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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of:

PHILADELPHIA ELECTRIC COMPANY

(Limerick Generating Station,
Units 1 & 2)

Docket No. 50-352
50-353

Location: Philadelphia, Pa.   Pages: 11,706-11,901

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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PHILADELPHIA ELECTRIC COMPANY   : Docket Nos. 50-352
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                              U.S. Customs House
                              Old Customs Courtroom No. 300
                              Second and Chestnut Streets
                              Philadelphia, Pennsylvania 19106

                              Wednesday, 30 May 1984

        The hearing in the above-entitled matter reconvened

at 9:00 a.m., pursuant to recess,

BEFORE:

        LAWRENCE BRENNER, ESQUIRE, Chairman
        Atomic Safety and Licensing Board
        U.S. Nuclear Regulatory Commission
        Washington, D.C. 20555

        RICHARD F. COLE, Member
        Atomic Safety and Licensing Board
        U.S. Nuclear Regulatory Commission
        Washington, D.C. 20555

        PETER A. MORRIS, Member
        Atomic Safety and Licensing Board
        U.S. Nuclear Regulatory Commission
        Washington, D.C. 20555

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APPEARANCES:

On behalf of the Applicant Philadelphia Electric Company:

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    U.S. Nuclear Regulatory Commission
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On behalf of the City of Philadelphia:

    MARTHA W. BUSH, ESQUIRE
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    1500 Municipal Service Building
    Philadelphia, Pennsylvania 19102

MM/mm

1   I N D E X

10

11

12 RECESSES: Page

16

17 EXHIBITS: IDENTIFICATION   EVIDENCE

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23

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25

1   P R O C E E D I N G S

2   JUDGE BRENNER: We are on the record. Good

3   morning.

4   I see evidence that Ms. Bush is here. Is she

5   around?

6   MR. WETTERHAHN: Yes, she is.

7   MS. HODGDON: May I address the matter of

8   Mr. Romano, as long as Ms. Bush isn't here? It doesn't

9   concern her.

10   I haven't been able to reach Mr. Romano. I have

11   left a message at his office. Someone answers the phone

12   there. He is not in. They do not know where he is. He does

13   not answer the phone at his home.

14   I expect I will be able to get him shortly and

15   can get a report at the first recess.

16   JUDGE BRENNER: All right, I appreciate your

17   continuing to try.

18   MS. HODGDON: Thank you.

19   Whereupon,

xxx 20   LEWIS G. HULMAN

21   and

22   SARBESWAR ACHARYA

23   resumed the stand and, having been previously duly sworn,

24   were examined and testified further as follows:

25   JUDGE BRENNER: Whenever you are ready, Ms. Bush,

1　　we will start.

2　　　　　　JUDGE BRENNER: Ms. Bush, would it be too early to

3　　ask you for a total estimate, just as a preliminary planning

4　　matter? If you think it is, you don't have to give me one.

5　　　　　　MS. BUSH: For today, you mean? Time for today,

6　　or for the remainder of my cross-examination?

7　　　　　　JUDGE BRENNER: Yes, for this contention and also

8　　for 13.

9　　　　　　MS. BUSH: I think there is a very good likelihood

10　　we will be finished today. I hope very much we will be.

11　　　　　　JUDGE BRENNER: That includes leaving time for

12　　other Staff questions when you say that?

13　　　　　　MS. BUSH: Yes.

14　　　　　　JUDGE BRENNER: All right. Let's see how it goes.

15　　　　　　　　　CROSS-EXAMINATION (RESUMED)

16　　　　　　BY MS. BUSH:

17　　　Q　　I would like to ask a few questions about the

18　　CRAC calculations you discuss on pages 15 through 17.

19　　　　　　I believe you did a CRAC run specifically to

20　　attempt to address the Contention issue 14B, is that correct?

21　　　A　　(Witness Hulman) To bound the estimates of risk,

22　　yes.

23　　　Q　　In that analysis, is it correct that you increased

24　　the population density at normal activity, shelter conditions?

25　　Do you understand the question or shall I rephrase it?

1   A   (Witness Acharya) Please state it again.

2   Q   Okay.

3   In that analysis, did you in the sectors involved

4 in east southeast and southeast sectors specifically increase

5 the population density that remained in those sectors compared

6 to your other CRAC run and have that increased population

7 increment engage in normal activity shelter conditions?

8   A   It was assumed that the increased population

9 engaged in similar activity as the local population would be.

10   Q   So that the population that was in the one to ten

11 mile area that had been in the evacuation exposure situation

12 was then changed to the normal activity exposure level?

13   A   The question is not very clear, but let me state

14 exactly what we did.

15   The population in the southeast and east of

16 southeast east sectors within the ten miles, besides receiving

17 their normal quota of radiation exposure as being the part

18 of all evacuatees, besides this the same population that is

19 from the southeast and east of southeast sectors within ten

20 miles their number was added to the population in the twenty-

21 twenty-five mile interval in the southeast and east of

22 southeast sectors.

23   That is apparently part of Philadelphia so this

24 added population, which is a transient population we will call

25 them, is assumed to mingle with the permanent residents in

lrg4

1 those areas and no special assumption was made as to how they

2 would behave.

3   In other words, their behavior is assumed to be

4 identical to the behavior of the people in that part of the

5 city.

6   Q   Now specifically with regard to that, were their

7 prior exposures included in their exposure at normal activity

8 levels in Philadelphia, that group that you moved out to

9 Philadelphia?

10   A   That is correct, plus if the code internally would

11 have identified any hard spots in those limits of areas which

12 is part of Philadelphia, the code would have assumed that

13 those people would be relocated twelve hours after the ground

14 exposure, so the same assumption was applicable to both the

15 transient population who arrived there as well as to any local

16 population who might be so affected.

17   Q   Is that after twelve hours the exposure at 200

18 rems?

19   A   No.

20   Q   I am sorry, what was it then?

21   A   If the code would detect that anyplace will be so

22 highly contaminated that the projected seven-day ground dose

23 would reach 200 rems to the total marrow, then that area will

24 be identified as a "hot spot" and people would be advised to

25 relocate immediately, but that immediate we translated to

1 mean twleve hours of ground exposure. So at the end of the

2 twelve hours of ground exposure, certainly the dose would not

3 be 200 rems, because the seven-day ground dose would be 200

4 rems, not twelve-hour. The twelve-hour would be much smaller,

End 1. 5 approximately than 200.

mgc 2-1

1   Q   So that the numbers in Table 3 do reflect the

2   acute fatalities, acute injuries, and latent effects for

3   those people that were exposed as you just described it?

4   A   You confused me. State the question again, please.

5   Q   So do the results presented in Table 3 reflect

6   the actue fatalities, acute injuries, and latent effects

7   as calculated as you just discussed?

8   A   That's correct. And that should be compared to

9   the corresponding numers in Table 4, which were used in the

10   FES calculations.

11   Q   Do you think that the assumption that people would

12   be engaged in normal activity and have the sheltering

13   associated with that simple reflects the exposure that they

14   would get if they were in an evacuation mode -- that is, in

15   their cars and the shielding that goes with that?

16   A   Let me get a clarification. Do you mean that

17   those evacuees who wound up in Philadelphia -- you are asking

18   about their behavior, whether they will be continuing in the

19   evacuation mode or be mingling in the normal activities of

20   the people?

21   Q   Correct.

22   A   Well, I don't think they would continue in the

23   same evacuation mode as before they arrived. That could

24   be certain mass care centers. They might be congregating

25   in those centers. There might be some relatives with whom

mgc 2-2

1 they might take residence or shelter, and some may be

2 continuing to evacuate. The picture is quite a

3 heterogeneous one. However, once they would be in the city,

4 though we haven't taken the credit either for them or for

5 the resident population in the City of Philadelphia, the

6 urban area shielding factors are much better compared to the

7 open area countryside, country region, because of the tall

8 buildings, the cloudshine shielding factors, which are

9 very likely to be less, and there would not be uniform

10 ground contamination because of a lot of building structures

11 in the city, and the ground contamination levels are likely

12 to be smaller compared to the ground contamination in the

13 open area.

14 So shielding factors are likely to be better for

15 everybody, whether the people are passing through or the

16 people in the city, a thing which you have not taken into

17 account.

18 A   (Witness Hulman) I would like to add to that,

19 if I can.

20 If you remember the basic assumptions of the

21 calculations, it was the assumption that all of the people

22 within ten miles would congregate at the city outskirts.

23 That's not very likely, in our minds, but it was done for

24 calculational purposes in an attempt to bound the risk

25 estimates.

1   In reality, some of those people would never show

2   up. They would go in other directions. So the calculation,

3   we think, is a reasonable one. I don't necessarily believe

4   that it should be much higher.

5   Q   With regard to Table 3, what is the absolute

6   probability value of a core melt accident occurring as

7   reflected in that table?

8   A   (Witness Acharya) About 9×10^{-5} per reactor

9   year. That is shown in the Table 5.11.d) of FES.

10   Q   Can you also look at Table 3, the top righthand

11   column, the righthand column, the top of the column, and

12   see the absolute probability value there?

13   A   Sure.

14   Q   And is that absolute probability value the total

15   probability of all of the accident sequences examined in

16   the runs that are displayed in Table 3?

17   A   Yes. I can interpret for you if you want me to.

18   Q   You can do what?

19   A   The answer is yes. If there is a problem of

20   understanding, I can explain that.

21   Q   Would you explain the difference between a relative

22   probability and an absolute probability, or explain the

23   absolute probability more?

24   A   Well, by "absolute probability," I would understand

25   that the probability -- the probability of consequence level,

mgc 2-4

which includes the probability of the occurrence of the

accident in contrast to the conditional probability of

certain consequence magnitudes, which is called "conditional"

because it is conditional upon the occurrence of the

accident, which does not include the probability of the

accident.

However, you can have a probability distribution

of the conditional consequences, because weather variations

would introduce elements of probability. So as far as this

table is concerned, all of the probabilities shown here

are absolute probabilities, meaning they include the

probability of the accidents.

Now let us see whether some of the probabilities

that are reported here or all the probabilities are

consistent with the probability that I just quoted -- that

is, the probability of all the core melt accidents -- namely,

9×10^{-5}.

Now if you look at the righthandmost column --

that is, the total man-rem -- sometime last week I explained

that you see there a multiplier of 1000. That multiplier

of 1000 is supposed to be a multiplier to the magnitude

as far as the total man-rem is concerned. One should read

this -- that is, the magnitude should be read in terms of

1000 person-rems.

Now the first magnitude is 1000 person-rems,

mgc 2-5

and the probability that 1000 person-rems will not be

exceeded is 8.67×10^{-5}. And I say it is consistent with

the probability of the core melt accidents, that is

9×10^{-5}, because not all the various categories would result

in man-rems in excess of 1000. Some of them could be

having man-rems in excess of 1000; some could be having

man-rems less than 1000.

If one or more of the accident sequences were

dropped out of contributing 1000 person-rems or more, then

the probability of that accident will drop out from showing

up in the probability for that person-rem, so the probability

that is shown here in this column should be less than the

probability of the core melt accidents. That's 9×10^{-5}, and

you see the top one is 8.67, which is close but not quite

equal to 9×10^{-5}. So these probabilities are consistent.

They are consistent with total core melt probability.

End 2

1   Q   Now the item that you termed "conditional

2 probability," could we get a conditional probability value

3 from this table by, for example, looking at the total latent

4 effects column, the value at the bottom of the column, 3.91

5 times 10^{-9}? Would the conditional probability value for that

6 be ascertained by dividing the value that I just stated by

7 the absolute probability value, 9×10^{-5} or 8.67×10^{-5}?

8   A   Well, strictly speaking the answer is no. Last

9 week, I was put a similar question and I also said no because

10 when we talk of the conditional probability, we talk of the

11 conditional probability for individual sequences, not for a

12 group of sequences.

13   For instance, if the probability, absolute

14 probability, for only one release category is given, then the

15 conditional probability for that release category for that particular

16 consequence magnitude can be obtained by taking the absolute

17 probability and dividing by the probability of the release

18 category. But, here we have got about 20-some release

19 categories combined. To divide any probability shown in that

20 column by 9×10^{-5}, which is the probability of the entire

21 spectrum of core melt accidents will give you a number, but

22 you do not know what that number is because it is -- the

23 number is not representing the consequence of the worst

24 accident, it's not representing the consequence from the

25 not-so-severe accident. It is a number but we do not

1 interpret it as a probability, conditional probability, for

2 anything.

3 Q Does your last answer suggest that to get the

4 conditional probability for, for example, the accident

5 portrayed on Table 3, you would divide any one of these

6 probabilities by a number that is smaller than the total

7 probability number of 9×10^{-5}?

8 MR. WETTERHAHN: Objection. There is no basis

9 and no foundation for that question, that Table 3 relates to

10 any specific accident.

11 The testimony previously relates to a spectrum of

12 accidents.

13 JUDGE BRENNER: The question is a fair question and

14 she is trying to see what direction the result might change

15 given the previous accident and explanation as to why it

16 couldn't be done the way it was previously proposed. It is

17 a perfectly acceptable question. We will allow it.

18 WITNESS ACHARYA: Would you please repeat the

19 question?

20 BY MS. BUSH:

21 Q Did you last response imply or indicate that in

22 order to get the conditional probability for the accident

23 results portrayed on Table 3 that one would divide any one of

24 these probability figures by a number smaller than the overall

25 probability value we discussed of 9×10^{-5}?

1   A   (Witness Acharya) No, we cannot do that.

2   Q   In order to get a conditional probability, what

3 number would you divide these by then?

4   A   You cannot divide these by any number to get the

5 conditional probability out of this. Let me add, in order

6 to get the conditional probability for any sequence, you have

7 to run it separately.

8   JUDGE COLE: You mean for each individual accident?

9   WITNESS ACHARYA: Yes, that is correct, sir.

10   (Pause.)

11   BY MS. BUSH:

12   Q   Is it your testimony then that one cannot derive

13 a conditional probability from the numbers on Table 3?

14   A   (Witness Acharya) That is correct.

15   Q   So we have no conditional probability values here

16 that we can derive from this for conditional probabilities

17 associated with all of the accident sequences?

18   A   That is correct.

19   Q   Do these results for latent health effects on

20 Table 3 obtain for all 360 degrees around the plant?

21   A   That is correct, but if you compare Table 3 with

22 Table 4 and you know the reason for the differences in the

23 results in Table 3 and 4, namely we lumped some additional

24 people in two area elements of Philadelphia, so any

25 difference between these two tables you will find, that is

1   very strictly associated with what we did, namely increase

2   the population of the two area elements which is in the City

3   of Philadelphia.

4   Q   But in terms of latent health effects on the

5   high density population in Philadelphia, that is not reflected

6   in Table 3 or Table 4?

7   It is included in it but it is not separately

8   reflected?

9   A   Not exclusively, for the City of Philadelphia

10   people, but what I am saying is when we took the people in

11   the southeast and east of southeast sectors within 10 miles

12   and lumped them within the city because artificial increase

13   in the population because of the influx, assumed hypothetical

14   influx of the evacuees, the difference in the two tables is

15   strictly ascribed to that.

16   Q   So that the difference in the two tables reflects

17   the incremental effects on the supplemental population as it

18   is exposed at normal activity in Philadelphia?

19   A   That is correct.

20   A   (Witness Hulman) At the outskirts of Philadelphia

21   in the maximum case.

End 3. 22   (Pause.)

23

24

25

mgc 4-1

JUDGE BRENNER: Mr. Hulman, as long as there is a pause, so I don't have to wait and come back at you later, when you said "maximum case," maximum as to what?

WITNESS HULMAN: We have described in our testimony what we believe to be a bounding case of assuming all the people from within the EPZ get relocated to the outskirts of Philadelphia. That's what we have called our bounding case.

BY MS. BUSH:

Q   It is your testimony, then, the bounding aspect of it, rather than the kind of average aspect of this portrayal is because the shielding factor somehow compensates for the fact that people are engaged in -- the shielding factors used somehow compensate for the fact that people are assumed to engage in normal activity, rather than being exposed under evacuation assumptions?

A   (Witness Acharya) No. We called it bounding because we took 100 percent of the people from within ten miles in the southeast and east-southeast to be lumped in the part of the city and the city outskirts, whereas in a real situation, that is unlikely to be the case, because not necessarily all evacuees prefer to go to the City of Philadelphia. Not necessarily all roads lead to the City of Philadelphia. So quite some people would have diverted from landing up in the city.

mgc 4-2

Q   So instead of making a realistic or bounding

evacuation shielding value for the people that go into the

east-southeast sectors, you decided to put them all in that

sector and assume that they wouldn't all go there, in fact?

A   No special shielding factors were considered,

and that was not the reason why we called it bounding. We

called it bounding because not all people will land up in

the city outskirts.

Q   Could you have done a calculation where you made

an assumption as to how many people would not go into

Philadelphia and used a realistic shielding factor for people

evacuating?

A   (Witness Hulman) Was your question, did we?

Q   Could you?

A   Yes.

Q   So was the shielding factor you used of normal

activity for the people evacuating, was that assumed to be

a realistic shielding factor or a bounding shielding factor?

A   (Witness Acharya) See, that's -- for the evacuating

people, the cloudshine shielding factor is 1. For the normal

activity, it is .75. On the other hand, the groundshine for

the evacuees is worse; it's .5,1/3 for the normal activities.

And the contention did not say that people -- well, that

was my interpretation, at least, that people will be

continuing the evacuation mode -- well, filtering through the

mgc 4-3

city. I assume that the contention was surmising that there will be a back-up of people in the city outskirts. So that's the reason why in our calculation we just lumped them in those two area elements which are part of the city.

