9 as I was describing to General Jefferson earlier  
10 today. The first part is what the General had  
11 described in Tab H of the hazard report which they  
12 describe as able to avoid, of which they had  
13 conduct three separate analyses.

14 The first one they use the database 121  
15 events, they collect 61 of them and analyzed them,  
16 and identify 59 of them out of 61 belong to the  
17 category what they call Able to Avoid which have  
18 two essential elements, control and time. And with  
19 that they identify a probability of 97 to 100  
20 percent.

21 And then they further conduct two  
22 separate analyses to confirm that number and then  
23 they select a number of 0.9, which is 90 percent  
24 success, and they label it as Able to Avoid. That  
25 represents the potential for the pilot to avoid a

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1 land target.

2 The second point, they call it in fact  
3 the pilot would be able to avoid a land target.  
4 They then use their collective expert opinion and  
5 wisdom to assign a probability of 0.95 based on  
6 three considerations, and let me repeat: the  
7 training of the United States Air Force pilot, the  
8 visibility of this future structure in the Skull  
9 Valley to be the biggest structure there is in the  
10 valley, and then the sufficient time for pilot to  
11 take action.

12 Just suppose your expert that now you're  
13 going to hire would come to you and say, aha, I  
14 think the second factor -- let's assume the first  
15 factor of 90 percent is not in dispute. But if  
16 your expert would come to you and say, well, I  
17 don't think it's 95 percent, I think it's 10  
18 percent, what basis would you have to assess that  
19 number, or would you believe this expert?

20 For example, if you hired Dr. Resnikoff,  
21 let's say you happen to had him, and he would come  
22 to you and say, no, it's like 1 percent, it's not  
23 95 percent. This is 0.01. So the product of the  
24 two probability the Applicant would have us believe  
25 is 0.9 multiplied by 0.95 which is 0.855.

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1 Therefore, the failure probability is 14.5 percent.

2 But if Dr. Resnikoff were your expert he  
3 would say, no, it's 0.1. As a matter of fact, he  
4 testified today it's zero. And if that's the case,  
5 zero multiplied by .9, you get zero. Therefore,  
6 the failure probability is 1. But let us be more  
7 tolerant of Dr. Resnikoff's view and let us say now  
8 we give you 10 percent or 20 percent, then what  
9 would your assessment be?

10 DR. CAMPE: If I simply heard the  
11 hypothetical alternate consultant tell me that, I  
12 would have very little basis for accepting it on  
13 just hearing it. That to me is vastly different  
14 from where the consultant plays out another  
15 analysis, which I would have an opportunity to  
16 review just like I reviewed the Applicant's  
17 reports, and using my engineering judgment and  
18 anything else that I know about the subject to form  
19 an opinion whether that alternate consultant's view  
20 has merit or how does it compare with what I have  
21 presently. But just to simply say, well, I think  
22 it's .1, to me, I would have trouble just accepting  
23 that.

24 JUDGE LAM: Well, in that regard, why  
25 would you except 95 percent either? See, right now

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1 we have two conflicting opinions here, one from  
2 General and one from Dr. Resnikoff.

3 DR. CAMPE: Well, I believe that in the  
4 second case with the 95 percent we have had an  
5 opportunity to examine the process by which that  
6 estimate was made.

7 DR. GHOSH: If I may add, we did a  
8 specific analysis on that factor also, find is 1  
9 percent or 20 percent.

10 JUDGE LAM: Yes, indeed, I was aware of  
11 your sensitivity analysis, Dr. Ghosh. What I'm  
12 trying to explore is I now have two opposing view  
13 before us. The expert panel of General Jefferson,  
14 General Cole and Colonel Fly have proposed three  
15 reasons for us to consider that indeed there will  
16 be 95 percent success when the pilot were given the  
17 opportunity.

18 Now I had heard from Dr. Resnikoff  
19 saying no, that probability should be zero just to  
20 be conservative. As a matter of fact, he did not  
21 testify to that probability being zero, he had  
22 testified to 1 minus this probability should be 1,  
23 which is basically saying no credit should be given  
24 to pilot's avoidance. Now, my question to you is,  
25 Dr. Campe, when you were doing your review, on what

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1 basis did you now select one expert opinion versus  
2 another?

3 DR. CAMPE: Well, I still feel that the  
4 comparison is -- I cannot do that comparison with  
5 equal weight on both sides. In the case of the  
6 Applicant, I've had opportunity to review a lengthy  
7 process where all the elements that come into the  
8 estimate were presented and I had an opportunity to  
9 look at them to see if any aspect is reasonable or  
10 not. In the case of Dr. Resnikoff's conclusion,  
11 all I have in front of me is, I think it should be  
12 1. I don't know how to evaluate that. I cannot  
13 give it the same weight as it stands.

14 JUDGE LAM: But could it be another  
15 panel of independent expert come in and say, well,  
16 maybe the value is .75? I mean, you know, to this  
17 licensing board, where would we be able to get some  
18 reliable assessment on what that number should be?

19 DR. CAMPE: I don't know -- I don't know  
20 where -- what the alternate means of determination  
21 might be. I mean, I could speculate, but any  
22 alternate consultant, whether that consultant was  
23 talking to me or anyone else, I would expect that I  
24 would afford the same process of review where I  
25 would have an opportunity to evaluate the basis and

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1 the analyses that support that final conclusion  
2 that the numbers should be this or that.