A   (Witness Hulman) Some of the people could have different sheltering coefficients than others. Some could have been worse; some could have been less.

Q   Isn't a realistic estimate an assumption that people are evacuating and therefore have that shielding factor, rather than assuming these various normal activities?

A   What is that shielding factor? I don't understand your question.

Q   The shielding factors associated with evacuation of one -- I guess is the one that Mr. Acharya just stated. Isn't that a more realistic or a realistic --

A   (Witness Acharya) I don't believe that is more realistic, because if the evacuees would wind up in the city, they would have better shielding factors than the evacuees out in the open, because urban area shielding factors are considered to be far much better compared to the open-road shielding factors, because of a lot of tall buildings, they will prevent the cloudshine, and because of tall buildings and the closely packed structures, the ground contamination is like to be less compared to the open space ground contamination.

So while we have not factored into our calculations these aspects, assumption of normal activity for the people who wound up in the city, it has not to my belief resulted in any understatement. Rather we think by putting all the people in the city outskirts, we have bounded the effect.

Q Can you know that this is a bounding analysis without having looked at the offset between the shielding factor used in the city versus in the rural, compared to the average shielding factor that you used in the exposure that would come from evacuation?

MR. WETTERHAHN: Objection. This question has been asked two or three times. I think it ends its productivity.

JUDGE BRENNER: She is allowed to probe a little further along the way she's going. As long as I've had to interrupt -- I'll allow the question -- but as long as I have had to interrupt, I think you have tried to explain, Dr. Acharya, and I appreciate you want clarification. Your answers are getting a little long, but I would appreciate on these last questions, if we could get precise answers as to what the different shielding factors were. You included that in your answer, but there was a lot more also. It's starting to get lost, and I was concerned that once or twice it was worse when a shielding factor was higher. I don't know what your subjective use of the word "worse" is, but

mgc 4-5

1 I think you meant the other direction.

2   At some point, if it doesn't get cleared up, I am

3 going to come back and just solidly get down to what

4 shielding factors the Staff would use, so I can just take a

5 look and see what difference there are with the Applicants

6 and decide if it's important.

7   I have made that speech to help the rest of the

8 questions before we get around to Board questions. But let's

9 get an answer to that question.

10   Do you want it read back, Ms. Bush, or can you

11 repeat it?

12   MS. BUSH: I will rephrase the question.

13   BY MS. BUSH:

14 Q   Would you agree, Dr. Acharya, that the analysis

15 you did reflected realistic rather than bounding shielding

16 factors?

17 A   (Witness Acharya) We did not use any bounding

18 shielding factors. We used the realistic shielding factors.

19   (Pause.)

20   JUDGE BRENNER: As long as there is a pause, let's

21 get the shielding factors you, as the Staff, would use for

22 each case.

23   Now what shielding factors did you apply to the

24 assumption in this analysis which you discuss at, I guess,

25 around Page 16 or 17 of your testimony? And as you describe,

mgc 4-6

that is the analysis where you assume all the population in those two sectors are going towards Philadelphia?

WITNESS ACHARYA: Now during the delay before evacuation, the shielding factors were .75 for the cloudshine, .33 for the groundshine. During evacuation, it's 1 for the cloudshine and .5 for the groundshine. For any other time, the shielding factors were as during the delay time before evacuation, which is for the normal activities.

JUDGE BRENNER: I may not have heard everything you said in the last answer.

When you said "for all other periods of time," that would be the same as normal activities, you say?

WITNESS ACHARYA: Yes. I can restate it, if you like.

For the evacuation, the cloudshine is 1, and the groundshine shielding factor is .5. For all other times, the cloudshine shielding factor is .75, and the grounshine shielding factor is .33.

JUDGE BRENNER: Which is what you have applied during the period of assumed delay?

WITNESS ACHARYA: That's right.

JUDGE BRENNER: Okay.

BY MS. BUSH:

Q I would like to make a comparison between Table 3 and Table L1.b, which is on Page L-23 of the FES.

mgc 4-7

                    If we look at Table 3, is it correct that we

can look at the magnitudes of consequences in the lefthand

column and associate that with, for example, the peak of

the lowest probability value? We can look at, say, the

highest consequence as it is associated with the lowest

probability?

        A   (Witness Acharya) That's true.

        Q   Now if we look at Table L1.b, those results are

presented in a format where you have a point estimate or

mean value for both the probability and the consequence.

        A   That's correct.

        A   (Witness Hulman) If I could add, it's not point

values. They are mean values, expected values, and not

point values. They don't reflect any particular sequence

or probability for any particular sequence.

        Q   I have the impression that the word "point

estimate" and "mean values" are interchangeable; is that

incorrect?

        A   (Witness ACharya) That is incorrect without

specifying the circumstances. For instance, the Staff used

all the mean values reported in the FES. They are the

point estimates of the mean values. Why so-called? Because

the accident probabilities were taken at their point values.

                    On the other hand, if you look at what was given

in SARA, you have the median CCDFs, you have upper bound

mgc 4-8

S2BU

End 4

1 CCDFs, but still each of them have a mean value. So depending

2 upon the context, one may change the mean and the point.

3 I don't know which is the correct one in every situation.

4 Q Thank you. Now going back to Table 3 where, for

5 example, the 3.91×10^{-9} total latent fatality peak value,

6 that low probability value is associated with a magnitude

7 of consequences. Would that be 30,000, or do you multiply

8 that times 1000?

9 A That's correct.

10 Q It would be 30,000; is that correct?

11 A Yes.

1   Q   In this regard of being able to look at a

2   distribution of probabilities and magnitudes, are you familiar

3   with the concept of evaluating risks, probabilities and

4   consequences on the concept of risk aversion, that is, that

5   people value risks in different ways depending on the

6   magnitude of the consequences?

7   A   Well, I am aware of that, but we did not use that

8   approach in the FES. We are following the guidance provided

9   in the statement of Interim Policy.

10   Q   So in your FES portrayal, you did not have an

11   intent to provide a distribution of values such as in Table 3,

12   where you can compare the probability as it relates to the

13   consequence?

14   A   I don't understand as to what we did not provide.

15   We provided the probability distribution in Table 3 and the

16   mean values in Table 2.

17   Q   In the original FES when you said you were follow-

18   ing the guidance of the Commission, so there is an implication

19   of that, that you interpreted that guidance to be that you

20   did not need to portray these various results in terms of the

21   probability and consequence, as tabulated in Table 3?

22   A   No, we had provided that both in the FES as well

23   as in here.

24   The CCDFs that are provided in the FES are nothing

25   but what is here in Table 4 in tabular form.

1   Q   Is that Table 5.4(c)?

2   A   I would like to keep my answer short, but in

3 Table 4, all these tabulation of numbers that are there,

4 you can associate that with some of the CCDF that are shown

5 in figure form in the FES.

6   Q   Would that be, for example, Figure 5.4(d) on page

7 5-86?

8   A   Let me identify some of this. What was the

9 question, please?

10   Q   5-86, Figure 5.4(d)?

11   A   Let me look at that. That is not right. That is

12 not correct.

13   Q   Would you tell me what figure -- just a moment.

14   JUDGE BRENNER: Wait a minute. There has been a

15 lot of jumping back and forth between Table 3 and then

16 Table 4. You asked a question and then jumped to the other

17 table and then back up to which CCDFs in the FES does the

18 witness think might represent the table.

19   I am telling you when you read this transcript, you

20 are not going to be able to match it up, so if this is

21 important to you, you better be a little more careful.

22   Are you asking him now which CCDFs in the FES

23 would represent Table 4 or are you asking him about Table 3?

24   MS. BUSH: I should have been asking about Table 4.

25 I was stating Table 3. I misspoke.

1   JUDGE BRENNER: All right. Now that we have got

2   that straightened out --

3   WITNESS ACHARYA: The distributions shown in

4   Table 3, they were specifically for the Contention City 14,

5   they are not in the FES.

6   MS. BUSH: Fine.

7   WITNESS ACHARYA: I will go to Table 4 now. Look

8   at page L-10 in the FES, okay? Now the curve in Table -- in

9   the Figure L.9 that is on page L-10, which is identified by

10   circles called "evac reloc," that is the figure which

11   corresponds to the one that is depicted in Table 4 under

12   "acute fatalities."

13   BY MS. BUSH:

14   Q   Would figure L.9 in the FES be comparable in terms

15   of latent cancer fatalities, comparable to Table 4 in your

16   testimony?

17   A   (Witness Acharya) In Table 4, the one that is

18   for the latent cancer fatality should be identified with --

19   that is in Table L.7 in FES, page L-8 with the circles on

20   the curve.

21   Q   I am sorry, did you say "Figure L.6" or "Figure

22   L.7"?

23   A   I said L.7. Just hold on, I may have made a

24   mistake. Figure L.7 is for 15 miles and that is what I

25   did not mean. It should be the figure L.8 on page L-9; that

1   is for the entire region.

2   Q   Could you explain the difference between L.8,

3   Figure L.8 in the FES and the table shown on page 5-86 of the

4   FES?

5   A   Please go in small steps. Which page do we compare

6   where?

7   Q   Figure L.8, which is on page L-9.

8   A   Okay.

9   Q   And Figure 5.4(d), which is on page 5-86 of the

10   FES.

11   A   Yes.

12   First, look at the figure L.8, which has two

13   component curves in that. One is coming from Evac Reloc,

14   that is for all accidents not initiated by severe earthquake

15   and also in the same figure, namely L.8, you have also a

16   curve identified by small squares. That is the latent cancer

17   fatality excluding thyroid CCDF for those accidents initiated

18   by severe earthquakes. And then the sum of the two is

19   identified as delta on the curve, which is the total CCDF for

20   all reactor accidents initiated by all causes and it is this

21   total on the figure L.8 identified by little triangles that

22   is transferred to the figure 5.4(d) on page 5-86. And there

23   it is identified by also the little triangles all along the

24   curve.

25   A   (Witness Hulman) And it is explained on page L-1.

1   Q   I believe on page 5-98 of the FES, beginning on

2   that page, you have a summary discussion of the risk consi-

3   derations, is that correct?

4   A   (Witness Acharya) Yes.

5   Q   In this summary discussion of the risk considera-

6   tions, am I correct that you did not attempt to address any

7   risk aversion type analysis where you would give the range

8   of probabilities associated with different consequences?

9   A   Yes. We have a table to that effect. We did not

10   use the word "risk aversion" but there is a table, I believe

11   5.11, maybe (g) -- let me check.

12   I believe that is 5.11(g).

13   Q   Is that (g)?

14   A   G as in "good." That is page 5-90, where we have

15   used all the CCDFs shown in the FES and rate the values of

16   the consequence magnitudes at probability levels ranging from

17   10^{-4} to 10^{-8}.

18   Q   Does this table give the peak values in terms of

19   magnitude and the associated low probabilities?

20   MR. WETTERHAHN: Objection. I don't have the

21   benefit of cross examination plan, but this discussion and the

22   previous discussion seems to be getting pretty far afield of

23   the contention which was admitted, so I would object on

24   relevance basis.

25   JUDGE BRENNER: Do you want to give me the

1   connection, Ms. Bush?

2   This particular one is not in the cross plan. For

3   your edification, Mr. Wetterhahn, I think Ms. Bush asked it

4   as a followup to being referred to the table. But the

5   question is still pertinent as to how does it relate to the

6   contention, the particular question, not the table.

7   MS. BUSH: On this table -- this Table 3 and 4 do

8   show the range of probabilities and consequences for either

9   a realistic or a bounding and that is subject to argument,

10   analysis about evacuation for one variable, and I am trying

11   to pursue that and establish with that table the difference

12   between peak values and mean values and seeing if this kind

13   of discussion was anywhere in the FES per se.

End 5.   14   (Board conferring.)

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mgc 6-1

JUDGE BRENNER: We don't understand how you approached the question of how Table 4, or 3 for that matter, in the testimony may be bounded by the question that you are now asking about Table 5.11(g). That's for starters.

Beyond that, even if you could conceive of something that we are missing, which is certainly possible -- we'll accept that possibility -- there has got to be a more efficient way of doing it. And it seems to me, you've already asked the questions as to what is represented in the FES, versus what they've done in the testimony response to the contention and the extent to which Table 4 is represented by some of the CCDFs in the FES, you can pursue that some more if you want to. If nothing else, it's certainly a more understandable way to us, and presumably this is for our benefit, and also it might be more efficient for you.

MS. BUSH: What are you suggesting I do?

JUDGE BRENNER: Well, we are sustaining the objection, because we don't understand how the question as to Table 5.11(g) that you just asked would accomplish the purposes you have expressed. We are accepting that as a valid purpose, however, and you can pursue that purpose by some other means. I think you've already pursued it, but you may have more on it. Go ahead, if you do.

MS. BUSH: I think I can withdraw the question --

mgc 6-2

well, I don't need to, because the objection has been sustained.

JUDGE BRENNER: Either way.

MS. BUSH: Yes. We can move on to another area.

JUDGE BRENNER: While you are in that area, I thought you were going to ask him -- and you stopped short of it -- while looking at all the figures in the FES, the CCDF figures that Dr. Acharya pointed us to on Table 4, and bearing in mind that the comparison that we started from is comparing Table 3 to Table 4 to see what incremental difference, if any, exists and the extent of it, I would like to ask, Dr. Acharya, why do you think the comparison was more valid to present a table -- namely, Table 4 -- as a tabular form of a CCDF that was for the total population, as opposed to using a different Table 4 which would be a tabular representation of the similar CCDF for the 50 miles?

WITNESS ACHARYA: Well, either approach would be equally okay for me. Now I could have run -- made the CRAC analysis respond to City 14 by using the 50-mile population. That would have covered Philadelphia. That's one way.

The other way is the one I have done. The purpose -- if I would have done the other one, the 50-mile, the differences between the two, the 50-mile one for City 14 and the one that was already in the FES would have shown exactlly the same differences that I have derived by using

mgc 6-3

1   the entire regional base, because the difference is picked

2   up only as to what happened to those two area elements.

3   JUDGE BRENNER: Okay. If I wanted to look at the

4   risk at certain particular distances, I can get that from

5   the CCDFs, from the effect of the CCDFs that you present

6   in various places in the FES, including the breakdown in

7   Appendix L. But when I look at the tables, I cannot get

8   distances unless I know a lot more about the population

9   distribution than I know.

10   Am I correct so far?

11   WITNESS ACHARYA: Not exactly.

12   JUDGE BRENNER: Could you explain it, please?

13   WITNESS ACHARYA: Yes. By looking at the CCDFs --

14 I don't know if I understood the question properly, but let

15 me answer it the way I understood.

16   By looking at the CCDF, the societal risk, it's

17 difficult to figure out which distance contributed to how

18 much of the consequence magnitude, because the CCDF reflects

19 the societal consequence over the entire area that was used

20 in the analysis. However, the type of differential analysis

21 that we have presented here for City 14, you will subtract

22 the new risk values estimated for Contention City 14 from the

23 old risk values that were presented in the FES. You get the

24 differential effect that is gotten from this lumping of the

25 people in the city outskirts.

mgc 6-4

1   JUDGE BRENNER: All right. I understand your

2   answer, and that helps.

3   Is it not also correct, though, that I can look at

4   individual risks at certain distances by looking at some of

5   the figures in the FES, for example, Figure L.15 or L.16,

6   if I wanted to look at something other than just total

7   societal risk?

8   WITNESS ACHARYA: Yes. You have to move to the

9   individual risk versus distance curves.

10   JUDGE BRENNER: I guess we'll hear more about that

11   in their other contention.

12   WITNESS ACHARYA: That's right.

13   JUDGE BRENNER: Ms. Bush, I'm sorry I interrupted,

14   but it helped straighten myself out anyway.

15   MS. BUSH: I think it's useful to do that.

16   BY MS. BUSH:

17   Q   The figures that you just referred to, L.15,

18   those would be mean probability values; is that correct?

19   That wouldn't reflect the range of possible individual dose

20   exposure?

21   A   (Witness Acharya) That's correct.

22   Q   I would like to move on in your testimony to --

23   if I could back up a minute -- to L.15, the comparable dose

24   distance curves. Let me take one, for example, the latent

25   cancer fatality curve, L.19.

mgc 6-5

1 Is there a way from the text or the FES document

2 itself that we could tell the range of individual exposures --

3 excuse me -- individual risk --

4 MR. WETTERHAHN: Objection. It's beyond the scope

5 of the contention. It is far afield.

6 JUDGE BRENNER: All right. I got into it a little

7 bit to try to help myself understand what was being compared

8 in Table 3 and Table 4, and how far I could apply that

9 comparison, as contrasted to the type of analysis or

10 comparative analysis that you can make using figures such

11 as L.19, so I will allow the follow-up.

12 The answer I got showed me that I shouldn't

13 pursue it anymore in the context of this contention, and

14 that's why I didn't. But because I got into it, I will allow

15 the cross-examiner some leeway. It may help later on

16 Contention 13 anyway, and that's another reason.

17 Do you remember the question after all that

18 digressive discussion?

19 WITNESS HULMAN: I think we remember the question.

20 Let's see if I can restate it, and if we understand it that

21 way, then I think we can respond.

22 Ms. Bush, is it, does Figure L.19 reflect the

23 range of individual latent cancer risk at any distance? Is

24 that your question?

25 MS. BUSH: It's slightly different from that.

mgc 6-6

BY MS. BUSH:

Q   Is there any way we can tell from the text the range of the risk to an individual?

A   (Witness Acharya)   No.

Q   Moving on to your discussion of the policy aspects of looking at bad weather, I believe at the bottom of Page 18 and the top of Page 19 in your testimony, is it your testimony that it is not required for disclosure purposes to show risks stemming from good and bad weather scenarios unless the weather scenarios were themselves the cause of reactor accidents?

A   (Witness Hulman)   No.

Q   Do I take it from your answer, then, that you believe that it is appropriate for disclosure purposes to show the health effects associated with bad weather, even if that health effect might not be caused by -- the weather might not cause the accident?

A   The answer is no. But it is our practice and our belief that it is necessary to consider such conditions, and we believe we adequately considered them.

Q   Is it them your testimony that you considered them, but you did not show them in the FES?

A   We showed the results of their consideration, but we did not show separately for each bad weather condition that was analyzed what the consequences of the accident were.

mgc 6-7

Q   When you say you showed the results. you mean that bad weather was averaged in with all of the weather situations, and therefore it was within your analysis?

A   In our testimony, we did not say that bad weather was averaged. We said the consequences from bad weather conditions were averaged, not the weather conditions themselves. There's a difference and a distinct difference.

Q   So in considering the consequences that had -- the averaged consequences that had the various weather scenarios in them -- is that what you mean when you say that you have considered the effects of bad weather?

A   We have considered, in our judgment, the effects of bad weather. We have sampled it. We have not done a worst case analysis.

Q   So you have not portrayed the results of a bounding worst case analysis that would be associated with bad weather?

A   That's correct.

Q   And do I take it that you consider that that is not required by NEPA?

A   May we confer?

Q   Certainly.

(The witnesses confer.)

End 6

1   A   Dr. Acharya reminds me we have done a couple of

2   things. We have not only sampled what would happen if a

3   reactor accident were to occur with bad weather and computed

4   our consequences and risks, as we have described in the FES

5   and our testimony, but we have assumed an alternative

6   emergency response sequence, which is in our minds equivalent

7   to what would happen under bad weather conditions.

8   So we have in our minds considered bad weather

9   two ways, one by sampling the meteorology and the other by

10   considering an emergency response mode indicative of bad

11   weather.

12   Q   And which emergency response sequence would that

13   be?

14   A   (Witness Acharya) Our early reloc mode of emergency

15   response, which is discussed in Appendix M of the FES.

16   Q   Early reloc, did you say?

17   A   That is correct.

18   Q   Is it correct that bad weather can cause a loss

19   of offsite power transient?

20   A   (Witness Hulman) Yes. And it was considered in

21   the FES.

22   Q   A loss of offsite power was considered?

23   A   Yes.

24   Q   Was it considered specifically or separately, in

25   conjunction with bad weather?

1   A   In the two ways that I have described how we

2   consider bad weather, in one case it was a sequence that was

3   sampled against all of the meteorology for a year of

4   historical data.

5   In the other case, where we have the early

6   relocation, it was analyzed for all weather conditions.

7   Q   In your opinion, with the 91 start-time pickup

8   methodology, is there reasonable assurance that a representa-

9   tive number of bad weather scenarios were reflected in your

10   analysis?

11   A   (Witness Acharya)   That is correct, but we also

12   say that our 91 sampling may have not detected some of the

13   worst weather that could be, worse than the ones that we have

14   analyzed.   Then we have said that could impact only the tail

15   ends of the CCDF and since the tail ends of the CCDF have got

16   the lowest probability, though the consequence of the worst

17   weather sampling, the peak could be somewhat a little higher.

18   It would also be associated with the lower

19   probability, so the impact will not be appreciable.

20   Q   When you said the peak could be somewhat higher,

21   do you have any kind of range or percentage of increase?

22   A   No, I don't have, but that could be found in the

23   literature. I don't remember now.

24   Q   That would be found where?

25   A   Found in -- in sensitivity studies for the code

1   comparison.

2   A   (Witness Hulman) Those sensitivity studies would

3   show the kind of increases that one could expect under more

4   severe weather conditions. They would not necessarily

5   reflect any indication of how much worse it could be for

6   Limerick.

7   You would have to do a specific evaluation for

8   Limerick.

9   Q   When you were initially making your uncertainty

10   bounds, as discussed on the record, is this an incremental

11   uncertainty to those previous uncertainties or was this

12   previously expressly included?

13   A   (Witness Acharya) The uncertainty factor I stated

14   some time ago. That is the risk would be higher by a factor

15   of 40 or lower by a factor of 300. That includes all the

16   elements that could contribute to uncertainty including the

17   one that we were discussing.

18   Did I say "300"? I should say "could be a factor

19   of 400 up or 400 down," not "300."

20   Q   40 and 400, right?

21   A   40 and 400, yes.

22   (Pause.)

23   JUDGE BRENNER: Ms. Bush, we can take a break

24   any time it is convenient for you. I don't know if you want

25   to try to finish now and we can take a break or if you want

1   to discuss some things at greater length with Mr. Finlayson.

2   We can give you the break now. Then you can come

3   in and finish up, as I read your cross plan.

4   MS. BUSH: Yes, I think it would be better to take

5   the break now.

6   JUDGE BRENNER: Let's come back at 10:40.

End 7.   7   (Recess.)

1   JUDGE BRENNER: On the record.

2   Ms. Hodgdon?

3   MS. HODGDON: I spoke with Mr. Romano, and he is

4   not able to make up his mind at this time regarding whether

5   or not he wishes to have oral argument and says that he will

6   not have an opportunity to study the Staff's and the

7   Applicant's reply findings in order to make up his mind

8   regarding that until tonight, and nothing that I said could

9   convince him that an earlier decision was required. I am

10   afraid I could not get a better answer than that from

11   Mr. Romano.

12   (The Board confers.)

13   JUDGE BRENNER: I would like to ask counsel for

14   the parties who might be involved in any potential argument

15   on the welding question as to their schedule.

16   Assuming that we finish with the City issues

17   today -- and we don't know when today, but it will be part

18   of the afternoon at least -- how inconvenient would it be

19   to appear at nine o'clock tomorrow morning, if at the

20   appearance we learn that we can be in recess at that time?

21   MR. WETTERHAHN: Everything is sort of tied

22   together. We're trying to put together our testimony with

23   regard to City 15, which is due to be filed on Monday. I had

24   already asked the other parties, and I have gotten a reply

25   from the Staff, whether a one-day extension in that filing

mgc 8-2

1 would be appropriate, that we move it from Monday to

2 Tuesday, in order that we may work the weekend and get a few

3 final details set.

4 Staff expressed no objection and asked if we

5 were granted, that they be granted a similar extension.

6 JUDGE BRENNER: You mean June 5th?

7 MR. WETTERHAHN: Yes. And if that extension were

8 granted, I would see no problem in my appearing here tomorrow

9 morning.

10 JUDGE BRENNER: We can grant that extension now,

11 and City has it also, of course.

12 MS. BUSH: Yes. I have no objection.

13 JUDGE BRENNER: Staff, same question I asked the

14 Applicant?

15 MS. HODGDON: Yes, the Staff has no objection and

16 would be here tomorrow at nine o'clock, and thinks, perhaps,

17 that it would be appropriate that that accomodation be made

18 to Mr. Romano, in view of the fact of his feelings about

19 this matter.

20 JUDGE BRENNER: All right. I don't know how

21 appropriate it is, but let me put it this way. Certainly,

22 it is going the last mile and beyond on the part of the Board

23 and the parties in terms of accomodating Mr. Romano, as far

24 as we are concerned. However, we will do it.

25 We think it would have been reasonable for him to

mgc 8-3

1 inform us, if not now, at least by the end of the business

2 day today as to what his desires were with respect to oral

3 argument tomorrow morning.

4 Be that as it may, we will go that last mile and

5 beyond, so to speak. And if you could inform him soon,

6 during the lunch break perhaps, that we will be here at

7 nine o'clock tomorrow morning, and he is to appear if he

8 wants oral argument -- and I assume by now you have pointed

9 out to him that we only are going to discuss the substantive

10 points in his findings that deal with the merits of his

11 contention, not the procedural rulings -- the bases for them

12 are already in the record, and we are not going to go over

13 them again -- he can appear if he wants oral argument at

14 nine o'clock.

15 If he is not going to appear, we would request

16 that he contact the Staff, if you can work out some feasible

17 means of contact tonight, to tell you that. And that is

18 only so you can report it tomorrow morning, so we are not

19 left in the dark if he is not here. But even if you are

20 so contacted tonight, we will still be here at nine o'clock

21 tomorrow morning. It will be very brief, and we will take

22 care of it that way.

23 MS. HODGDON: Yes, Judge Brenner. My remark

24 with regard to the appropriateness of making the

25 accomodation for Mr. Romano was that he had understood that

mgc 8-4

he didn't need to give an answer until tonight when he spoke

with Mr. Vogler yesterday, and also he feels that he needs

more time to study the filings of the Applicant and the Staff,

because he is a pro se intervenor.

JUDGE BRENNER: Okay. Well, I think if he thought

he had until tonight, that was not a correct understanding,

as I recall where we left it yesterday. But be that as it may,

we have now accomodated him, either appropriately or above

and beyond, depending on your point of view.

MS. HODGDON: Beyond appropriately.

JUDGE BRENNER: I will accept that. He is covered

in any event and well protected procedurally.

All right, Ms. Bush, did you say you have

finished the cross-examination on 14?

MS. BUSH: Yes, I have.

JUDGE BRENNER: All right. We can go to the

Applicant, if they have any question of the Staff's

witnesses.

CROSS-EXAMINATION (CONTINUED)

BY MR. WETTERHAHN:

Q   Yesterday the panel was asked questions about

trying to predict wind shifts in fifteen minute intervals.

Do you recall that testimony?

A   (Witness Hulman) Yes.

Q   How significant are short-term variations in

wind direction as opposed to longer-term trends, as far as

informing the population that it is evacuating as far as

the direction to go?

A   With respect to Philadelphia, I believe it is

of small significance. With respect to people in the EPZ,

it may be of some more significance, but unless there is

a significant shift for a protracted period of time, it would

not be of much consequence.

Q   For the types of diffusion conditic .. that would

cause the worst type of consequences, more severe

consequences, is there likely to be variability as far as

wind direction in those diffusion conditions? Can you

comment on that?

A   I'm afraid I don't understand your question.

With respect to what more?

Q   More variation for worst case diffusion, as far

as wind direction is concerned, as opposed to better

diffusion.

A   The worse the diffusion, the higher the

consequences. But I'm afraid I don't understand the context

of the question.

Q   Okay. Would the weather service at the airport

or in Philadelphia have information with regard to the

expected direction of the wind during the course of an

accident over a period of time?

A   The weather service would be providing

information. There would be information available from the

Applicant's meteorological tower, and if necessary,

emer_. cy meteorological equipment could be sited and

operated, such as was done for Three Mile Island.

Q   So there is both a likelihood based upon experience

and your knowledge that sufficient meteorological informa-

tion would be available to predict what action evacuees

and those perhaps in the City of Philadelphia should take?

A   Yes.

Q   You were asked about Tables 3 and 4 today. Do

you recall that dialogue?

A   Recall the dialogue, yes.

Q   In reaching your conclusions, you based your

conclusions, if I understand it correctly, on the differences,

the deltas between Table 3 and 4; is that correct?

A   Yes.

Q   And whether the table was -- whether your

information was generated out to 50 miles or 500 miles,

the deltas would presumably be the same.

A   Correct.

Q   Is the importance in evaluating the difference

of the assumptions -- is the area under the two curves,

the integrated area, the difference in area? Is that what

is meant by the delta?

mgc 8-7

1   A   Yes.

2   Excuse me. I would like to consult with

3   Dr. Acharya for a moment.

4   (The witnesses confer.)

5   There are two deltas. One delta is the area,

6   the difference in the integrated value. The other is the

7   delta between the two curves that indicates the increase

8   in risk at a specific probability.

9   Q   Using either of those indicia, is there a

10   significant increase in the risk by varying the assumptions

11   between Table 3 and Table 4?

12   A   Not an appreciable increase.

13   A   (Witness Acharya) The differences between Table 3

14   and 4 are depicted in Table 2.

15   A   (Witness Hulman) On an integrated basis.

16   JUDGE BRENNER: As long as there is a little bit

17   of a pause, I wonder if you can give me a moment. I have

18   left my copy of some material back there during the break.

19   (Pause.)

20

End 8

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1   BY MR. WETTERHAHN:

2   Q   So Table 2 is in effect the difference in the

3   area on a risk basis per reactor year, is that correct?

4   A   (Witness Acharya) That is correct.

5   Q   And it is your conclusion that these differences

6   are insignificant.

7   A   They are very small.

8   Q   Okay. In your minds, would you consider the

9   following hypothetical.

10   If instead of utilizing the sheltering factors that

11   you used for the population at the edge of the City of

12   Philadelphia, for those individuals who are evacuating, you

13   utilized the sheltering factors appropriate if they were

14   still sitting in their cars, as if they were still evacuating

15   but making no progress and sitting there for an extended time

16   at the edge of the City of Philadelphia.

17   Would you expect the risk per reactor year to

18   change significantly from that depicted in Table 2?

19   A   If I would be confronted with the question for

20   selecting the shielding factors appropriate for the evacuees,

21   in contrast to the shielding factors that we used for the

22   normal activity, I would not do that that simply. I would

23   make a rough guess as to what is the likely percent of the

24   people who headed towards southeast and east of southeast,

25   those directions, would eventually land in the City area

1   elements. That would be a more appropriate analysis, a final

2   cut analysis. So I would assume that if I would have done

3   such an analysis, taking both factors into consideration, I

4   would not get any substantial different result than what I

5   have in Table 2.

6   JUDGE BRENNER: Excuse me, I may not have heard

7   everything leading up to your last sentence, Dr. Acharya.

8   Was your last conclusion based on assuming the

9   question as hypothetical, even though you have explained why

10   you would not approach it that way, or was it based on your

11   own assumptions, which you gave?

12   WITNESS ACHARYA: If I would be confronted with

13   the situation to make any additional fine tuning of my

14   analysis, namely if I would assume that the evacuees who

15   ended up in the City of Philadelphia or its outskirts would

16   be still in the evacuation mode, and having the shielding

17   factors as appropriate for the evacuees, that by itself would

18   increase the risk a few percent of what I have shown.

19   But then if I would be confronted with that kind

20   of situation to make a very fine tuned analysis, I would not

21   put the hundred percent of the evacuees in the southeast and

22   east of southeast directions in the Philadelphia outskirts.

23   I will remove a certain fraction of the people because they

24   might have left the area by travelling in crosswinds

25   directions.

1   BY MR. WETTERHAHN:

2   Q   Let me follow up with my hypothetical. I believe

3   your answer was, if you accept the hypothetical, it would

4   increase the risk a few percent. Is that your testimony?

5   A   That is my belief.

6   Q   Would you believe considering all of the

7   uncertainties involved, an increase of a few percent given my

8   hypothetical are significant in terms of risk?

9   A   (Witness Acharya) It would be lost in the back-

10   ground of uncertainty.

11   Q   Can you turn to Table 2 for a second, please? And

12   also Table 5-11(h) on page 5-99.

13   Just looking at Table 2, you have carried that out

14   to two decimal places, correct, as far as the significant

15   digits?

16   A   (Witness Hulman) Yes.

17   Q   In looking at Table 5.11(h), not for any absolute

18   value, but in the FES, you have not used any significant

19   places as far as -- any decimal places, as far as significance,

20   is that correct?

21   A   That is correct. One significant figure was

22   reported in the FES.

23   Q   Okay, now let's look at Table 2 and look at the

24   results. If you use that one significant figure, as far as

25   the difference, let's look under consequence, Type 1.

1   The first column is 2.40×10^{-4}. If you used one

2   significant place, what would it be?

3   A   Two times minus 4.

4   Q   And the same for the second column? Would that

5   also be 2×10^{-4}?

6   A   That's right.

7   Q   What about consequence, Type 2? The first column,

8   what would that be?

9   A   It would be 1×10^{-2}.

10   Q   And that would be equivalent to the second column,

11   correct?

12   A   That is correct.

13   Q   All right. Let's do consequence, Type 3. The first

14   column would be --

15   A 6^{-2}.

16   Q   And the same thing for the second column?

17   A   That's correct.

18   Q   So the fourth column?

19   A   To be 1×10^{-2}.

20   Q   And would it be the same on the next, the second

21   column?

22   A   That is correct.

23   Q   On column 5, what would be the first consequence,

24   Type 5, in the first column?

25   A   10 to the power or 3.

1   Q   Would that be the same as the second column?

2   A   That is correct.

3   Q   So if you used a consistent rounding policy, you

4   wouldn't see any difference at all?

5   A   That is correct.

6   MR. WETTERHAHN: I have no further questions.

XXX   7   EXAMINATION BY THE BOARD

8   BY JUDGE BRENNER:

9   Q   Gentlemen, on page 14 of your testimony, you give

10   some of the conditions or assumptions which would have to

11   apply to get to the situation asserted in City 14B.

12   In the paragraph that starts "Third," you state

13   among other things that the atmospheric diffusion conditions

14   would have to be poor to allow sufficient concentrations of

15   radioactivity to remain in the plume to constitute a

16   significant hazard to evacuees approaching the outskirts of

17   Philadelphia.

18   If you have poor atmospheric diffusion conditions,

19   does that mean that the air is -- the wind is relatively

20   calm and stable?

21   A   (Witness Hulman) Not necessarily calm but

22   relatively stable and slow-moving. If it were calm. none of

23   the activity would ever reach Philadelphia.