3 JUDGE LAM: Because 95 percent is a high  
4 value, would you agree?

5 DR. CAMPE: Yes.

6 JUDGE LAM: Because in this proceeding  
7 we also have heard from the State's witnesses that  
8 in situation that involve life and death decisions  
9 there will be a great deal of stress; there is the  
10 possibility of visibility issues, there is a  
11 possibility of time, there may not be sufficient  
12 time. Although the State had conceded, indeed, the  
13 United States Air Force pilots are well trained,  
14 they have impeccable training, but that's not in  
15 dispute here. But the visibility issues is being  
16 disputed, the available time is in dispute, and  
17 then we have one expert panel of testimony saying  
18 based on these three elements, two of which are  
19 being disputed by the State, and the Staff now  
20 still maintain the position that a 95 percent  
21 success probability is a defensible one?

22 DR. CAMPE: May I, in an attempt to  
23 answer that, may I share with you at least some of  
24 the evaluation process that I went through when I  
25 was reviewing the Applicant's analyses?

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1 JUDGE LAM: Please do.

2 DR. CAMPE: Just to pick one aspect for  
3 illustration, visibility, which speaks to the  
4 ability to avoid striking the facility. After  
5 becoming familiar with the flights and the flight  
6 environment in Skull Valley, I saw from the  
7 numerous descriptions of what is involved in  
8 emergencies in how visibility and cloud cover might  
9 come into play, the one thought that I could not  
10 easily dismiss, and that is whether or not at all  
11 times I have to have a precise location of the  
12 facility in order to exercise any kind of avoidance  
13 action.

14 In talking to the Hill personnel, we  
15 talked to the Hill personnel at a meeting to get  
16 better firsthand information about the particulars  
17 flights in Skull Valley. I came to the  
18 understanding that there's a certain general  
19 familiarity with the valley. On a very rudimentary  
20 basis the pilots know they're going along the  
21 valley, generally from north to south and, as such,  
22 they have mountain ranges on either the east or the  
23 west side. They have that general information for  
24 most of the few minutes that they spend flying  
25 through Skull Valley.

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1                   And so when I see the discussions of all  
2                   the parameters involved in avoidance, including  
3                   visibility, I cannot dismiss the thought that in  
4                   the event of an emergency the amount of effort that  
5                   would be involved in simply pointing the aircraft  
6                   away from the valley towards either mountainside  
7                   would go to a large degree in avoidance of the site  
8                   even though one does not have precise notion of  
9                   where the site is. This is the kind of thought  
10                  process that I'm going through as I review the  
11                  information in front of me.

12                  So even though there is an attempt to  
13                  make an evaluation, a numerical evaluation of the  
14                  actual probability of not hitting the target, and  
15                  to which enter things like knowing where the  
16                  facility is and whether visibility is a factor or  
17                  not, I have to also consider all the other  
18                  realities of the flights in Skull Valley, such as  
19                  the general orientation of the pilots, their  
20                  awareness of where they are in a large sense.

21                  Timing, how much time is available.  
22                  I've had opportunity to read both some of the  
23                  accident reports as well as information on Air  
24                  Force websites describing specific instances where  
25                  under extreme stress pilots have nevertheless

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1 exercised avoidance actions. I cannot dismiss that  
2 from my thought process, it's there. And so I wind  
3 up giving some weight or credence to discussions  
4 along those lines.

5 I don't know if this addresses your  
6 question, but this is where I come from when I do  
7 the evaluation as opposed to simply looking at the  
8 bottom line number and saying, yeah, it looks good.

9 JUDGE LAM: Thank you. And, Dr. Campe,  
10 when the four factor formula was developed way back  
11 many years ago, was pilot's ability to avoid an  
12 element of consideration then?

13 DR. CAMPE: Only in the sense that it  
14 was captured in the data that was being used for  
15 the crash rate. If a site had military, let's say,  
16 flight activity in proximity of the site and a  
17 crash rate was used, even though a particular  
18 applicant may not have culled it out explicitly, it  
19 was embedded in that data.

20 JUDGE LAM: Yes, yes. But I thought if  
21 that being the case, that the formula as it stood  
22 then and also as it stands now, would include all  
23 the crashes, not selectively include some.

24 DR. CAMPE: Right, right. It includes  
25 all unless you take the next step of excluding them

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1 for whatever reason. You may exclude aircraft by  
2 virtue of size, for example, or some other  
3 attribute.

4 JUDGE LAM: Okay. So if you are able to  
5 exclude them to the extent you could, you're free  
6 to do so. And also depending on if you are able to  
7 justify or not? You have to be able to justify it,  
8 right?

9 DR. CAMPE: Yes, your Honor.

10 JUDGE LAM: Okay. Thank you, Dr. Campe.

11 JUDGE FARRAR: Following up on that last  
12 question, I guess I've always viewed this formula,  
13 and maybe I have an incorrect understanding, it's  
14 kind of a great probabilistic concept that's good  
15 as far as it goes in terms of screening out  
16 concerns.

17 In other words, here's a nuclear power  
18 plant, so many miles away is an airfield, and it  
19 had these general concepts that readily allowed you  
20 to assure yourselves and the public, don't worry  
21 about it with all these random probabilistic  
22 numbers, no problem here. As you begin to tinker  
23 with that concept, kind of what you just said to  
24 Judge Lam, well, we'll eliminate these planes and  
25 we'll, you know, add in pilot avoidance, that

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1       you're now tampering with the essence of your  
2       original formula. You're asking your formula to do  
3       too much. You're going from a probabilistic and  
4       bringing in all of these deterministic measures,  
5       each of which you may justify, but to me there's a  
6       -- don't they do violence to what you originally  
7       set out to do? Do you understand my question?

8               DR. CAMPE: I believe so. I believe so.  
9       Perhaps the best way to answer it is by example.  
10      An example that comes to mind that perhaps  
11      addresses your question is how do we normally  
12      review, and I'm now talking about nuclear power  
13      plants, how do we normally review general aviation  
14      hazards as opposed to commercial aircraft or  
15      military aircraft.

16             Quite a long time ago it was looked at  
17      and determined that because of the existence of  
18      protection requirements for power plants against  
19      tornado missiles and their different criteria,  
20      depending on what part of the country you're in,  
21      but because of the existence of those requirements  
22      which translate into so many inches of reinforced  
23      concrete for safety-related systems and components.  
24      On a basis of some early analyses it was indicated  
25      that most general aviation are not -- are incapable

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1 of causing any releases.

2 So as a rule, unless there's something  
3 noticeably exceptional in a particular area in  
4 terms of aircraft size or something, but if  
5 there's, let's say, a county airport servicing  
6 general aviation near a plant, normally it's not a  
7 problem on that basis and you don't need to go  
8 through the formula to do that. I don't know if  
9 that addresses your question.

10 JUDGE FARRAR: No. I'm talking about,  
11 say, the commercial aviation case where you -- the  
12 formula doesn't work. You run this and, as I think  
13 you said before, it's an iterative, or you used a  
14 different word, process. You run the thing  
15 generally back to the envelope analysis and, aha,  
16 you come up with a problem. So you look at it a  
17 little more.

18 At some point as you keep looking at it  
19 a little more closely to try to say there isn't a  
20 problem here, you've done violence to the random  
21 aspects. In other words, your flights within the  
22 width of the corridor are distributed randomly and,  
23 you know, that makes sense. And the more precise  
24 you try to be the more to me you've lost the beauty  
25 of your original formula.

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1 DR. CAMPE: I'm not sure if I can  
2 address the beauty aspects of the question. I can  
3 only perhaps mention two things that might give you  
4 an answer. One is in the very case of the TMI  
5 hearings, there was a need to go into considering  
6 or segregating your data by aircraft types within  
7 the commercial sector by size, and where certain  
8 size aircraft were deemed to be not a problem  
9 because of their size.

10 And the other thing is that all of the  
11 NUREG 0800 methodology is predicated on the  
12 underlying assumption that, given a strike,  
13 nonmechanistically you assume in the case of  
14 nuclear power plants a part 100 release. And that  
15 is there in the background waiting in the process  
16 that you described should a need arise where you no  
17 longer can do it simply on probabilistic grounds  
18 with that conservative assumption of a  
19 nonmechanistic release. Then you have the door  
20 open for considering release effects, how probable  
21 is it and so on and so on.

22 JUDGE FARRAR: Which you haven't done  
23 here yet, but you were not asked to do?

24 DR. CAMPE: That's correct.

25 JUDGE FARRAR: One last question or

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1 maybe only one question. You mentioned 1 times 10  
2 to the minus 6 was an order of magnitude number.  
3 We've talked about this, is the number 1.0 and  
4 you're fine, 1.1 you're no good, .9 you're fine.  
5 And I guess until you gave your order of magnitude  
6 answer today I thought you were stuck with the  
7 precise number 1.0 because what you were talking  
8 about was a range.

9 In other words, these are only  
10 estimates, there's a range of error in them, and  
11 that unless you pick a specific number you're going  
12 to be unfair to one side or the other. Because if  
13 the Applicant comes in and shows .9, the State  
14 could say, wait, there's a range of error, that  
15 could be 1.4. And so while I understand that it's  
16 a estimate and in your mind is a range or an order  
17 of magnitude, from our point of view, if you  
18 don't -- one way we could approach it is if you  
19 don't pick a precise number and stick with it then  
20 you're all over the line. And every time I have  
21 seen -- I've only been back here a little while,  
22 but when the Commission says something, they say  
23 it's 1.10 to the minus 6 or 1.10 to the minus 5 and  
24 they don't add a footnote that says roughly.

25 DR. CAMPE: I believe in the regulatory

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1 guidance that we have on this, in all of the  
2 recollections I have the word "approximately" or  
3 "about" is used --

4 JUDGE FARRAR: In all the Commission  
5 decisions I read it's not used.

6 DR. CAMPE: Okay, I cannot speak to  
7 that. But the NUREG 0800 and some of the other  
8 supporting reg guides. I have to be honest, in  
9 numbers like these where we're relying on the  
10 databases that we have, to say that it's 1.1 versus  
11 2 is misleading. We don't know the answer that  
12 well, but I think we have a certain amount of  
13 confidence that we're within in the order of  
14 magnitude.

15 JUDGE LAM: Now, Dr. Campe, you meant --  
16 earlier I thought I heard when you said order of  
17 magnitude guidelines, 10 to the minus 6 means --  
18 even 5 times 10 to the minus 6 is still within the  
19 guideline. Am I --

20 DR. CAMPE: Well, you're right on the  
21 fence. For bookkeeping's sake, I would say 4.9  
22 times 10 to the minus 6 is pushing the edge, but  
23 it's still technically 10 to the minus 6 order of  
24 magnitude.

25 JUDGE LAM: Wow. I then like to hear

1 from Mr. Turk and Ms. Marco, is this how we do  
2 licensing? If somebody come in Commission and give  
3 us guidance of 10 to the minus 6 per year, somebody  
4 come up with an application, 4.8 times 10 to the  
5 minus 6, the Staff will still accept that?

6 MR. TURK: Your Honor, that's a  
7 hypothetical case that I don't think we have to  
8 face here and I don't have a clear answer for you.  
9 But I can tell you that we did present early in  
10 this proceeding, I believe the State wanted to  
11 introduce the decision, I think it was the Big Rock  
12 Point decision, in which the Licensing Board there  
13 said 2 times 10 to the minus 6, which was the  
14 number that came out there, was approximately 1  
15 times 10 to the minus 6 and, therefore, it was  
16 acceptable and met the criteria.