24   Q   If the atmospheric diffusion conditions were poor,

25   as you have just defined it, does that mean that you would

1   have more time than in another wind situation to ascertain

2   and inform in advance the people who might be on the outskirts

3   of Philadelphia what they might expect in the next 15 minutes?

4   A   Fortuitously, yes.

5   Q   In other words, that is not a prediction in

6   advance but rather ascertaining near the plant what the

7   conditions would be and still having time to pass that

8   information on before the condition reaches the outskirts of

9   Philadelphia, is that right?

10   A   That is correct.

11   Q   Is it reasonably likely to postulate sufficient

12   concentrations of radioactivity so as to constitute a hazard

13   on the outskirts of Philadelphia, that is reaching the

14   outskirts of Philadelphia, if you have poor atmospheric

15   conditions?

16   In other words, is that assumptions in that part

17   of the paragraph in your testimony which we are discussing

18   internally inconsistent?

19   A   It is less likely to have poor diffusion conditions

20   than the opposite, if I understand your question correctly.

21   Q   All right. But even though you say "less likely"

22   you think it is still reasonable to assume both conditions,

23   that is poor atmosphere diffusion conditions but also having

24   the plume reach the outskirts of Philadelphia in sufficient

25   concentrations to constitute a hazard?

1   A   (Witness Acharya) Yes.

2   A   (Witness Hulman) Sufficiently likely that we

3   have done the assessment and it is part of the evaluation of

4   the FES and our separate bounding assessment in the testimony

5   both speak to that.

6   Q   On page 19, you discuss the stratefied sampling

7   scheme, as you term it, used in the CRAC analysis to assess

8   the succession of weather scenarios to get 91 samples.

9   Now during the break I was trying to find where

10   in the FES this might be explained and we have not had an

11   identification by contention, as I have endeavored to get in

12   this proceeding. It may be that the FES explains this and

13   I have missed it. But just reading your testimony, I don't

14   understand how the 13-hour intervals work in connection with

15   the four days.

16   In other words, if you have a four-day succession,

17   I understand that gives you approximately 91 samples plus a

18   few days left over in the year. Could you explain to me how

19   the 13-hour intervals figure into that?

20   A   (Witness Acharya) Yes, I would like to do that.

21   Q   And if it is in the FES, you can direct my

22   attention to that too.

23   A   It is in the FES. At a certain point -- let me

24   identify that, then I will explain how we do the sampling.

25   On page 5-79 of the FES, that is the paragraph

1   just before the last one, there is one sentence here -- to

2   obtain a probability distribution of consequence, calculations

3   were performed --

4   Q   That's okay, we can read that.

5   A   That of course did not go into the details of the

6   sampling that is in here.

7   Q   I guess I need even a few more details then, and

8   you were about to explain it?

9   A   That's right.

10   Of course a four-day interval would give you 91

11   samples. Now the first start time is January 4th, the 13th

12   hour. The second start time is January 8, 2 p.m.. The third --

13   Q   What was the hour on January 8th?

14   A   Okay, the first one was January 1st, 1 p.m. The

15   second one was January 8, 2 a.m. The third one is January 12,

16   3 a.m. The fourth one is January 16th, 4 a.m. So it is

17   alternating between the a.m. and p.m. hours of a 24-hour

18   clock.

19   So when you come to 91, cover all the 91, the

20   24-hour clock would be covered almost three times.

21   A   (Witness Hulman) The object being to sample the

22   meteorology during the day as well as from day to day.

23   Q   So you take a four-day interval.When you start

24   the next interval, you back it up 13 hours?

25   A   Yes.

1   Q   Or whatever you need?

2   A   (Witness Acharya)   Whatever is needed, without

3   changing the date.

4   Q   You picked one year as the base.   What year was

5   that?

6   A   (Witness Hulman)   Recollection was it was 1976.

7   A   (Witness Acharya)   It is in the FES.

End 9.   8   A   (Witness Hulman)   Let us confirm that if we can.

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1   A   (Witness Acharya) This is an FES, Page 5-78

2   for the year 1976.

3   Q   Can you explain to me what your judgment was,

4   both in picking one year as a base only, and why that year?

5   A   Well, we had available to us, as I recall, five

6   consecutive years of meteorological data. When our Staff

7   meterologists examined the data, they found that the 1976

8   data was most complete in terms of hour-by-hour information.

9   A   (Witness Hulman) And the representative of the

10   other years of record. Separately we have studied different

11   years using CRAC to see if different years of meteorological

12   data tend to produce distinctly different CRAC results, and

13   have found that as a general rule they do not.

14   Q   For Limerick, or just in general?

15   A   In general. We have not studied Limerick

16   specifically.

17   A   (Witness Acharya) We had a request to the Applicant

18   during our review process to show what difference it makes

19   by using the different one-year data for five different

20   years and comparing that with one another or compare that

21   with, if one would use all the five years of data at one

22   time in one CRAC run. The difference that was shown to us

23   was not substantial. That is documented in our Appendix N.

24   Q   Could you explain to me what the judgment was

25   in picking an approximate four-day succession, modified as

mgc 10-2 1   you have explained it, to get night and day representatives?

2   Is that a study judgment, as opposed to using start times

3   that would give you longer or shorter intervals?

4   A   This is a study judgment. It is very well

5   documented in Chapter 13 of WASH_1400, where several

6   sampling schemes were used, including completely random

7   sampling, and it was found that if one would use completely

8   random sampling, that would be too much -- the results do

9   not converge from different sets of random samples.

10   On the other hand -- in other words, if one would

11   go to a large number of completely random sampling, then one

12   may get a convergence of   results from different sets

13   of a large number of sampling. On the other hand, the

14   convergence was much better if one would try to systematically

15   do the sampling the way that was finally adopted in WASH-1400

16   and which is also adopted here in the FES, the so-called

17   stratified sampling.

18   Q   At the bottom of Page 19 -- and you have been

19   asked about this at least once, but not quite in this way,

20   I don't believe -- you say it is possible that a few other

21   scenarios worse than those samples may have been missed.

22   Why would that be possible? Do you mean because

23   there might be worse scenarios not represented in that base

24   year, or is it the start intervals that you use that would

25   mask or average certain bad scenarios?

mgc 10-3

1   A   Primarily that is from the sampling that we do.

2   When we choose the string of weather conditions at four-day

3   intervals --primarily the possibility would arise from the

4   missed worst sequences that might be occurring in between

5   the starting times of the meteorological sequences sampled.

6   Second, there could be a possibility that the

7   worst sequence, meteorological sequence, might not be

8   represented in the 1976 data. It could be some other year's

9   meteorological data.

10   Q   In terms of what you gave as the primary reason

11   of the particularly worst or relatively-speaking-worst

12   bad weather scenario occurring between the start times used

13   in the four-day as adjusted intervals, you didn't mean that

14   there would actually be a gap, did you, because as I

15   understand it, the intervals succeed one another without a

16   gap?

17   A   There is no gap. We used all 8760 hourly data

18   following each start time. As many hourly weather data were

19   used as were called for by the wind speed until the plume

20   reached out to the farthest region in the analysis.

21   A   (Witness Hulman) By "missed," I think what we

22   meant was that our stratified sampling scheme of four days,

23   thirteen hours, may have missed a particular bad sequence

24   in that year or in another year.

25   Q   Notwithstanding all these questions about what may

mgc 10-4

1 have been missed in the regular analysis you performed,

2 on Page 20 you refer to the alternate analysis which you

3 believe would bound the impacts of bad weather; is that

4 correct?

5   A   (Witness Acharya) That's correct.

6   JUDGE BRENNER: Thank you.

7   BY JUDGE COLE:

8   Q   Just a couple of questions.

9   With request to these 91 starting times, you

10 indicated that you used all of the data, that you had

11 8740 hours of data.

12   Do you indicate that, Dr. Acharya?

13   A   (Witness Acharya) Well, all of the 8760

14 constituted data were available in our meterological file

15 that was accessed by the code.

16   Q   Okay. I thought in the CRAC code you assumed

17 constant wind speed and direction during --

18   A   No, sir. About the wind speed, that's not the

19 correct statement. The wind speed was variable, as given

20 by the hourly data. In the 8760 hourly data, what is there

21 in the data is whether it's raining or not raining, what

22 is the atmospheric stability conditions and what is the

23 wind speed. So from hour to hour, we have the actual

24 measured speeds. Speed is not constant in the CRAC

25 dispersal model. It is the plume direction that is held

mgc 10-5 1   constant.

2   A   (Witness Hulman) I'll see if I can answer the

3   question and shed a little more light on it.

4   As I understand it, your question went to whether

5   we assumed a constant wind speed for the entire course

6   of the accident. The answer is no.

7   We just assumed different start times and used

8   the meterology in terms of wind speed and diffusion

9   conditions that followed that accident hour-by-hour.

10   Q   From the historical data?

11   A   From the historical data.

12   Q   All right, sir.

13   Mr. Hulman, you indicated earlier that you did

14   have some experience both in training and the study of

15   meteorology.

16   A   Yes, sir.

17   Q   And that includes the study of winds and stability,

18   does it not, sir?

19   A   Yes. But I don't -- I have supervised diffusion

20   meteorologists. I don't claim to be an expert in diffusion

21   meteorology.

22   Q   I want to try to get a better handle on how

23   frequently the wind might change from hour to hour. I have

24   often heard it said from non-weather people that the best

25   way to predict the weather for the following day is to

mgc 10-6

just predict the same thing that happened today, and one a percentage basis, they generally do better than the professional weather people.

Well, have you looked at the wind data for the Limerick area, and do you have any feeling for how variable that is from hour to hour?

A   I personally haven't looked at the variability from hour to hour.   But the variability from hour to hour is called "persistence" by the meteorologists, and my understanding of the persistence factor at Limerick is that it's rather high, on the order of about three-quarters of the time.   If the wind is blowing in one direction, the next hour it will be blowing in the same direction.   That's my recollection.

Q   How did you get this factor of three-quarters?

A   It's a persistence factor that the meteorologists compute, based on whether in the following hour the wind is blowing in the same direction as it was the hour before.

There are times, however, when -- and as I remember, it's on the order of 25 percent of the time -- when it is not blowing in the same direction it was an hour before, or close to the same direction.

JUDGE COLE: All right, sir.   Thank you.   That gives me a better feel.

Thank you.

End 10

1   (The Board confers.)

2   JUDGE BRENNER: Any redirect by the Staff?

3   MS. HODGDON: May I have five minutes, please,

4 in order to determine that?

5   JUDGE BRENNER: Surely. We will take a break

6 until 11:35.

7   (Brief recess.)

8   JUDGE BRENNER: We are ready to proceed.

9   Ms. Hodgdon?

10   MS. HODGDON: The Staff has no redirect.

11   JUDGE BRENNER: Ms. Bush, you said you had

12 follow-up questions?

13   MS. BUSH: Yes.

14   FURTHER CROSS-EXAMINATION

15   BY MS. BUSH:

16   Q   Mr. Acharya or Mr. Hulman, one of you, I believe,

17 spoke on the last set of questions about, that there would

18 be emergency equipment or there could be emergency equipment

19 available to facilitate prediction of wind direction in

20 the area around Limerick, as it is, I believe you stated,

21 around TMI.

22   Do you recall that response?

23   A   (Witness Hulman) I believe I made the response,

24 and it was not as you characterize. It was as was done

25 during the Three Mile Island accident.

mgc 11-2

1   Q   I see. So the equipment you are envisioning would

2   be put in place after an accident.

3   A   No. I said in my response that there was equipment

4   in place. There is equipment in place at Limerick, and it

5   could be supplemented by additional equipment, such as was

6   done during the Three Mile Island accident.

7   Q   So would you envision it being supplemented at the

8   time of an accident or before for routine use?

9   A   Subsequent -- not for routine use. Subsequent,

10   if necessary, but there is no requirement for such

11   instrumentation.

12   Q   And the current instrumentation, how far of a

13   distance from the plant is that?

14   A   There is a meteorological tower located at the

15   Limerick site, and during an emergency, my understanding is

16   that it would be supplemented from other weather recording

17   facilities in the region, including those in Philadelphia,

18   at the airport and at the North Philadelphia airport.

19   Q   Isn't it correct that the most severe weather

20   scenario would be a high-velocity wind toward Philadelphia

21   where that wind would then slow down over the Philadelphia

22   area?

23   A   No.

24   A   (Witness Acharya) That's not the worst, because

25   as you said, if the initial wind velocity would be high,

mgc 10-3

that would provide very good dilution dispersion in a favorable direction.

A   (Witness Hulman) It's very difficult to tell what the worst meteorological condition would be.

Q   The case that you mentioned as the third condition in your testimony -- I can't find the page at the moment --

JUDGE BRENNER: Page 14.

BY MS. BUSH:

Q   -- I believe Judge Brenner asked you some questions about various wind and diffusion conditions; do you recall that?

A   (Witness Hulman) Generally, yes.

Q   Isn't it correct that the CRAC code would show the worst weather conditions that were available in the samples in the tail-end values of any CCDF curve, whatever those conditions were?

A   (Witness Acharya) That's correct.

Q   Would a condition where there was precipitation of a cloud over Philadelphia be the worst weather conditions, or can you make that kind of --

A   (Witness Hulman) It could be. It could be part of those conditions, but it would depend upon what happened prior. If you had your original postulation of a high-velocity wind, most of the activity wouldn't -- would be so well diluted and dispersed that by the time it

mgc 10-4

1   rained, it could be less severe than another condition.

2   It's very difficult, as I said, earlier to tell what kind

3   of weather condition would be the worst.

4   Q   One final area. In the discussion about the

5   bounding case, I believe Mr. Wetterhahn was asking you

6   about that, for looking at evacuees that would be trapped in

7   Philadelphia, I believe, Mr. Acharya, you discussed that

8   if you did a refinement of your analysis, you would have

9   some of those people that went from the one-to-ten-mile

10 area into Philadelphia go out of the east-southeast and

11 the southeast sectors in any new analysis; is that correct?

12 You would say you didn't have all of them come into

13 Philadelphia; some of them would go into other sectors?

14   A   (Witness Acharya) If I were to make a very fine

15 calculation, I would not lump all people originating from

16 zero to ten miles in the southeast and east-southeast

17 direction in the Philadelphia outskirts.

18   Q   Would you consider it reasonable to have some

19 people who might come from the south-southeast sector go

20 into the Philadelphia sectors, as well as some people going

21 out of those sectors?

22   A   Yes.

23   A   (Witness Hulman) I'm afraid I didn't understand

24 the question. Could you repeat the question? I think we

25 may have a differing opinion.

mgc 11-5

1   MS. BUSH: Certainly. Could the court reporter

2   read it?

3   (The reporter read the record as requested.)

4   WITNESS HULMAN: The only differing opinion I have

5   is how many, and since you didn't ask the question, there

6   is no different opinion.

7   The reason for my statement -- I have to explain

8   it -- is that there is no reason in my mind to believe that

9   any of the people that would come out of the EPZ in such a

10 situation would be routed to Philadelphia, either by their

11 own choice or by the authorities. I'm not sure if we

12 were to choose a number, how big or small it would be, but in

13 my judgment, it would turn out to be a pretty small number,

14 in my mind.

15   BY MS. BUSH:

16 Q   Wouldn't there also be a consideration or element

17 in how many people would go or would be routed toward

18 Philadelphia, questions about road availability, main

19 expressways such as the Schuylkill Expressway and its

20 capacity to carry people and the need generally to

21 distribute people? Would not that influence the number of

22 people that would go into the southeast sector, for example,

23 from the south-southeast sector?

24 A   (Witness Acharya) I believe when the emergency

25 plan will be fully developed, it would identify the previous

mgc 11-6

evacuation routes for the people originating from the different sectors, not only that as to what could be or what should be their destinations, and those destinations are mass care centers. So that could be known when the emergency plan would be fully developed.

MS. BUSH: I have no further questions.

JUDGE MORRIS: Dr. Acharya, how much time would be involved for producing Table 4?

WITNESS ACHARYA: I didn't understand the question, Judge Morris. How much time?

JUDGE MORRIS: Computer time or additional personal time to produce Table 4.

WITNESS HULMAN: For what condition?

WITNESS ACHARYA: The Table 4 is already there. It's produced.

JUDGE MORRIS: How much time did it take to produce it?

WITNESS ACHARYA: Well, Table 4 was performed, or the analysis was there as part of the FES analysis. If one would do this specifically, I mean, from the very start, maybe -- see, these are very big jobs. They have to be processed by the computer only at nighttime, so these are all-night jobs, and one is not sure that giving -- submitting the job to the computer -- we work with the BNL computer -- we're not sure we could get a turnaround within

mgc 11-7

1   the next day or two. So I should say about three days

2   maximum.

3   WITNESS HULMAN: But this was one part of the FES

4   preparation that took in excess of three months and

5   involved CRAC runs whose costs were somewhere between

6   fifty and a hundred thousand dollars.

7   JUDGE MORRIS: Total?

8   WITNESS HULMAN: Total.

9   JUDGE MORRIS: Thank you.

10   JUDGE BRENNER: Any follow-up? Applicant?

11   MR. WETTERHAHN: No, sir.

12   JUDGE BRENNER: Staff?

13   MS. HODGDON: No.

14   MS. BUSH: No.

15   JUDGE BRENNER: All right. We can dismiss the

16   Staff witnesses temporarily. We'll see you back on City 13,

17   gentlemen. Thank you again for your time on this one.

18   (Witnesses temporarily excused.)

19   JUDGE BRENNER: I guess it would be most efficient

20   to break for lunch unless somebody else has a different

21   suggestion. We will break for the usual hour and a half

22   until 1:20.

23   (Whereupon, at 11:50 a.m., the hearing was

24   recessed to resume at 1:20 p.m. this same day.)

25

End 11

mgc 12-1

(1:20 p.m.)

JUDGE BRENNER: Good afternoon.

Two preliminary matters. First of all, may we inquire if Mr. Romano now has the message that we discussed today? Were you able to contact him over the lunch period?

MS. HODGDON: No, we were not able to contact him over the lunch break.

JUDGE BRENNER: Was he not available?

MS. HODGDON: He is not available until later today, as we understood earlier.

JUDGE BRENNER: I see. I'm sorry. I didn't understand that earlier.

Did you leave a message with his secretary?

MS. HODGDON: I have left a message with his office, yes, but we don't expect to be able to contact him. We expect that he will contact us later.

JUDGE BRENNER: Does his office have the message that if he wants to have oral argument on the findings, he is to appear here at nine o'clock tomorrow morning?

MS. HODGDON: I haven't specifically left that message, but I will leave that message with his office.

JUDGE BRENNER: Okay. Thank you. Then if you do, in fact, actually have contact with him later today, we can hear that, too, so that at the end of the day, maybe

mgc 12-2

1   you could bring the matter back before us and tell us what

2   the status is.

3   MS. HODGDON: Yes, I will do that.

4   JUDGE BRENNER: Of course, if he has made a

5   decision already, that would be nice to hear, even though

6   we know he might not.

7   On another matter, I mentioned the open question

8   of the changes to the emergency plan implementing procedures.

9   Is there anything to report on that?

10   MR. WETTERHAHN: I understand there are telephone

11 conversations among the parties going on today, and I hope

12 to be able to report either later in the afternoon or

13 tomorrow morning as far as the status.

14   JUDGE BRENNER: All right. Thank you.

15   MR. WETTERHAHN: If I am not so able to report,

16 we will report in writing to the Board as soon as possible.

17   JUDGE BRENNER: Well, I think I want to hear on

18 the record by tomorrow morning one way or the other, because

19 there just is not enough time to handle it in writing between

20 now and possibly having to do something with it next Monday.

21 We are not available as a Board after next Wednesday until

22 we are back in session here. And in any event, even aside

23 from that reason, the sooner we take care of this, the

24 better. It doesn't seem to be so complicated that we cannot

25 at least ascertain the parties' positions.

mgc 12-3

1   All right. The Applicant's panel is back at

2   the witness table.

3   Whereupon,

4   G. F. DAEBELER,

5   SAUL LEVINE

6   E. R. SCHMIDT

7   G. D. KAISER

8   resumed the stand and, having been previously duly sworn,

9   were examined and testified further as follows:

10   JUDGE BRENNER: Ms. Bush, you can proceed with

11   respect to your cross-examination on City 13.

12   MS. BUSH: Thank you.

13   CROSS-EXAMINATION

14   BY MS. BUSH:

15   Q   I have some questions initially about Paragraph 58

16   on Page 44 of your testimony. I believe there you state

17   that the testimony addresses possible consequences inside

18   the City of Philadelphia by presenting dose distance -- a

19   family of dose distance curves and various specific

20   probability consequence relationships for persons within

21   the city; is that correct?

22   A   (Witness Kaiser) Yes.

23   Q   The family of dose distance curves are the ones

24   on Figures 2 and 3 at the end of your testimony; is that

25   correct?

mgc 12-4

1   A   Yes.

2   Q   And those curves present a distribution of

3 different probabilities which reflects all of the cases

4 that you analyze for the City of Philadelphia; is that

5 correct -- all of the accident sequences that you looked at?

6   A   Yes.

7   Q   Now with regard to the figures, then, we can see

8 the probabilities associated with various consequences all

9 along the curves; is that correct?

10   A   Yes.

11   Q   Now moving to the second item that you mentioned

12 in your testimony, the various specific probability

13 consequences of the relationships, are those portrayed in

14 Table 8 of your testimony?

15   A   Yes, they are.

16   Q   Now those values are specific consequences

17 associated with specific probabilities; is that correct --

18 more point estimates?

19   A   These are point estimates which basically give

20 you the lefthand end of the CCDF.

21   Q   In the latter half of that Paragraph 58, I believe

22 you go on to conclude that using these relationships, the

23 level of societal and individual risk is extremely small

24 for the people within the City of Philadelphia; is that

25 correct?

A   Yes.

Q   And you further state that some perspective is given to the specific examples cited in the contention by looking at that in the context of risk; is that correct?

A   That's correct, yes.

Q   Now when you say "viewed in the context of risk," do you mean taking the probability of the accident element and combining it with the probability of the consequence element?

Would you like for me to break that question down?

A   Yes, please.

Q   The analysis that was shown in the City's initial filing separated out the probability of the accident occurring and portrayed probabilities of various consequences; is that correct?

A   That's right. It portrayed probabilities conditional on the occurrence of that particular accident sequence.

Q   And by this statement here that you make in your testimony, "when viewed in the context of risk," do you mean by that, when viewed in the context of that probability of the accident happening, and including that with the consequences once the accident happens?

A   Yes. I mean by incorporating the predicted frequency of occurrence of the accident sequence, as well as

mgc 12-6

End 12

any subsequent probabilities which may arise from different

weather conditions or wind directions or what have you.

1   Q   In making that statement, when viewed in the

2   context of risk and the conclusion that you draw from that,

3   are you taking into account or have you thought of the element

4   of risk aversion and are you familiar with that term?

5   A   I am generally familiar with the term "risk

6   aversion." What we have done here is to present frequencies

7   and magnitudes of consequences.

8   A   (Witness Levine) I would like to amplify on that.

9   We have not included any consideration of risk aversion

10   factors in this work. Risk aversion factors are not generally

11   enough quantifiable. They are generally not presented in

12   compilations of statistical risks that have actually occurred

13   no matter how small, merely you present the frequency of the

14   events and their consequences and people make their own

15   judgments about how averse they might be to that risk.

16   (Pause.)

17   Q   Turning now to paragraph 59, the sentence that

18   begins at the bottom of that page, I believe you state that

19   it is not necessary in terms of disclosing the environmental

20   risk to prepare dose distance curves for the sectors which

21   include the City of Philadelphia. Is that an accurate reading

22   of that sentence?

23   A   Yes, it is.

24   Q   Was that statement in terms of not necessary

25   element intended to address any legal requirements under NEPA?

1   A   No.

2   Q   Moving to paragraph 60, although really my question

3 is about Figures 2 and 3, those figures would be the same in

4 any -- for any direction from the plant at that distance, is

5 that correct?

6   A   (Witness Kaiser) No, they wouldn't, because in

7 this case we have factored in the probability that the wind

8 blows into the two sectors, east southeast and whatever the

9 two sectors containing the city.

10   Q   So other than the wind factor that is in the

11 curve itself, the wind factor, that .272?

12   A   Yes, it is.

13   It would be pretty much the same in any other

14 direction except it might move up or down depending on the

15 ratios of the probability of the wind blowing in those

16 directions.

17   Q   I have some questions on Table 8. I am not clear

18 on how these values were derived. Are they mean values

19 associated with distances of Philadelphia?

20   A   The calculations were performed by using CRAC-2

21 with the population zeroed out, except for not in the City

22 of Philadelphia. Otherwise, it was done in the same way as

23 was done for the base case runs, with the exception I should

24 add that we made the assumption that people persist in their

25 normal activities for 48 hours.

1   Q   I didn't get what you said in the previous

2 sentence, except what -- did you say zero population?

3   A   Yes, we carried out some CRAC-2 runs in which the

4 population was zero everywhere except in the city, so these

5 results that we have here apply specifically to the City

6 of Philadelphia.

7   Q   It is a fair implication of your earlier statement

8 about this being the left hand side of the curve, that these

9 results are the lowest probability -- the highest probability,

10 results that you -- that outputted from the CRAC code that

11 you ran?

12   A   If we had in fact calculated similar results for

13 different numbers of, say, fatalities, the associated

14 frequency would indeed have been smaller.

15   Q   Could you provide a little further amplification

16 on that statement?

17   A   If you look at typical CCDFs, they always have the

18 same general kind of shape, which is that they start off at

19 the lefthand end and they fall off as you go to higher

20 consequence magnitudes, which means that the frequencies

21 associated with higher consequence magnitudes are smaller.

22   Q   So that any -- so it is correct that if you had

23 any larger consequence, it would have a lower probability?

24   A   That is correct.

25   Q   I would like to move to paragraph 63. I believe

1   in that paragraph you comment on the II-T/WW results that

2   were in the filing made earlier by the City of Philadelphia

3   and make some adjustments to that for the wind probability.

4   You also state the probability of that particular

5   sequence, accident sequence, is that a fair summary of that

6   paragraph?

7   A   Yes.

8   Q   My specific question is with regard to the

9   sentence at the bottom of page 46, where you state, "However,

10   the way in which the results are presented does not give

11   useful insight."

12   Are you referring there to the element of the

13   probability of that -- or rather the frequency of occurrence

14   of that particular sequence and the weather probability

15   variable, or the absence thereof?

16   A   What I am referring to when we say here that the

17   way in which the results are presented do not give useful

18   insight is referring to the contention itself, where the

19   various levels of dose are associated with various conditional

20   probabilities. And I think the reason why we feel this does

21   not give useful insight is that you can often use the code

22   CRAC-2 to calculate what seem to be perhaps high consequences,

23   but you can't put them in perspective until you work out how

24   often those consequences occur. That can only be done by

25   factoring in all of the probabilities that go into how often

1   that event is likely to happen, included the predicted

2   frequency of the accident sequence itself.

3   Q   Does that answer imply that it is not useful to

4   look at the probability of the consequence stated or portrayed

5   separately from the frequencey of occurrence of the accident

6   itself or the probability of the accident?

7   Or are you saying one must consider both of the

8   elements?

9   A   When your intention is to try and assess risk, you

10   cannot do that without considering all of the elements that

11   go into the probability side of the risk.

12   Q   I understand that. Are you going one step in

13   addition to that and saying it does not give useful insight

14   tc look at and review those numbers stated in separate

15   fashion?

16   A   I don't think they are particularly helpful.

17   A   (Witness Levine) If I could amplify, in my mind

18   the use of conditional probabilities and reporting consequences

19   is not useful in terms of assessing risk. Risk is both

20   probabilities, i.e, your best estimate of absolute probabili-

21   ties and their consequences and that is the definition of

22   risk, whether you call it probability and consequences or

23   probability times consequences.

24   You have to have the absolute probability and the

25   absolute consequence to compare them, to make an estimate of
     risk. So using conditional probabilities is not of great utility.

End 13.

mgc 14-1

Q   Is that because in your mind you can easily look at a risk number and make a quick separation, so that you have a sense of the probability element, as well as the consequence element?

A   I don't fully understand the question. But to make an estimate of risk, you have to consider probabilities, and you have to consider consequences together, either in the CCDF where they are presented as probabilities and consequences, or in an area under a CCDF curve where they are represented as probabilities times consequences. And those are definitions of risk that are universally accepted. And something less than the absolute values of probabilities and the absolute values of consequences are not particularly useful. In fact, I don't know how you think about those in terms of overall risk.

Q   Would you agree that not all people weigh the consequences of accidents equally? That is, they don't give the same weight to an accident involving 10,000 deaths versus one death, assuming the same frequency?

A   I would think that different people would weigh those things differently. On the other hand, if the frequencies were very low, and here in connection with the kind of large consequences that we consider in PRAs, the frequencies are so low as to be almost beneath comprehension of the average person, when you start talking about

mgc 14-2

1 probabilities of one in a million or one in a billion per

2 year, it's very hard to conceive what those numbers mean.

3 So it's very hard to conceive of what the consequence means,

4 certainly independent of the absolute probability or even

5 with the absolute probability, it's sometimes difficult to

6 conceive of it.

7 For instance, if there were a million people

8 killed in an earthquake in China recently, in the last ten

9 years, if such earthquakes happened every ten years, then

10 people would rebuild China to be very different from the way

11 it is today. On the other hand, if it happens once every

12 hundred years, they sort of forget about it in the ensuing

13 hundred years, and they are willing to accept that. So

14 there are differences in the way individuals view risk,

15 and there are differences in the ways societies view risk.

16 And it's very hard to draw meaningful conclusions about

17 risk aversion or risk perspective. That's why we talk

18 about risks being small, because that's an objective

19 statement. The probability and the consequences or the

20 probability times the consequences are small numbers compared

21 to existing risks.

22 Q   Given your agreement or statement that people

23 do look differently at risk, would you think that it would

24 be important to disclose those probabilities, separated

25 from -- not isolated from, but separated from the

mgc 14-3 1   consequences, so that one could see each separately?

2   A   I don't think you can view them separately. I

3   think you have to view probabilities and consequences

4   jointly, whether it's with an "and" or with a "times."

5   Q   Okay. Focusing on the difference between portraying

6   it with an "and" or a "times" for a moment, would the

7   presentation be more valuable or enlightening, meaningful

8   to a person or to a group of people, if there were some

9   risk-averse people in the group, if it were portrayed with

10   an "and" instead of a "times"?

11   MR. WETTERHAHN: Objection. That question is so

12   hypothetical and general as to have no probitive value.

13   (The Board confers.)

14   JUDGE BRENNER: We have a slightly mixed opinion

15   up here, but I think we can solve it this way. We think

16   we know where you are going, and you can get at it more

17   usefully and more efficiently by asking a more specific

18   question. So regardless of any opinion we might have as

19   to whether the witness is capable of responding anyway --

20   in other words, I don't think Mr. Wetterhahn's objection

21   arises to a legal objection; however, I think in the name

22   of efficiency, you should rephrase it more specifically.

23   You are going to get there anyway, I think.

24   If it's very general, it's not going to help you

25   later in writing your findings.

New BU

mgc 14-4 1

(Pause.)

2   JUDGE BRENNER: You are going to have to ask

3 another question sooner rather than later.

4   MS. BUSH: I am at a loss at how to proceed.

5 I'm going along in my mind --

6   JUDGE BRENNER: I don't want to have a whole

7 dialogue on it. I think we have been quite lenient in giving

8 you a lot of opportunity, which the record does not reflect,

9 because there have just been long periods of silence for you

10 to consult with your advisor, some of which the length of

11 which has surprised me, since I don't think the answers were

12 that surprising, if you and your advisor had consulted

13 sufficiently in advance.

14   But be that as it may, we have been giving you

15 that leeway, and we will continue to do it within reason.

16   I can't advise you how to proceed. If you keep

17 the contention in mind and what kinds of things you have

18 to write, when you ask the questions, you can nail the

19 question down a little more. Generally, you have been quite

20 good at doing that. This last one, however, you did not.

21   Incidentally, when I said we had a difference

22 of opinion up here, the other opinions were just to sustain

23 the objection. So the consensus you got was the one most

24 favorable to you.

25   MS. BUSH: Well, maybe then you have to make the

mgc 14-5 1

ruling that you think is appropriate. I can't think of

2   another question.

3   JUDGE BRENNER: We didn't sustain the objection.

4   You can ask the question more usefully. You may have asked

5   it already in various different ways. You have been getting

6   at the same thing.

7   Even if I wanted to help you, I'm not positive

8   I know where you are going.

9   MS. BUSH: I think the last question was where

10   I was going.

11   JUDGE BRENNER: Let me finish. I have the cross

12   plan, and I still make that statement.

13   MS. BUSH: It has all to do with the last

14   question on Paragraph 63, and I was honing in on that. And

15   we were getting more and more refined, in my opinion, and

16   we were down to the last question, and we got an objection.

17   So I have nowhere else to go.

18   JUDGE BRENNER: Ask the question again, and then

19   give us a chance to react before we get an answer.

20   MS. BUSH: Can you read it back?

21   JUDGE BRENNER: Can you rephrase it? I think that

22   would be better, especially since I don't think you want

23   to stay with the original phraseology as to every detail.

24   If you don't remember the question, it can't be

25   that important to you.

MS. BUSH: I'm trying to get it clear.

JUDGE BRENNER: Okay.

BY MS. BUSH:

Q   Given your previous testimony that there are people who weigh consequences differently -- excuse me -- your agreement earlier that all people do not weigh the consequences of accidents equally -- that is, give the same weight to an accident involving 1000 deaths versus one death -- assuming the same frequency in each case -- do you recall that testimony?

A   (Witness Levine)   I don't think I agreed with that statement.

JUDGE BRENNER: I don't understand that statement myself. It sounds a little different than what we got before.

BY MS. BUSH:

Q   Do you agree that not all people weigh the consequences of accidents equally? That is, they do not give the same weight to an accident involving 10,000 deaths versus one death, assuming the same frequency in each case?

JUDGE MORRIS: By "same frequency," Ms. Bush, do you mean the same number of deaths over some time period?

MS. BUSH: The same probability of the accident occurring.

WITNESS LEVINE: Well, I think people might view

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those differently. Certainly anyone who is rational would view that, that at the same frequency, the larger consequence is a more serious event than the smaller consequence at the same frequency of occurrence.

Q   Would you agree that as the probability of the accident increases, you come to a marginal point where, given the same probability of occurrence that might be low, if you have one death versus 10,000 deaths, you would weigh that probability differently?

MR. WETTERHAHN: Objection. That question is incomprehensible.

JUDGE BRENNER: It is to me, subjectively speaking. I may not be the right standard, but I am going to have to understand it someday. I think I at least understand the English language, even if I don't understand all the technical intricacies of the subject.