17 JUDGE LAM: Okay. Because 4.9 is a lot  
18 bigger than 2 times 10 to the minus 6.

19 MR. TURK: It is. And although we're  
20 talking now in a hypothetical sense saying this is  
21 where orders of magnitude are defined. We're not  
22 saying absolutely we would find that to be  
23 acceptable. I'm not ready to tell you absolutely  
24 we would do that.

25 JUDGE LAM: Okay. I appreciate that

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1 answer.

2 MR. TURK: I'm not saying we wouldn't,  
3 but I can't tell you absolutely we would.

4 JUDGE FARRAR: Given the hour, let's  
5 defer any legal argument on that which it, in  
6 essence, is. So I think that concludes the Board's  
7 questions.

8 MR. TURK: I have one follow-up, your  
9 Honor, if I may.

10 JUDGE FARRAR: Okay.

11 Q. (By Mr. Turk) Dr. Campe, you mentioned  
12 several factors that went into your thinking about  
13 the acceptability of the R factor. I didn't hear  
14 you mention your meeting at Hill Air Force Base,  
15 although I do recall you had discussed that in the  
16 last round of hearings in April. Do you recall  
17 meeting with Hill Air Force Base personnel in  
18 September 2001?

19 DR. CAMPE: I recall, and I believe I  
20 mentioned in the recent discussion.

21 JUDGE FARRAR: He did mention it.

22 Q. (By Mr. Turk) And in your meeting  
23 there, did you meet with the base commander,  
24 Colonel Larkin?

25 DR. CAMPE: Yes.

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1 Q. And also Colonel Lightfoot, the  
2 commander of the 388th fighter wing of F-16  
3 aircraft?

4 DR. CAMPE: That is correct.

5 Q. In April you put on the record that you  
6 came away with the conclusion that pilots would  
7 avoid. Is there anything more you can add to that  
8 in order to flesh out the record with respect to  
9 what was indicated to you in your conversations at  
10 the Hill Air Force Base? And subsequently you  
11 also met with the civilian director of safety at  
12 the Air Force Base, correct? He was at that  
13 meeting also?

14 DR. CAMPE: That is correct. While I  
15 can't remember specific statements or sentences, I  
16 do recall walking away from that meeting with a  
17 general understanding that the pilots -- in the  
18 event that PFS was there, the pilots would be  
19 briefed of its existence and its location prior to  
20 any sortie, that in a general sense of emergency  
21 situations the pilots do routinely consider  
22 avoidance of ground -- they used the term, I  
23 believe, built-up structures or populated areas.  
24 That sort of impression I walked away with having  
25 talked with the Hill people.

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1 MR. TURK: Thank you.

2 JUDGE FARRAR: Does the Applicant have  
3 any questions?

4 MR. BARNETT: No, your Honor, we don't  
5 have any.

6 JUDGE FARRAR: The State?

7 MR. SOPER: We do have a few, your  
8 Honor. Do them now?

9 JUDGE FARRAR: Oh, yes. And then that  
10 will be the end of this, we finish them tonight,  
11 they get to leave, right?

12 MS. MARCO: Yes.

13 JUDGE FARRAR: Then we'll finish them  
14 tonight.

15 MR. SOPER: Thank you.

16

17 REBUTTAL CROSS EXAMINATION

18 BY MR. SOPER:

19 Q. Good afternoon, gentlemen.

20 DR. CAMPE: Good afternoon.

21 DR. GHOSH: Good afternoon.

22 Q. Dr. Campe, you just said that you  
23 attended a meeting at Hill. And you can't remember  
24 any specifics, but you walked away with the  
25 impression that pilots could avoid the PFS site if

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1 it's built; is that right?

2 DR. CAMPE: No, sir, that's not what I  
3 said.

4 MR. SOPER: Could you read back what he  
5 answered just a moment ago, please?

6 (Record read as follows: "Dr. Campe,  
7 you just said that you attended a meeting at  
8 Hill. And you can't remember any specifics,  
9 but you walked away with the impression that  
10 pilots could avoid the PFS site if it's built;  
11 is that right?")

12 Q. (By Mr. Soper) And do you remember your  
13 testimony in that regard, sir?

14 DR. CAMPE: Yes, sir.

15 Q. And so have you operated -- well, when  
16 was that meeting?

17 DR. CAMPE: I would have to refer to my  
18 notes. I don't recall.

19 Q. (By Mr. Soper) Well, what year was it?

20 DR. CAMPE: It was either 2000 or 2001,  
21 I believe. I'm not sure.

22 Q. And since that time have you continued  
23 to operate with that impression that you had when  
24 you left that meeting?

25 DR. CAMPE: That impression was based on

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1        what I -- on the information that I obtained from  
2        that meeting. Since then I have heard arguments on  
3        both sides and so I'm aware of alternate views on  
4        it. But basically I don't believe that there's an  
5        overwhelming basis for saying that the pilot would  
6        not avoid a built-up structure or populated area.

7            Q.        And I think you also told us that there  
8        are some things that you just couldn't get out of  
9        your mind, including the simple effort that it  
10       would be to simply point at the mountains to avoid  
11       the site in the event of nonvisibility or  
12       something?

13            DR. CAMPE:    Correct.

14            Q.        And that the time that a pilot would  
15       have; is that a factor that kept coming to mind?

16            DR. CAMPE:    I'm sorry, I don't  
17       understand that one.

18            Q.        Well, I'm repeating what you said just a  
19       few moments ago that there were some factors that  
20       you just couldn't get out of your mind in thinking  
21       about this. One was the fact that it was a simple  
22       effort to point towards the mountains; another was  
23       the time available to a pilot?

24            DR. CAMPE:    Yes.

25            Q.        And I think another was examples of

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1 pilots under stress taking various actions that you  
2 had read as examples in reports or something?

3 DR. CAMPE: Correct.

4 Q. And I guess when you say you can't get  
5 those out of your mind, you had made some  
6 subjective decisions based on that that have  
7 colored your review of this application?

8 DR. CAMPE: What I tried to indicate was  
9 that I had evidence in the form of those factors  
10 that you just described which I had no basis for  
11 dismissing from my awareness. So when I reviewed  
12 the discussions or participated in this hearing,  
13 that is part of my understanding of how things are,  
14 and that is what I meant.

15 Q. Well, you had said you had reviewed some  
16 examples where pilots had avoided things under  
17 stress, being the accident reports, I think you  
18 mentioned?

19 DR. CAMPE: Right.

20 Q. And even though you're not a pilot  
21 yourself, are you, sir?

22 DR. CAMPE: No, sir.

23 Q. You've made some conclusion based on  
24 your personal review of those reports?

25 DR. CAMPE: Yes.

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1 Q. You've also told us, I think, that you  
2 can view the R factor as a component of the formula  
3 by considering it to be a different crash rate, a  
4 C' I think was referred to?

5 DR. CAMPE: That is -- I tried to  
6 describe it that way as an illustration, yes.

7 Q. You're familiar with what's commonly  
8 referred to as the ACRAM document, the Data  
9 Development Technical Support document for the  
10 Aircraft Crash Risk Analysis Methodology Standard,  
11 are you not, sir?

12 DR. CAMPE: I'm familiar with it. Not  
13 in great detail, but I have looked at it.

14 Q. It's State's Exhibit 51. But you do  
15 know which document I'm referring to generally?

16 DR. CAMPE: I believe so, sir.

17 Q. And you used that in your work from time  
18 to time, I take it?

19 DR. CAMPE: No, sir.

20 Q. You're kidding. You've never used this  
21 document?

22 DR. CAMPE: No, sir.

23 Q. You have never used a crash rate from  
24 this?

25 DR. CAMPE: I don't believe so.

1 Q. Are you aware that the PFS application  
2 is based on this document in some respects?

3 DR. CAMPE: Yes, sir.

4 Q. But you have not looked it up yourself?

5 DR. CAMPE: I didn't say I didn't look  
6 it up. You asked me if I have used it.

7 Q. Well, okay. Then have you used it to  
8 verify the PFS claims that are made in the  
9 application?

10 DR. CAMPE: I used the methodology and  
11 experience I have in association with NUREG 0800.  
12 The fact that they used that document or any other  
13 document is not what I would call this is what I  
14 used.

15 Q. You have done assessments of risks of  
16 aircraft crashes for nuclear facilities in the  
17 past, have you not, sir?

18 DR. CAMPE: Yes, sir.

19 Q. Several?

20 DR. CAMPE: Yes, sir.

21 Q. And on those occasions have you ever  
22 consulted the ACRAM document to obtain a crash  
23 rate?

24 DR. CAMPE: No, sir.

25 Q. No kidding. Where do you get the crash

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1 rates?

2 MR. TURK: Your Honor, is this a new  
3 line of cross-examination? We had rebuttal  
4 testimony and we had Board questions. I don't  
5 think we were talking about the ACRAM report at  
6 all.

7 MR. SOPER: We're talking about crash  
8 rates.

9 JUDGE FARRAR: They haven't  
10 cross-examined the witnesses?

11 MR. TURK: They have cross-examined the  
12 witnesses in their main testimony and now the  
13 witnesses are called back to give rebuttal with  
14 respect to certain things in Dr. Resnikoff's  
15 testimony and then the Board proceeded to ask some  
16 questions.

17 JUDGE FARRAR: Yeah, but --

18 MR. TURK: No one asked about ACRAM and  
19 classification of aircraft crashes, not from this  
20 panel.

21 JUDGE FARRAR: But it's within the same  
22 general subject. Objection overruled.

23 Q. (By Mr. Soper) And, sir, for example,  
24 where would you get the crash rate of a particular  
25 aircraft if not from this document?

1 DR. CAMPE: I would go, typically, to  
2 sources like, in the case of commercial aviation,  
3 to FAA data. I may have occasion to delve into  
4 NTSB reports. In the case of military aircraft I  
5 would go to the military sources, the Air Force,  
6 Navy, whatever is appropriate.

7 Q. And were you even aware in this case  
8 that many of the calculations for the crash rate,  
9 mode of flight and other information, came from  
10 this particular ACRAM document?

11 DR. CAMPE: Yes, sir.

12 Q. I see. But you haven't consulted it  
13 yourself in your review of this application?

14 DR. CAMPE: You have to keep in mind  
15 that a substantial amount of the actual review in  
16 terms of calculations, checking calculations and so  
17 on were Dr. Ghosh, and he would be much more  
18 familiar, intimately familiar with the report and  
19 how it was applied or used by PFS.

20 Q. But that didn't quite answer my  
21 question. My question is, you have not reviewed  
22 this document in connection with the PFS  
23 application?

24 DR. CAMPE: I have looked at it. I have  
25 not reviewed in the sense of establishing its

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1 validity, if that's what you mean.

2 Q. You are familiar with the document,  
3 though, are you not?

4 DR. CAMPE: I am familiar with it.

5 Q. And basically what does it contain?

6 MR. SILBERG: Mr. Chairman, I am going  
7 to object to this. We are going so far beyond  
8 rebuttal that if we continue -- I propose that we  
9 adjourn and come back tomorrow morning. What we're  
10 now on is a complete reexamination of stuff that  
11 the State had a full opportunity to investigate, to  
12 cross-examine a month ago. There is no  
13 relationship to the questions that were posed on  
14 rebuttal, there is no relationship to the questions  
15 that were addressed by this Board. I think we're  
16 going to be here for a long time tonight unless  
17 this Board restricts cross-examination to the scope  
18 of rebuttal.