BY MS. BUSH:

Q   Was your prior statement that some probabilities can be so low that even if there were one or 10,000 deaths, a person would not be concerned because the frequency of the accident or the probability of the accident is so low?

A   (Witness Levine) Yes, I would agree with that.

Q   Would you also agree that you can move up the CCDF curve, if you will, or toward a lower probability -- excuse me -- a higher probablity of occurrence of an

mgc 14-8

accident and get to a marginal point where at that probability, you would not worry about one death, but you would worry about 10,000 deaths?

    A   I think that's possible, but I think it's so speculative that it's very hard for me to answer yes or no to that question.

    Q   What part of it do you think is speculative?

    A   I don't know where on the curve you are.

    JUDGE COLE: Mr. Levine, don't you -- as the frequency of an event increases, would you not tend to be more concerned with it?

    WITNESS LEVINE: It depends on its consequence.

    JUDGE COLE: Okay. Now all consequences being equal, as frequency of an event increases, would you not tend to be more concerned?

    WITNESS LEVINE: It depends on the number of consequences. If they are very small, I might not be concerned at all.

    JUDGE COLE: But as that increases, would you not tend to be more concerned?

    WITNESS LEVINE: Excuse me, sir. As what increases?

    JUDGE COLE: I agree the discussion is a little too general to be useful, but I think she is trying to establish something.

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WITNESS LEVINE: I would say there is some frequency of occurrence at which I would be concerned about 10,000 deaths. If that's the question, I can say yes.

JUDGE COLE: You can say that for any number of deaths. There would be a certain frequency where you would become concerned.

WITNESS LEVINE: No, I'm not so sure about that.

JUDGE COLE: One death.

WITNESS LEVINE: In fact, for one death, you know, deaths in the United States are forty to fifty thousand a year from automobiles that are well distributed in time and space and almost ignored by society, but not quite.

On the other hand, if 40,000 people were killed in one day in one place, it would be regarded as a calamity.

So I cannot answer such a question independent of the magnitude of the consequences.

JUDGE COLE: All right, sir. I understand your position.

JUDGE BRENNER: But beyond that, Ms. Bush, even if he could answer the question, I don't know what the heck I would do with it, unless I talked about it in the context of the estimates being run here for Contention 13, whether they be your estimates in the contention, or as you may uncover on cross-examination or the Applicant's estimates in the direct testimony or the Staff's estimates in its

mgc 14-10

direct testimony or something else. I've just got to have a context. And to the extent you can give it one, I think that will help the record.

Let me say one more thing. Maybe this will help.

As long as you ask questions that generally, it doesn't sound like anything more productive than some questions we had last week by a cross-examiner as to whether or not the definition of risk is probability times consequences. You are asking it in different ways, but I can't deal with it any differently. It comes down to the same thing.

MS. BUSH: I guess my concern is that the --

JUDGE BRENNER: Unless you feel the need, we don't have to discuss it. You can just ask another question. I haven't cut you off. I'm just trying to indicate what I think would assist us, and you can take it or leave it within reason.

End 14

1   BY MS. BUSH:

2   Q   The testimony that was presented here for the

3   City of Philadelphia did not include any distribution,

4   tabular summary or figure form distribution of the various

5   probabilities and their associated consequences, is that

6   correct? In terms of health effects?

7   A   (Witness Kaiser) Yes, we presented dose distance

8   curves. We have Tables 8 and 9. Where do you want me to go

9   beyond that?

10   Q   The dose distance curves are individual health

11 effects. I am speaking in terms of health effects like

12 latent health effects, latent cancers, early fatalities,

13 fatalities in early injury.

14   Did you have in your testimony a portrayal of the

15 probability of various consequences in terms of a CCDF

16 distribution of probabilities plotted against health effects?

17   A   No. As you can see from the testimony, no CCDFs

18 were included in response to City-13.

19   Q   I have an area to ask about that was mentioned

20 yesterday, I believe, in cross-examination of the uncertainty

21 factor in the SARA and I believe you stated on cross-examina-

22 tion a range of 60 to 180 and in explaining the 100 factor

23 on page 9, paragraph 13, is my recollection correct or could

24 you just state again your derivation?

25   JUDGE BRENNER: You are asking him what he means

1   by on the order of a factor of 100 in that paragraph?

2   MS. BUSH: That is correct.

3   JUDGE BRENNER: I think I asked him that question

4   last week.

5   MS. BUSH: And you got 60 to 180?

6   JUDGE BRENNER: Yes, something like that, so you

7   are asking him to remember back to last week and I interjected

8   because I think you said yesterday.

9   MS. BUSH: Yes.

10   WITNESS KAISER: That judgment of the order of a

11   factor of 100 is made on the basis of figures in SARA,

12   Supplement 3, Table 1, and represents an approximate ratio

13   between the upper and lower estimates that are presented in

14   that table.

15   JUDGE BRENNER: Dr. Kaiser, I made a note when you

16   answered the question last week and my note says that your

17   answer, I think, or one of this panel member's answer was that

18   it was a range of 60 to 180. Is that correct?

19   WITNESS KAISER: Yes. The range is different for

20   the different health effects.

21   JUDGE BRENNER: Yes, that's true. I had the

22   impression that the general range that you gave me when I

23   asked the general question was a range that encompassed the

24   different ranges that you might obtain for different health

25   effects. Is that incorrect?

1   A   (Witness Kaiser) No, I believe that is correct.

2   JUDGE BRENNER: If you want more detailed ranges,

3   I didn't ask him that.

4   BY MS. BUSH:

5   Q   Do you have for SARA numbers that are comparable

6   to the FES range of uncertainty of 40 as a factor too low

7   and 400 as a factor too high?

8   A   (Witness Schmidt) No, we don't. We do not have

9   any comparable numbers since the basis for their numbers is

10   really not very clear except it could be that much higher

11   or that much lower. SARA presents uncertainties in consider-

12   able detail. The comparability of those limits, however,

13   is not clear.

14   Q   Can you give me an upper limit of uncertainty for

15   your point values?

16   A   I can give you the ratio of our upper estimate

17   to the point estimate quoting from Table 1 of Supplement 3.

18   Looking at those values, the ratio of what we call the 95th

19   percentile to the point estimate for early fatalities is a

20   factor of three higher and a factor of 60 lower.

21   Q   What would that value be for latent cancer

22   fatalities?

23   A   In latent cancers, it is a factor of approximately

24   five higher or 16 lower.

25   Q   16?

1   A   16 -- 1-6.

2   Q   Could you tell us what your total core melt

3   frequency is?

4   A   The total core melt frequency as estimated in

5   SARA?

6   Q   Yes.

7   A   Table 4 of Supplement 2 to SARA presents a median

8   annual core melt frequency of 1.8×10^{-5}, the point estimate

9   value is 2.4×10^{-5}.

10   Q   Turning to Figure 2 that is attached to the back

11   of the testimony, can you explain how I could get a

12   conditional probability value for Figure 2-A?

13   A   (Witness Kaiser) Conditional on what?

14   Q   On the kinds of core melt.

15   A   You would -- at any level of consequence, you would

16   divide the corresponding frequency by 2.4×10^{-5} and then

17   divide it by .27.

18   JUDGE COLE: Are you sure you divide by .27 or

19   multiply by .27?

20   WITNESS KAISER: Divide.

21   WITNESS SCHMIDT: To make it conditional on wind

22   direction also.

23   BY MS. BUSH:

24   Q   The .27 is the wind direction, is that correct?

25   A   (Witness Kaiser) It is the probability that the

1   wind would blow towards Philadelphia.

2   Q   I believe that you have indicated that some of the

3   contract work that NUS did was with regard to the use of a

4   PRA, are you familiar with that, for the NRC?

5   A   (Witness Levine) Could you be more specific,

6   please?

7   A   (Witness Schmidt) That is the Staff list. We

8   have a separate list.

9   Q   On your list, do you have the item "expert opinion

10   on the use of probabilistic risk assessment and safety goals?

11   A   (Witness Levine) Yes, we do.

12   Q   Did any of that relate to issues that are addressed

13   in SARA?

14   A   The bulk of the work I did was for the office of

15   policy evaluation. In fact, it was all for the Office of

16   Policy Evaluation. It had to do with developing a structure

17   for the formulation of safety goals, which has nothing to do

18   with SARA.

19   Q   Could you enlighten me as to what safety goals

20   are?

21   MR. WETTERHAHN: Objection. Beyond the scope of

22   the contention, beyond the sceope of this hearing, which has

23   to do with environmental matters.

24   MS. BUSH: I don't know that because I am not sure

25   myself -- I am not an NRC litigator -- what safety goals are.

1   JUDGE BRENNER: What he is talking about, the

2   proposed -- I guess it is proposed policy statement on

3   safety goals, which has been issued. It is in the public

4   record. We know what it is and I --

5   MS. BUSH: Okay, I can look them up and if I think

6   it is relevant, I can argue that in my brief, I guess.

7   JUDGE BRENNER: Yes, you might look for a sentence

8   or two to the effect that the Commission is trying to develop

9   I guess what you might call an experiment.

10   -   Somebody might think that is an unfair term, but

11   an experiment to see if they can develop safety goals.. They

12   recognize it as a project that will take some years and that

13   the goals in the meantime should not be used in licensing

14   decisions or words to that effect.

15   But even that approach I think is still proposed.

16   I can tell you over the years there has been a plethora of

17   proposals on how to consider on a rulemaking basis, that is

18   not individual proceedings, but a rulemaking basis, the

19   consideration of severe accidents. And they have had different

20   tentative statements, proposed statements, announced rule-

21   making and they have given each of them a different label

22   and then, more recently, they have taken a step back -- they

23   being the offices that advise the Commission -- this OPE

24   example, Office of Policy Evaluation, as well as the Staff

25   and the Commission has indicated I think somewhere that they

1   are going to take a look as to whether or not to combine

2   what they consider the most productive of those approaches

3   into some coherent format.

4   To my knowledge they have not yet done that but

5   that is the big picture. The sub-picture is that there is

6   this proposed statement on safety goals which has been

7   referred to.

8   MS. BUSH: Safety goals have nothing to do with

9   severe accident safety. They are design basis -- ?

10   JUDGE BRENNER: I didn't say that.

11   MS. HODGDON: If I may, the policy statement on

12   safety goals was a final policy statement, not proposed. The

13   safety goals themselves are proposed. You are perhaps

14   confusing it with the Severe Accident Policy, which was

15   proposed.

16   JUDGE BRENNER: Yes.

17   MS. HODGDON: Both of those came out last year,

18   I think the safey goals on March 12th or 13th, if I remember

19   correctly, of '83 and followed in April by the Severe

20   Accident Policy that was proposed.

21   JUDGE BRENNER: Thank you. The confusion I made

22   was exactly the one you suggested. Ms. Hodgdon is quite

23   correct, but this shouldn't be new to you because both of

24   these statements that Ms. Hodgdon refer to , which have been

25   published, have been cited many times when we were arguing on

1   the admissibility of contentions at several stages in the

2   pre-hearing process of this hearing.

3   MS. BUSH: I am familiar with the policy statement

4   on severe accident. I was led to believe by the objection

5   that the safety goals is not related to severe accidents.

6   JUDGE BRENNER: I did not say that.

7   MS. BUSH: I am afraid I have relied on the

8   statement made in the objection.

9   JUDGE BRENNER: It does not matter what his

10   statement was. There is something in there, I don't have it

11   in front of me -- an appreciate it would come up that we are

12   not to use the safety goals in licensing. They are primarily

13   in the safety area rather than the environmental area, but

14   not necessarily exclusively so because either in that policy

15   statement or proposed rulemaking notice or some other policy

16   statement, there is a reference to the potential inter-

17   relationship of when they are in the safety area and I think

18   it is the earlier statement that actually says that.

19   So it is not correct that there is no possible

20   connection, but we are not using the goals as numerical goals.

21   But you can proceed with the litigation that we have before

22   us.

23   If you want to read that safety goal statement

24   and see something in there that you want to argue about, go

25   ahead.

1   MS. BUSH: I would like to ask the witness some

2   questions in terms of what he has advised the ommission on.

3   JUDGE BRENNER: Fine. But while we are on the

4   subject, the Staff in response to our request of last week,

5   I guess, left on our bench the beginning of this week,

6   something entitled, "Alphabetical Listing of All NUS

7   Corporation Contracts (Includes Active and Inactive Contracts)

8   and no party has made any mention of it and I forgot about

9   it.

10   After no party brought it up, I assumed we would

11   do something with it, since we asked for it on the record

12   and it was a follow-on to the Applicant's Table 4, which we

13   did make part of the record.

14   Staff, what did you intend to do with that?

15   MS. HODGDON: If we can address that here, there

16   might have been some confusion as to the scope of what should

17   have been done. In any case, the Board did mention that we

18   could print up -- we had on computer the contracts with NUS

19   and that we should provide that. That is what has been

20   provided, the contracts with NUS.

21   The person who did that did not have any under-

22   standing regarding sub-contracts, but we have no reason to

23   believe that -- we don't have the capability of doing

24   sub-contracts that easily, however I would remind the Board

25   that we did address this matter in July, I believe, of 1982

1 where a paper was filed in the Shoreham proceeding, also

2 filed in this proceeding, regarding NUS contracts and

3 sub-contracts with the NRC in this area and this would be

4 by way of an update on that.

5   JUDGE BRENNER: All right.

6   As I look at your listing, is it the Staff's

7 position that there is nothing on the Staff's listing which

8 would relate to PRA or severe accident type work, which has

9 not already been included on the Applicant's Table 4?

10   MS. HODGDON: That is correct.

11   JUDGE BRENNER: Okay. Then we will leave it at

12 that. There is no need to put it in the evidentiary record,

13 but it has been provided to the parties for whatever use they

14 may have wanted to make to it and we appreciate that.

15   MR. WETTERHAHN: Mr. Chairman, in the interim, I

16 have located my copy of the proposed Commission policy

17 statement.

18   JUDGE BRENNER: Whic h one?

19   MR. WETTERHAHN: Both of them.

20   The proposed commission policy statement on

21 severe accidents and related views on nuclear reactor

22 regulation, which was 48 Federal Register 16014, April 13,

23 1983, and it has a statement with regard to the limits of

24 consideration of such matters in licensing proceedings. And

25 the other policy statement, which you also noted, the Safety

1   Goal Development Program, has a similar statement, so that

2   might be the reason for the confusion. The prohibition

3   against considerations in individual licensing proceeding,

4   as stated in both of them, I can read them into the record

End 15. 5   or just give the citation to the page if that is acceptable.

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mgc 16-1

JUDGE BRENNER: I don't think it's necessary. I think we have had argument in the prehearing stages using, I'm sure, the two sentences or the several sentences you might want to quote now. And certain counsel for the City has seen those briefs, as we all have over the past in this case. I don't want to go too far in characterizing the safety goal policy statement, since I don't have it in front of me, but these are proposed, and Ms. Hodgdon, I believe, stated it correctly, that although it's a policy statement, it is a policy statement on proposed goals. So even though they don't have "proposed policy statement" in the title, it is, in essence, a proposal rather than something which has now been solidly defined. And that's what I meant.

I believe Ms. Hodgdon clarified it correctly. I believe we can all look at it later if it becomes important.

Now you want to ask these witnesses questions to the extent that their work might somehow involve a substantive conflict, if not legal conflict.

MS. BUSH: Right. If there is any --

JUDGE BRENNER: Well, you got an answer from Mr. Levine already. You can pursue that answer, if you want.

Are you finished with everything else?

mgc 16-2

MS. BUSH: Everything else, yes.

JUDGE BRENNER: All right.

BY MS. BUSH:

Q   Was the advice that you gave to -- did you say "Policy Evaluation Office;" is that the correct name?

A   (Witness Levine) Office of Policy Evaluation.

Q   Did any of that advice have to do with questions about the assessment of risk, in the sense that we have been using it here, the probabilities and the consequences?

A   I suppose in the most general sense. We did have conversations that included a lot of subjects inherent in the PRA. More specifically, however, the principal problem we were talking about was how to structure safety goals, whether, in fact, early fatalities and latent cancer fatalities could somehow be combined, or should they be treated separately, and how should one consider them and so forth and so on.

Q   When you say "how one should consider them," were there questions about evaluating risk, in the sense that we using "risk" here today?

A   No.

Q   Are you testifying that the discussions were about how to present these questions, not what the standard would be or the substance of how you evaluate it?

A   They way in which they should be evaluated were,

1 to the best of my recollection, very peripheral matters

2 in the discussion to understand things. But the principal

3 things under discussion were the structure of the safety

4 goals. Should they be quantitative? Should they be

5 qualitative? Should they be both? Should you combine

6 earlies and latents? Should you consider them separately?

7 Should you consider core melt?

8   There were at this time perhaps a dozen different

9 proposals that had been broached around the world. I had

10 written a report comparing these proposals, and they were

11 very difficult to understand, the relationship between these

12 various proposals. I had written a report comparing them

13 on a comparable basis.

14   So one was then able to understand what they

15 really meant relative to one another, and this provided a

16 good background for such discussions.

17 Q   With regard to what you have described as the

18 peripheral discussions, did I understand you to say that

19 there were some discussions as to how to evaluate risk

20 in the sense that we are talking about risk now?

21 A   There were some general discussions about what

22 an event tree was, what a fault tree was, and how to put

23 all of this together to get a risk assessment. There was

24 nothing that I can recall involving the details to which

25 you have probed the consequence model.