19 JUDGE FARRAR: How much more do you  
20 have, Mr. Soper?

21 MR. SOPER: I don't expect too much,  
22 your Honor.

23 MR. TURK: Your Honor, I would note a  
24 further objection. The witness has stated that if  
25 detailed answers are what the counsel seeks there's

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1 another member of the panel who is a Staff witness  
2 who is familiar with the documents in detail. So  
3 what have we established?

4 JUDGE FARRAR: I think you've  
5 established your point with this witness about his  
6 level of familiarity or lack thereof and I don't  
7 think you can get any more out of him.

8 MR. SOPER: If I might just one or two  
9 more questions on this, your Honor.

10 JUDGE FARRAR: Okay.

11 Q. (By Mr. Soper) You, Dr. Campe --

12 JUDGE FARRAR: Only by our indulgence.  
13 Go ahead.

14 MR. SOPER: Thank you.

15 Q. (By Mr. Soper) You are aware, are you  
16 not, sir, that this document does provide crash  
17 rates for various military aircraft?

18 DR. CAMPE: Yes, sir.

19 Q. And included in those crash rates are  
20 the crash rates for specifically the F-16 aircraft?

21 DR. CAMPE: That is correct.

22 Q. And that with respect to the F-16 crash  
23 rates there is no mention, is there, sir, of  
24 discounting the crash rate, calling it C' or  
25 anything else based on the fact that the pilot

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1 might avoid a nuclear facility?

2 DR. CAMPE: That is correct.

3 Q. And there is, in fact, not even a  
4 mention that this may be appropriate or may be  
5 looked into or the researcher may want to  
6 investigate this subject? It's entirely absent  
7 from this document, is it not?

8 MS. MARCO: I believe he just answered  
9 that question. I object.

10 JUDGE FARRAR: We did get that answer.  
11 Mr. Soper, you have demonstrated that it was within  
12 the scope of the -- your line of inquiry was within  
13 the scope of the rebuttal testimony. But we heard  
14 the answer once, we don't need to hear it again.

15 MR. SOPER: All right. Thank you, your  
16 Honor.

17 Q. (By Mr. Soper) Your view that R can be  
18 restated as C' is not shared by the ACRAM document?

19 JUDGE FARRAR: Same question. We got  
20 it.

21 MR. SOPER: All righty.

22 Q. (By Mr. Soper) You also, Dr. Campe,  
23 made the statement twice that you ought to capture  
24 as much data as possible; is that correct?

25 DR. CAMPE: That is an incomplete

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1       characterization, but that certainly is part of it.

2           Q.       And you also at one point said,  
3       "Isolating a small subset is not reasonable." And  
4       in that regard you are referring to Dr. Resnikoff's  
5       use of the past seven years to predict a increasing  
6       trend in the crash rate. Was that your reference  
7       in that testimony?

8           DR. CAMPE: I believe so, yes.

9           Q.       Are you aware, sir, that Dr. Resnikoff  
10       uses the entire lifetime history crash rate for the  
11       F-16 in his probability calculations?

12          DR. CAMPE: Yes.

13          Q.       And that his only use of the seven-year  
14       subset is to demonstrate that contrary to PFS'  
15       claim, the last few years are not a decreasing  
16       crash rate?

17          DR. CAMPE: I believe he has used that  
18       five-year -- I'm sorry, the period '95 to 2000, I  
19       believe, to establish a trend that demonstrates an  
20       increase with years.

21          Q.       And do you have the State Exhibit 187  
22       before you, sir? That's the trend line.

23          DR. CAMPE: No, I don't.

24          Q.       Do you have it now, sir?

25          DR. CAMPE: Well, it's not marked as



1 such, but I'll take it that that's what it is. If  
2 this is the one that has the lifetime rate line on  
3 it?

4 Q. Yes, sir. And that's a document that at  
5 the top bears the language Class A Crash Rate,  
6 F95-FY01?

7 DR. CAMPE: Correct.

8 Q. And in your view, this is a unreasonably  
9 small subset to demonstrate this trendline, is that  
10 your testimony?

11 MR. TURK: Which one, the '95 to '01 or  
12 the lifetime?

13 MR. SOPER: The lifetime. No, excuse  
14 me. The trendline showing '95 through '01, that's  
15 correct.

16 DR. CAMPE: I believe I did indicate  
17 earlier in answer to somebody's question that, it  
18 was the Staff's question, I believe, that insofar  
19 as the analysis, Dr. Resnikoff's analysis shows for  
20 the time period '95 to 2001, if you do the linear  
21 regression analysis that it will indeed show, and I  
22 agree with it, it will show an increasing trend.

23 Q. And in the event that in FY02 the crash  
24 rate would support this trendline that's shown here  
25 now for eight years, would you also say that that

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1 is a unreasonably small subset?

2 MS. MARCO: I object to that. We don't  
3 have anything --

4 MR. SOPER: It's hypothetical.

5 MS. MARCO: But there's no basis to  
6 support it.

7 JUDGE FARRAR: Well, I thought he was  
8 getting to didn't you all use 10 and I think --

9 MR. SOPER: That's exactly right.

10 JUDGE FARRAR: And he's going to ask if  
11 10 is all right, how come 8 isn't? So I think the  
12 objection is overruled.

13 DR. CAMPE: Sorry, may I have the  
14 question repeated? I'm sorry.

15 JUDGE FARRAR: The question is, if the  
16 next year, if '02 fits within where this is, now  
17 you have eight years, why is eight years no good?