Q   And were there any discussions on the level of separating out probabilities from consequences or risk aversion or things of that nature?

A   There were discussions of risk aversion, but not separating probabilities and consequences. In fact, I don't know what you mean when you say "separating out probabilities and consequences." I can't understand that statement.

Q   On the discussion about risk aversion, could you summarize for us the substance of those discussions?

A   As best I can recall, the Advisory Committee on Reactor Safeguards had included a factor in their proposal for safety goals that included a risk aversion factor. None of the others that I can recall included such a factor. And that was discussed.

My recommendation was not to include a risk aversion factor.

MS. BUSH: I have no further questions.

JUDGE BRENNER: For what it's worth to you, Ms. Bush, I'm surprised that you or your advisor do not know this -- maybe you do -- related to your last question, to the extent you are curious on your own and outside this record, there is a rather thick NRC document -- I think it's published as a NUREG or something like it -- that explains the detailed background of many of the

mgc 16-5

considerations that led to the policy statement on the

proposed safety goals, and it discusses different proposals,

and I think it discusses the ACRS, among others, that

Mr. Levine just referred to.

MS. BUSH: Thank you.

JUDGE BRENNER: Staff, any cross-examination of Applicant's witnesses?

MS. HODGDON: The Staff has no cross-examination of the Applicant's witnesses.

EXAMINATION BY THE BOARD

BY JUDGE BRENNER:

Q   Gentlemen, on Page 48 of your testimony, you discuss what you think the appropriate estimates should be for fatalities per million man-rem, assuming that an accident has occurred. These are all conditional -- that is, the accident has occurred in the assumption. And I want to ask some questions about that.

You reference SARA for some of the background, including Page 10-15 and 10-25. In part, you state that applying the 10.5 million person-rem to the population of Philadelphia corresponds to about five rem per person. Obviously you plugged in the estimate of two million for the population.

You would then apply the reduction by a factor of five. You reference SARA for that. Page 10-15 of SARA

mgc 16-6

is in evidence as Applicant's Exhibit 152. Page 10-16 is not.

The paragraph to which you are referring is the last paragraph on 10-15, and it continues over, and there is some detail in that paragraph which we can all read for ourselves -- it is part of the record -- as to the threshold, and it indicates at least for the doses to particular organs discussed in the portion on Page 10-15, why the corresponding dose of about five rem per person would make the reduction by a factor of five to be in order. But I don't know what the threshold would be for the other organs or, in fact, what other organs are discussed in the page that's not in evidence. At least the record doesn't know.

So looking at that paragraph, what would be the threshold for the breast and thyroid, which are the two mentioned before the sentence continues over to the next page?

A   (Witness Kaiser) The central estimate does not apply to the breast or the thyroid, and no other organs are mentioned.

Q   Why wouldn't it apply if you were looking at total conditional fatalities?

A   Could you restate or repeat your question, sir?

Q   I asked you for some details which are not in the

mgc 16-7

1 portion of SARA that is in evidence, and in effect you told

2 me that I don't need that in order to see if you have

3 properly applied the reduction of five in Paragraph 65 of

4 your testimony, because you are dealing only with what you

5 have termed the central estimate.

6   And my question is, what is under consideration

7 is the total fatalities, a conditional estimate of fatalities,

8 assuming the accident occurred, as I stressed, and I don't

9 understand why doses to organs which could lead to

10 fatalities would not apply. Is that because they are

11 already considered under the central estimate?

12   A   No. I'm not an expert in this field. It must

13 have something to do with the way in which, say, the thyroid

14 responds to radiation dose. But beyond that, I can't answer

15 that question.

16   Q   Maybe if you read me the rest of that sentence,

17 that would clarify it. We are dealing with the sentence

18 fragment that ends on Page 10-16 of SARA, and if you read

19 the rest of the sentence into the record, which would start

20 with 10-16 which I do not have in front of me, maybe that

21 would help.

22   A   "This applies to all organs except the lung for

23 which the corresponding thresholds are 60 and 600 rem

24 and the breast and thyroid to which the central estimate

25 does not apply."

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S2BU

End 16

Q   Okay. Well, for what it's worth, at least your answer is consistent with what is in there, and I didn't know that until this moment.

In applying the factor of five and ending up with your estimate in the testimony in Paragraph 65 of about 400 fatalities, just roughly doing the arithmetic, I guess that's a round up to the nearest hundred. It would actually be around 350 fatalities; is that correct?

A   (Gesturing.)

Q   Was that a yes?

A   No. I'm just checking my sums again.

1   Q   All right.

2   A   Yes, about 350, 360.

3   Q   I am go.ng to ask the Staff about the same

4   subject, but by then, I will have lost the benefit of your

5   presence, so I would like to ask you a little bit about

6   your opinion of the Staff's testimony on the same subject,

7   and if the answers are that you don't know, that will be

8   an acceptable answer, since it is not your testimony.

9   But on Page 23 od the Staff's testimony in

10 Answer 31 and Answer 32, the Staff gives conditional mean

11 values for population exposures and then for latent cancer

12 fatalities. And I would like to just restrict the discussion

13 for now to the southeast sector for simplicity, and also

14 that is the sector quoted in the contention.

15   The Staff has an estimate of about 18 million

16 person-rems for the southeast sector, again assuming the

17 particular accident being utilized by the Staff occurs.

18 And the background on that is in Answer 30 as to what

19 analysis they are looking at.

20   Using the 18 million person-rems, the Staff ends

21 up with about 1100 latent cancer fatalities, which struck

22 me as being rather low on a per-million estimate, if I did

23 my arithmetic correctly. That is about 60 per million

24 person-rems, which is certainly lower than the central

25 estimate reported in your testimony and, of course, lower

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than the higher estimate that you can derive from the contention.

Did you look -- and if you did, could you give uas an opinion as to how the Staff arrived at that and why it is so different than the fatality estimate that you provide per million person-rem?

A   I can speculate. I would say these -- well, these estimates would presumably come out of the CRAC analyses and would be a more accurate calculation of consequences than what I did. It would perhaps take account of the fact that some people might be exposed above the 30 rem threshold where the central estimate factor of five applies, and some people below, so that overall, when compared with that 168 cases per million man-rem that I quoted, the application of the central estimate doesn't quite give them a factor of five; it gives them more like a factor of three to bring it down to that 60 per million that you quoted.

But I must emphasize that that is somewhat speculative.

Q   I guess I don't understand -- and arithmetic is not my strong suit -- but if you have a factor of three, that is something lower than a factor of five. Wouldn't the fatalities per million person-rem be higher for the Staff's estimate, rather than lower?

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A   Effectively in my estimate, I started with 168

per million and then divided that by five. That's what

the central estimate does, which brings me down to about

30, 35, as opposed to the 60 that we have already mentioned

for the Staff.

Q   All right. Thank you. That's in your testimony.

In your testimony, you just have used the 10.5

million person-rem, which was reported in the contention.

Do you have your own opinion as to what the correct

conditional mean value would be?

A   I think that 10 million is very much in the right

ballpark.

Q   How big is the ballpark? Would the Staff's 18

million also be in the same ballpark?

A   Yes.

Q   In your testimony in the rest of Paragraph 65,

you go on to discuss the probabilities, given the accident

occurring, but further probability reductions for wind

direction, and then you also have frequency of occurrence

and so on. The Staff -- and I mention that by way of

background -- the Staff in Answer 32 goes on to apply these

factors also.

By quick comparison, the factors the Staff

applied, where they are in common with the ones you have

applied and the Staff discusses another sector, are very

1 similar, if not the same, and I want to get your opinion

2 on that, both for probabilities of wind blowing in the

3 southeast direction, and also the probability of the release

4 for the Category II-T/WW.

5   A   The wind direction probabilities are consistent

6 with the ones we used, and the probability of release is

7 the same. It's taken from the FES.

8   Q   Do you have an independent opinion on that

9 probability of release, aside from the fact that, for the

10 sake of your testimony, you took it from the FES?

11   A   No. In order to comment on that, I would have

12 to look into the details of the systems analysis and the

13 containment event tree and so on.

14   JUDGE BRENNER: That's all I have. Thank you.

15   Any follow-up questions?

16   MS. BUSH: No.

17   MR. WETTERHAHN: Could I have one moment with

18 our witnesses?

19   JUDGE BRENNER: Let me ask the Staff if they

20 have any follow-up.

21   MR. WETTERHAHN: Don't I get redirect first?

22   JUDGE BRENNER: Oh, I'm sorry. I thought you

23 had redirect already. I'll give you the moment. Go ahead.

24 If you want more than one moment, --

25   MR. WETTERHAHN: No. Let's sit in place and

1 try to finish this.

2 (Pause.)

3 REDIRECT EXAMINATION

4 BY MR. WETTERHAHN:

5 Q Turn for a second to Paragraph 65, please, where

6 we were at the probability 3×10^{-7} appearing at the next

7 to the last line. Do you see that?

8 That is the probability of an event occurring

9 in any one of the two sectors comprising Philadelphia?

10 A (Witness Kaiser) Yes, it is.

11 Q If you turn to Page 24 of Staff testimony, they

12 have given two numbers in their corrected testimony, in

13 the last two lines before Question 33, of the two sectors,

14 southeast sectors, 2×10^{-7} and 3×10^{-7} to get the

15 combined probability of it occurring in both sectors.

16 Would you add up those probabilities?

17 A Yes.

18 Q So your number of 3×10^{-7}, do you believe that

19 is close to their value of 5×10^{-7} and therefore comparable?

20 A Yes. I think we are both doing essentially

21 back-of-the-envelope calculations at this point, and a small

22 difference like that is not really significant.

23 Q Mr. Daebeler, would you turn to Page 10-33,

24 which is Table 10-2, which is Applicant's Exhibit 152?

25 A (Witness Daebeler) I have that in front of me.

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Q   I will ask the panel, is this tabulation of population surrounding the Limerick site the one that was used in the CRAC-2 analysis?

A   (Witness Kaiser) Yes.

A   (Witness Schmidt) Yes.

Q   Is Philadelphia Electric doing any reevaluation of the population projections to the Year 2000?

A   (Witness Daebeler) It is correct that Philadelphia Electric is doing some preliminary evaluations of the population projections based on the 1980 Census. That preliminary evaluation indicates approximately a reduction of about 20 percent for the Year 2000.

Q   So if there were indeed a reduction of 20 percent in the population, that would make your results, as shown in SARA, conservative as compared to any lower population projection; is that not correct, panel?

A   (Witness Kaiser) Yes, it is.

A   (Witness Schmidt) Yes.

MR. WETTERHAHN: I have no further questions.

JUDGE BRENNER: Ms. Bush, any follow-up?

(Pause.)

MS. BUSH: Shall I proceed?

JUDGE BRENNER: Yes.

RECROSS EXAMINATION

BY MS. BUSH:

Q   Mr. Daebeler, this revision in your estimates of population, when was that revision undertaken?

A   (Witness Daebeler) That has just started in the last month or so.

Q   Is that an in-house effort?

A   Yes, it is. It is based on some 1980 Census data, however.

Q   Are you looking at all of the population displayed on Table 10-2, or are you looking at one particular aspect of it?

A   We are looking at the population in the general area of Limerick.

Q   Would that be in the ten miles around the plant? Would that be fifty miles or what?

A   It's out at least to fifty miles, and they may be going further. I'm not familiar with all of the details of that analysis.

Q   Is that 20 percent reduction, then, in the population in all areas around the plant?

A   I don't know that detail. I just know in general there has been an indication of about a 20 percent reduction in the area.

Q   You don't know if that's a net reduction, if there

1 is an increase in some areas, decrease in others or what?

2   A   No. That's specific, detailed information which

3 I don't have at this time. Again, I might note that the

4 analysis has been preliminary.

5   Q   Do you know whether there is, in fact, a growth

6 in some areas like Bucks County, Montgomery County?

7   A   As I mentioned previously, I don't know the details

8 of specific changes in specific localities.

9   Q   So that could be a reduction for one area that

10 might be offset by an increase for another area?

11   A   I think if I interpret your question correctly,

12 that wouldn't be correct, because the overall reduction

13 is 20 percent as far as total population surrounding the

14 area roughly in the 50-mile region.

15   Q   Do you know for a certainty that that covers 50

16 miles in a circle around the plant, the net reduction of

17 20 percent?

18   A   No, I do not know that. It is an approximate

19 value. That's what I understand the study is about. But

20 not having done it exactly myself, no, I do not know if

21 it's exactly 50 miles.

22   JUDGE BRENNER: Ms. Bush, let me ask you a

23 question. Do you have a lot more on Mr. Wetterhahn's

24 question and Mr. Deebeler's answer as to their preliminary

25 results on that reduction in population?

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MS. BUSH: That's all I have on that. That's the only area I have.

JUDGE BRENNER: I'm not criticizing. I'm just asking. I'll tell you what my reason is, depending on your answer.

MS. BUSH: Maybe I have three or four more minutes.

(The Board confers.)

1   JUDGE BRENNER: We have got something to say that

2   may help you. Then if you feel you want to ask the questions

3   anyway, because you have already thought them up, I will let

4   you.

5   Mr. Wetterhahn's question and Mr. Daebeler's

6   answer at this point in the record has no further value and

7   we are not going to rely on it.

8   Even if procedurally we would have been willing

9   to rely on it, your cross-examination has already vitiated

10   any possible use of it as applied to the analysis here,

11   because Mr. Daebeler does not know enough about it and just

12   that total factor is too general to be applied to the

13   particular sectors that might be of interest in City

14   Contention 13 at least.

15   Beyond that, and I am making this as a general

16   statement, it was just procedurally improper to wait until

17   redirect to drop a little fact like that it. If it had

18   really been more essential to the contention, it would have

19   been big procedural trouble.

20   It happens that it is not in this case, but I am

21   using it as a forum to make the general point. It should

22   have been put in as a note in the written testimony. From

23   Mr. Daebeler's answer, it sounds like it could have been

24   known by May 11th, when the testimony was filed. If it

25   was learned afterwards, the parties and the Board could have

1   been informed in a brief supplement, preferably in writing,

2   but at least by an oral statement at the time the testimony --

3   at the time we started the hearing, even though it was in

4   advance of the time we were taking up this particular

5   contention, so that parties would have been on notice.if

6   it would have been important.

7   It is clear that a cross examiner wanting to probe

8   it would not have had time to prepare because he would not

9   have been on notice and be able to pursue it. It is not

10   important in my judgement. If it was, you have vitiated it

11   anyway by your cross-examination so far, but I want everybody

12   to bear in mind for future contentions and use a little

13   judgment in terms of information that would be material as

14   to whether it is something that you can hold in abeyance for

15   whatever reasons, be they strategic or substantive, for the

16   redirec., because if a party wanted more time to come back

17   at it an' if it was important, our ruling might have been

18   "yes," the party would have been entitled to do that.

19   That does not apply here for the two reasons I

20   have given.

21   Did you want to say something, Mr. Wetterhahn?

22   MR. WETTERHAHN: I just wanted to say that it was

23   purely informational and the Applicant is perfectly willing

24   to rely upon the numbers. If there were any way -- if I

25   knew in any way they would be nonconservative, I certainly

1   would have brought them to the attention of the Board.

2   There are some matters which, you know, I want to

3   make the parties and the Board aware of it, when I have come

4   to a conclusion, to a certainty that it cannot affect the

5   results in an unconservative manner and that has been

6   confirmed by the party. And I consider that a trivial matter

7   but I still wanted to bring it up to the Board's attention,

8   the fact that such an effort was ongoing, not that we were

9   going to rely and multiply every number by 20 percent in

10   reducing it and say that is essential to the outcome of the

11   analysis.

12   Certainly the Applicant would be criticized for

13   doing that and I certainly would assume that the record would

14   be reopened if we took that course of action.

15   But it was merely notification of a matter which

16   is ongoing rather than something substantive that we would

17   rely on in any findings that we might wish to submit.

18   JUDGE BRENNER: That's nice that you said it now,

19   but there is no such thing as purely informational when you

20   are asking facts on the evidentiary record here and you know

21   that and if Ms. Bush had not asked the cross-examination,

22   somebody, maybe not you but somebody might have written the

23   very finding that you just said nobody was going to write.

24   That is number one.

25   Number two, we agree, appreciate and accept your

1 point that if it had been unconservative you would have

2 certainly felt a stronger obligation on the act of notifica-

3 tion and the timing of notification and that is correct.

4 The fact is -- and I am not saying -- I never said you

5 violated a notification obligation -- my point is, I just did

6 not address that either way and I am not going to -- my

7 point is, if you wanted to bring it up on the record, it

8 should have been done sooner than this point because

9 notwithstanding, your conclusion that you have just given us

10 about the use of it, another party understandably would feel

11 compelled to protect the record from that other party's point

12 of view and that is what we have seen.

13   Again, I have used this as an example for the

14 future more than its importance in the present context. With

15 all that, Ms. Bush, do you have any further questions?

16   MS. BUSH: I have no further questions.

17   JUDGE BRENNER: Staff, any followup?

18   MS. HODGDON: No followup.

19   JUDGE BRENNER: Applicant?

20   MR. WETTERHAHN: Quite while you are behind.

21   (Laughter.)

22   No further questions.

23   JUDGE BRENNER: We can dismiss this panel. I

24 think we have completed with this panel.

25   MR. WETTERHAHN: I would ask that they be excused.

1   JUDGE BRENNER: All right. Gentlemen, thank you

2   very much for your time on the other contentions and on this

3   one also.

4   You are excused at this point.

5   (Panel excused.)