18 DR. CAMPE: I have to go back to my  
19 original premise, and that is, that the  
20 appropriateness I believe is measured by using as  
21 large a data set as is possible. And when I said  
22 that it was inappropriate to look at the '95 to  
23 2001, I said that in the context that I had  
24 available data for a larger time period than that.  
25 So if you add another year you're getting better,

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1 but you're still ignoring the years prior to '95  
2 that should be part of your database.

3 Q. I see. In the same token, you have  
4 approved the use of a 10-year, it happens to be the  
5 lowest 10-year period, average period of crash rate  
6 to base the probability calculations for the  
7 Applicant. Now, there are available another 15  
8 years or so in addition to that 10 years. Wouldn't  
9 it also be better to use a larger than a 10-year  
10 period to base the crash rate?

11 DR. CAMPE: When you point to -- when  
12 you indicate availability of additional data of so  
13 many years, I'm not sure -- how far back are you  
14 going with that? If I look at the data in the time  
15 period, let's say -- oh, approximately let's say  
16 1984 or so to 2001, the data generally show a  
17 flatness, which if you look at the lineal  
18 regression results, there's no correlation with  
19 time. It's just some random fluctuation.

20 So in that sense whether you take --  
21 it's not that sensitive to whether you take 10  
22 years or 12 years. Ten years already has captured  
23 something that filters out your statistical  
24 fluctuations from year to year, the local type  
25 effects.

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1 Q. Well, what about the most recent crash  
2 rates of '99, 2000 and '01, wouldn't it be  
3 reasonable to include them as being the best, most  
4 recent data?

5 DR. CAMPE: They should be included or  
6 it's appropriate to include them.

7 Q. You think it would be appropriate to  
8 include those in the crash rate?

9 DR. CAMPE: I can see no reason why not.

10 JUDGE FARRAR: Mr. Soper, let's hold on  
11 a minute.

12 (A recess was taken.)

13 MR. SOPER: Now that you've taken that  
14 short break, your Honor, I think I'm ready to stop.  
15 Thank you. Thank you, gentlemen.

16 JUDGE FARRAR: Thank you, Mr. Soper.  
17 Does the Staff have any?

18 MS. MARCO: The Applicant has to do a  
19 little redirect.

20 JUDGE FARRAR: Okay.

21 MR. TURK: Your Honor, I think I'll ask  
22 a few questions, if you don't mind

23

24 REBUTTAL REDIRECT EXAMINATION

25 BY MR. TURK:

1 Q. There was one statement, Dr. Campe, that  
2 you made when you were asked about Dr. Resnikoff's  
3 use of the period 1995 to 2001. You were talking  
4 about linear regression, and I think you said if  
5 you do a linear regression for that period it will  
6 show an increasing trend, and I agree with it. Did  
7 you mean to say that you agree that it's  
8 appropriate to use that period of time in order to  
9 show the trend?

10 DR. CAMPE: No. I agreed with the fact  
11 that the trend would be a linearly increasing trend  
12 for that time period.

13 Q. But, again, you don't think that's the  
14 appropriate period of time to use in order to do  
15 that analysis?

16 DR. CAMPE: That is correct.

17 Q. Also, you were asked about whether it's  
18 appropriate to include the most recent two years'  
19 data, which in this case would be the year 2000 and  
20 2001 crash rate data. Is there some point in time  
21 when you say, okay, we'll draw a line and say, now  
22 the analysis is complete, let's see what it shows,  
23 or do you constantly go through every new year's  
24 data? Every time a new set of data come out, do  
25 you have to go through and redo the analysis, in

1 your view?

2 DR. CAMPE: I responded to that question  
3 simply in a technical sense that there's nothing  
4 inappropriate about adding in additional years,  
5 such as the more recent data that is available. I  
6 did not answer it in the sense that this is a  
7 continuing process. And in that sense, yes, you do  
8 your analysis at the time with the best available  
9 data.

10 Q. Now, if someone was to add in another  
11 year or two of additional data, such as the year  
12 2000 or 2001 data, does that mean that instead of a  
13 10-year database you would use a 12-year database,  
14 or would you simply take a different 10-year period  
15 of time?

16 DR. CAMPE: I would expect to use, as I  
17 said before, what I would think is appropriate to  
18 use is as large a database as is reasonable. And  
19 if at the time of the analysis you have additional  
20 years available, I don't see anything wrong with  
21 incorporating that data into the sample. So if it  
22 turns out to be 12 years instead of 10 years,  
23 there's no particular reason not to do that.

24 Q. Earlier you mentioned that you thought  
25 that the use of the 10-year period, which I believe

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1 was 1989 to 1998, was an appropriate database. Is  
2 what you're saying now, then, that you would simply  
3 go forward from that time period to 12 years or why  
4 wouldn't you continue to use the same time  
5 interval, the same 10-year time interval except  
6 covering different years, the most recent 10-year  
7 period?

8 DR. CAMPE: I'm saying this in the  
9 context of what is practical in how one does an  
10 evaluation. If this process started all over again  
11 and you were faced with doing an evaluation,  
12 clearly you would have data available that would  
13 allow you to extend to whatever, the 12 years or  
14 more.

15 On the other hand, if you do another  
16 evaluation and you submit your findings, do I then  
17 put on the requirement that next year as soon as  
18 the data is available you redo the whole thing?  
19 This is in the context in which I was saying no.

20 MR. TURK: That's all we have, your  
21 Honor.

22 JUDGE FARRAR: Does the Applicant have  
23 any?

24 MR. BARNETT: Your Honor, I just have  
25 one question to both Dr. Campe and Dr. Ghosh.

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REBUTTAL CROSS EXAMINATION

BY MR. BARNETT:

Q. Based on your review of the ACRAM document, did you see anything in there that would indicate that it was inappropriate to consider pilot avoidance or an R factor in assessing a crash impact hazard probability?

DR. CAMPE: In my reading the report I did not see any explicit or specific discussion that would in any way relate to using a factor to account explicitly for avoidance.

On the other hand, I see the methodology in there to be related to or similar to the NUREG 0800 methodology in that it captures the principal factors in the probability calculation, namely, the crash rate, the flight frequency, target area, things of that area.

DR. GHOSH: I have the same opinion. There's no particular significance to that.

MR. BARNETT: Nothing further, your Honor.

MR. SOPER: May I just briefly?

REBUTTAL RECROSS-EXAMINATION

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1 BY MR. SOPER:

2 Q. So, Dr. Campe, your understanding would  
3 be to some extent a pilot's ability to avoid would  
4 be captured in that data? In other words, had the  
5 pilot restarted an aircraft or guided it to another  
6 site, the aircraft would not have crashed,  
7 therefore, that whole episode would be captured in  
8 the crash rates themselves?

9 MR. SILBERG: Excuse me.

10 MR. SOPER: I would like him to answer  
11 first.

12 MR. SILBERG: Well, I think it's a total  
13 mischaracterization of the testimony. You're  
14 saying if the plane didn't crash and it's captured  
15 in the crash report? That's not what he said at  
16 all.

17 JUDGE FARRAR: Is this a follow-up to  
18 Applicant counsel's question? Because I thought  
19 the only answer to that was concepts that were  
20 contained.

21 MR. SOPER: Yes. I thought it was  
22 significant that it was in the nature of the NUREG  
23 0800 in that information was captured in the data  
24 that was in there. So if there were a --

25 JUDGE FARRAR: Let's get an answer.

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1 We'll get an answer faster than we'll talk about  
2 it.

3 MR. TURK: Do you understand the  
4 question?

5 DR. CAMPE: I believe so. I will try.  
6 And this goes back to an answer that I provided, I  
7 think, in the previous session back in April in  
8 response to one of the questions. That crash rate  
9 data being in a sense actuarial data, historical  
10 data, what happened what happened, capture any and  
11 all factors that affect that data, including things  
12 like whether or not the pilot tried to avoid  
13 hitting something or not. The rub of it is how do  
14 you extract that? And that's the whole issue that  
15 we've been discussing with the R factor, whether  
16 the whole job was done reasonably or not.

17 MR. SOPER: That's all I have. Your  
18 Honor.

19 JUDGE FARRAR: Does that do it?

20 MR. SILBERG: If I could ask one  
21 follow-up question.

22 JUDGE FARRAR: Okay.

23

24 REBUTTAL RECROSS EXAMINATION

25 BY MR. SILBERG:

1           Q.       Isn't it true that the only thing the  
2 crash rate captures is whether the plane crashed,  
3 and if you're avoiding a site the plane is still  
4 crashing? So isn't it true that avoidance will not  
5 show up because all that shows up is the crash?

6           DR. CAMPE: It is true that the crash  
7 rate records, let's say, damaged or destroyed  
8 aircraft and nothing else. All I'm saying is that  
9 intrinsically embedded in that crash rate are  
10 factors that may or may not be extractable, if you  
11 will, and in that sense it could be anything. It  
12 could be reliability of the engine, design flaws,  
13 pilot behavior, all of that is in there.

14          MR. SILBERG: Thank you.

15          JUDGE FARRAR: All right. I think that  
16 does it for these witnesses. Thank you for your  
17 second round of testimony.

18          DR. GHOSH: Thank you, your Honor.

19          JUDGE FARRAR: We appreciate your  
20 presence and your views and I guess they're excused  
21 for good. Who are we hearing tomorrow?

22          MR. GAUKLER: We're hearing Wayne Lewis.

23          JUDGE FARRAR: Is he going to be all  
24 day?

25          MR. GAUKLER: I don't think so, no, your

1 Honor.

2 JUDGE FARRAR: Who are we hearing after  
3 him?

4 MR. GAUKLER: Mrs. Chancellor is not  
5 here, but we had two witnesses scheduled for this  
6 week, or potentially three in addition to aircraft  
7 crash. Mr. Sullivan, who I think we've reached  
8 agreement on between us, the Staff and the State,  
9 Dr. Arabasz, and --

10 MR. SILBERG: Excuse me. What is the  
11 agreement you reached? Just to stipulate what his  
12 testimony is?

13 MR. GAUKLER: Yes. I'm sorry.

14 JUDGE FARRAR: And so we'll have Lewis  
15 and then --

16 MR. GAUKLER: And Dr. Arabasz. Just to  
17 set a schedule, we agreed among ourselves that Dr.  
18 Arabasz was going to start Friday morning.

19 JUDGE FARRAR: So if we finish Lewis --

20 MR. GAUKLER: We would have some free  
21 time.

22 MR. TURK: When would Arabasz start,  
23 Friday?

24 MR. GAUKLER: That's what I thought we  
25 had said.

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1 JUDGE FARRAR: Work it out. Just so we  
2 know so we can get ready. Let us know tomorrow.

3 MR. TURK: I'm assuming we're going to  
4 start Arabasz tomorrow afternoon.

5  
6 (The proceeding was concluded  
7 for the day at 6:45 p.m.)

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CERTIFICATE

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

Name of Proceeding: Private Fuel Storage, LLC

Docket Number: Docket No. 72-22-ISFSI

ASLBP No. 97-732-02-ISFSI

Location: Salt Lake City, Utah

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