6   JUDGE BRENNER: We can take a break now and when

7   we come back the Staff witnesses should be in place on

xxx   8   City 13. We will come back at 3:20.

End 18.   9   (Recess.)

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1   JUDGE BRENNER: We are back on the record.

2   Whereupon,

3   LEWIS G. HULMAN

4   and

5   SARBESWAR ACHARYA

6   resumed the stand and, having been previously duly sworn,

7   were examined and testified further as follows.

8   JUDGE BRENNER: The Staff witnesses have previously

9   been sworn as you know. You can resume your cross examina-

10   tion of the Staff witnesses on City Contention 13.

XXX 11   CROSS-EXAMINATION

12   BY MS. BUSH:

13   Q   Thank you. Some of this cross examination is

14   eliminated because we have gone over this in various ways

15   and various angles before.

16   I would like to direct your attention to the

17   bottom of page 22 of your testimony. Now I believe there

18   you state that if you have given conditional individual dose

19   distance curves for all the accidents, it would have resulted

20   in a substantial increase in the bulk of DES without providing

21   any additional perspective regarding important impacts.

22   Is that correct?

23   A   (Witness Hulman) I think that is a fair

24   characterization of that sentence, yes

25   Q   Would your statement be the same with regard to

1   conditional -- let me start it this way: would your statement

2   have been the same with regard to CCDF curves that some --

3   all of the accident probabilities versus latent health effects

4   or early fatalities, early injuries for the area of

5   Philadelphia?

6   A   (Witness Acharya) I am not sure we understand the

7   question.

8   Q   Okay, let me try to rephrase it.

9   If you had presented CCDF curves that portrayed

10   the whole array of probabilities of all of the accidents as

11   one axis and the other axis as health effects, such as latent

12   health effects, and the other two we normally have been

13   talking about, deaths and acute fatalities and injuries,

14   would the statement that you make also apply in the sense

15   that would it have resulted in substantial increase in the

16   bulk without providing any additional perspective regarding

17   important impacts?

18   A   I still don't understand what kind of a curve you

19   are suggesting. I don't know how to generate one CCDF for

20   all the different health consequences unless I use some

21   weighting factor.

22   Q   I meant three curves.

23   A   We have provided CCDFs for several categories of

24   risk that show an integration of all of the sequences and

25   their weather conditions.

1   Q   My question is specifically with regard to

2   Philadelphia.

3   A   Would it have added perspective if we would have

4   done it just for Philadelphia or in addition showed

5   Philadelphia?

6   Q   If you had showed it for Philadelphia in addition

7   to what you have done in the FES, would it have resulted in

8   substantial increase in the bulk of the FES without providing

9   any additional perspective regarding important matters?

10   A   (Witness Acharya) So far as the FES is concerned,

11 we did not even consider to provide a separate analysis for

12 the City of Philadelphia, so far as the CCDFs are concerned

13 but we have provided in the FES the risk to an individual up

14 to 50 miles and those risk curves, namely the risk of early

15 fatality, risk of early injury and risk of the latent cancer

16 fatalities, the thyroid and non-thyroid, one can use those

17 curves to calculate the impact on any population group in any

18 direction.

19   We didn't -- though we did not provide the portrayal

20 of the risk to the City of Philadelphia, there are elements in

21 our FES, namely the risk to an individual as a function of

22 distance curves, which can be used to assess the risk to any

23 population group in any direction from the site within fifty

24 miles of the site.

25   A   (Witness Hulman) In answer to your question, would

1   it have added materially to show it just for Philadelphia?

2   No, Philadelphia in our judgment is no different than

3   Harrisburg or Baltimore or Wilmington, Delaware, or New York.

4   It is another population center whose populations

5   are shown and whose risks can be easily computed as

6   Dr. Acharya has stated.

7   Q   Let me take the first point first. When you state

8   that there are risks to the individual as the function of

9   distance in the FES, am I correct that those are all mean

10   value risks?

11   A   (Witness Acharya) That is correct. For each

12   distance, the number in the plot is the mean for that distance,

13   mean computed from the CCDF for that distance.

14   Q   So it is not correct that we could use that to

15   determine the range of potential risk or exposure that the

16   individual would have as a function of distance?

17   A   No. But the range is already factored into -- in

18   the risk calculation.

19   Q   Am I correct in what I stated, that because the

20   dose distance curves that you have only show mean values in

21   terms of consequences to the individual as a function of

22   distance, we cannot use that then to get the range of

23   consequences to the individual and to the group at any

24   location?

25   A   You cannot generate a CCDF.

1   Q   Was that derived --

2   A   I said you cannot generate a CCDF out of those

3   curves for any particular location but you can get an

4   assessment of the risk to any group of population in any

5   direction at any distance.

6   Q   When you say "assessment of risk," do you mean the

7   range of possible consequences and the associated probabilities?

8   A   That is correct. They are all integrated together.

9   A   (Witness Hulman) But not separate. They are

10   integrated together. You can't get an estimate of the

11   uncertainties associated with probabilities by themselves or

12   with consequences by themselves but you can from the instruc-

13   tions, the information in the FES get an estimate of the

14   uncertainty and risk.

15   Q   Is it a fair statement of your testimony to me

16   just now that you are saying that we cannot get a calculated

17   range of probabilities and consequences for the group we are

18   talking about but we can get some uncertainty range for them?

19   .   I have problems with your question. As I have

20   tried to explain before, we review risk as the product of

21   probability times consequences. You can get an estimate of

22   the uncertainties in the risks from the information in the

23   FES and we think that is quite clear.

24   What you cannot do is get an estimate of the

25   uncerainties in either the probabilities or the conseuquences.

1   Furthermore, you can't get an estimate of the

2   individual accident consequences.

3   Q   Now my next question is, could you have generated

4   that information with CRAC and in terms of bulk output, would

5   it have been three pages, 100 pages?

6   A   To portray it so a reader could comprehend it, if

7   we have 91 start times and approximately 20 release categories

8   for approximately half a dozen different consequence categories,

9   I believe the bulk would have been a multiple of several times

10   the size of the FES and in our view, unwarranted.

11   Q   Can you output the results of that analysis in

12   terms of, for example, a tabular distribution of the

13   probabilities and associated consequences, health consequences,

14   and if you can, would that be a one sheet summary result?

15   A   A one-sheet summary result for what? I don't

16   understand the question.

17   Which specific --

18   Q   It is what we were talking about before, the

19   probabilities of all of the -- the probabilities associated

20   with all of the accident sequences that you analyzed in

21   CRAC compared to latent fatalities, early fatalities and

22   early injuries?

23   A   The mean values of consequences?

24   Q   No.

25   A   Their peaks?

1   Q   No. A distribution of all of the probabilities

2   associated with all the accident sequences.

3   A   It couldn't be put on one page.

4   Q   Do you agree with that, Mr. Acharya?

5   A   (Witness Acharya) Well --

6   Q   Could it be put on one page?

7   A   If you are asking me to make an estimate of the

8   page, I can think aloud and you can pick the answer. For

9   instance, if you are suggesting that we show -- if I under-

10   stand your question, you are saying that for

11   each of the distances that we have in the CRAC code, we would

12   provide -- we should have provided what --

13   Q   You are not understanding my question. I am

14   talking about the high density Philadelphia population area

15   and I am talking about a tabular summary of the distributions.

16   A   For Philadelphia alone?

17   Q   Yes.

18   A   That was not our intention for inclusion in the

19   FES.

20   Q   I understand that. My question is, did you agree

21   with Mr. Hulman's statement -- I don't remember whether to

22   call it specifically a statement, but would that be a one

23   page output --

24   A   I don't think it could be one page --

25   MR. WETTERHAHN: Objection, I don't see what

1   materiality this has, whether it is one page or two pages.

2   JUDGE BRENNER: I don't either, because it is

3   not probative. If you want to apply some sort of mini-balance

4   as to whether even if it doesn't add much in their view, it

5   wouldn't be hard to do. Assuming for the sake of argument

6   that that is appropriate to some extent for you to probe into,

7   how many pages it is in the resulting summary output is not

8   probative of how hard it is to do it in terms of time, effort

9   or whatever, so it is not going to be helpful.

10   MS. BUSH: I believe it will be a one-page output.

11   JUDGE BRENNER: Do you understand my point as to

12   why it doesn't matter?

13   MS. BUSH: If the question is -- I think it is

14   important to find out how much work it would be and I am

15   happy to ask about that. I would like to ask about that.

16   JUDGE BRENNER: Well, I have read things that have

17   taken 20 pages and have been very easy to write because I

18   didn't take the time to edit it down because I had to get it

19   out in a hurry.

20   On the other hand, something worked over carefully

21   that was complicated, which resulted in a page and a half,

22   might have been a lot harder to write and taken a lot more

23   drafts and I am sure many of the people have had those

24   similar experience and that is an example of why your

25   question is not probative.

1   BY MS. BUSH:

2   Q   Is it correct that you have a program all ready

3   for the CRAC that you can run to get a CCDF curve related

4   specifically to Philadelphia for health effects?

5   A   (Witness Acharya) Well, we don't have any

6   specific program. The same program that we have run can be

7   used for running assessment of consequences, all kinds of

8   consequences for the City of Philadelphia. All that one has

9   to do is just kind of zero out the populace everywhere else

10   and shine out Philadelphia as the only population group.

11   Q   So it would not be a difficult effort?

12   A   Nothing is difficult. It would take time and

13   additional effort.

14   Q   How much time?

15   A   It is doable.

16   MR. WETTERHAHN: Objection. It is not probative

17   of any element of this contention. Perhaps if it had taken

18   a year and it was essential to the contention, it would make

19   a difference.

20   MS. BUSH: As I understand the steps --

21   JUDGE BRENNER: You don't have to talk to each

22   other. Give me a chance or else I'll go home and you two

23   can talk to each other.

24   We will give the cross-examiner a little bit of

25   leeway on this because this is going to the point that I

1   earlier discussed.

2   How important it is going to be later I don't

End 19.   3   know.

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1   If she wants to argue the scope of disclosure

2 and what might have been reasonable, and there is case

3 law that talks about what is reasonable to this clause,

4 given the effort involved, balanced against the worth of

5 it, so we will give her a little bit of leeway. I don't

6 think it will take too long and may be appropo of something

7 I may say at the end of all this also.

8   WITNESS HULMAN: Let's see if I can answer your

9 question now, as I understand --

10   JUDGE BRENNER: Let's get another question or

11 have the same one rephrased, because I think we've gotten

12 fragments of the question for a number of reasons, and I

13 think it would be easier for the witnesses, as well as

14 for the cross-examiner, to get that in.

15   BY MS. BUSH:

16 Q   How much time would it take for you to do the

17 computer runs where you output the probability distribution

18 of accidents, of all the accidents you've run in the CRAC

19 model, summarized for health effects on Philadelphia?

20 A   (Witness Acharya) If I give you a similar item

21 for every item I have here in the FES, exclusive of the

22 City of Philadelphia, that would take about as much time

23 as it took me to prepare to the FES analysis.

24 Q   That wasn't my question precisely. My question

25 was, how long would it take you to output from the computer

the CCDF curves associated with Philadelphia and health

effects on Philadelphia?

A   It would take at least a month.

Q   To output --

A   Yes. Output is just not a simple procedure where

you hit the button and the computer gives everything. You

have to prepare the text. You have to prepare your input

carefully and zero out the population elsewhere except for

the City of Philadelphia --

Q   Wait, Dr. Acharya, slow down.

JUDGE BRENNER: Yes.

WITNESS ACHARYA: To provide exclusive analysis

for the impact of all the accidents that we have analyzed

in the FES exclusively to the population in the City of

Philadelphia, we have to go through the similar procedure

as you have done for the entire FES. In addition, we have

to take also -- to zero out the population from everywhere

else in the world except in the City of Philadelphia and

put it in the CRAC analysis.

So if you see the complexity of the FES analysis --

now I would like you to pay attention to this example -- we

have the conditional mean values in one table. Okay, that's

in the Appendix K-1 table. We would have to generate a

similar table for the City of Philadelphia, and there are

about 20-some sequences. Each sequence is analyzed under

three different emergency response conditions, so it's

20 times 3 at so many runs for a similar table like Table K-1

for the City of Philadelphia. And besides analyzing these

individual runs for Appendix K, we have to run all the

accidents put together for the overall absolute CCDF for

presentation of the results in a similar manner as they

are in the figures in Appendix L.

In Appendix L, each has three curves, one for

the severe accident from severe earthquakes and one for

non-severe earthquake initiated accidents, and those have

to combine to get the sum. The plotting that is done

there is outside the computer. There is a lot of human

intervention involved in going from the computer output

that we have seen that are present in the tables and

translating that into the plots and then pulling all this

stuff together and present it in a manner that is presented

in the main text of the FES.

So therefore it will be almost similar to what

we have already in the FES, just to address the City of

Philadelphia alone.

WITNESS HULMAN: I would like to add, Ms. Bush,

I don't see anything that would be added by that effort.

Why would the Staff need to differentiate between the

people in the City of Philadelphia in that manner, when there

are people in Bucks County and Montgomery County and

mgc 20-4 1

Harrisburg and Pottstown?

2   We think that the kind of treatment we have

3   provided in the FES gives the information necessary for a

4   decision on environmental impact and also gives the public

5   enough information to make a decision on whether the impacts

6   are severe or not.

7   BY MS. BUSH:

8   Q   If I could continue with the first half of this

9   issue, Mr. Acharya, are you stating that you would have to

10 output Table K and put it in summary form before you could

11 get the total probability distribution for all the accidents

12 together?

13   A   (Witness Archarya) Not necessarily. To address --

14 I'm anticipating that you will ask me the question as to how

15 the individual accidents are impacting the City of

16 Philadelphia -- well, I would think yes, perhaps it would

17 require a table like K-1.

18   Q   But if I didn't ask for that --

19   A   Then I wouldn't do it.

20   MR. WETTERHAHN: Objection. Too speculative.

21 Immaterial. Irrelevant.

22   JUDGE BRENNER: All right. We will overrule the

23 objection. The question has been asked and answered in any

24 event, but that's not the only reason for overruling it.

25 I think we could be more productive just completing this

mgc 20-5 1 line, which I think is kind of a digression, given the main

2 answer already.

3   BY MS. BUSH:

4   Q   Would you look at Table 4, please, in your

5 testimony? Now that table has the magnitudes on one side

6 and the various probabilities, which is a summation of all

7 the probabilities and accident sequences examined; is that

8 correct?

9   A   (Witness Acharya) That's right.

10   Q   Now have I correctly understood what you said and

11 have you correctly understood me, that you are indicating

12 it would take a month to develop that table for the City

13 of Philadelphia? Is that what we have discovered here?

14   A   No. That was not the question I am responding to.

15 Now you are narrowing to Table 4. Your earlier question

16 to which I responded that it might take a month, that was

17 in order to prepare the very similar type of analysis that

18 is present in the FES exclusively for the purpose of

19 Philadelphia. That would take about a month.

20   Q   I see. Now to develop Table 4 for the City of

21 Philadelphia, how long would that take?

22   A   I think I responded to a question in that

23 connection, to the question of Judge Morris, that just to

24 prepare something like this for the City of Philadelphia

25 exclusively, that would take perhaps about three days.

mgc 20-6 1   (Pause.)

2   Q   If we portray these results as in Table 4

3   specifically for Philadelphia, I would like to discuss

4   briefly the question of whether that would add any additional

5   perspective regarding important impacts. And I believe it

6   is your testimony that it would not add any additional

7   perspective; is that correct?

8   A   That's exactly so.

9   JUDGE BRENNER: We've heard that a few times,

10   Ms. Bush.

11   MS. BUSH: That was just laying the foundation.

12   JUDGE BRENNER: Okay. It was fresh and

13   persistent. Go ahead.

14   BY MS. BUSH:

15   Q   Do you state that, because it is your opinion, that

16   the high-density population area associated with that

17   sector, in its relationship of distance from the plant,

18   would not present any unique areas of concern in terms of

19   health impacts?

20   A   (Witness Acharya) Any inference one would like

21   to draw as to the share or the proportion of the impacts

22   that could be ascribed to the City of Philadelphia is

23   derivable from what we have already presented.

24   Q   Is what from what we have already presented?

25   A   Is derivable from the information that we have

mgc 20-7

already presented in the FES on some important health

consequences -- early fatality with and without support of

medical treatment, early injury and latent cancer fatality

including and excluding thyroid -- for the City of

Philadelphia, and also we have the uncertainty factor --

that is, it could be upped by a factor of 40 and down by

a factor of 400.

Q   Assuming hypothetically that that information

is not derivable, what would be the answer to my previous

question?

JUDGE BRENNER: Wait.   I guess I'm going to

object on my own.   When you have a hypothetical, if that

bears no relation to the evidence -- in fact, is contrary

to the evidence just educed -- it's a waste of time.

Sometimes we will allow hypotheticals in adminstrative

proceedings on the basis that you will tie it up later, but

this one has been untied before you asked the question by

your previous question.

End 20

mgc 21-1

BY MS. BUSH:

Q   Mr. Acharya and Mr. Hulman, did you not agree with me that you could not derive the range of consequences and probabilities to citizens of Philadelphia in terms of health effects?

A   (Witness Acharya) That's what we said, we could not derive the CCDF. But we derived the risk and the uncertainty in the risk for the City of Philadelphia.

Q   Okay.

A   (Witness Hulman) That's what we have done. But your previous question, could we do it for the City of Philadelphia in terms of CCDF, it could be done, yes.

Q   My question is, given the unique relationship that Philadelphia has to the plant in terms of its particular density and its distance, is it your opinion -- in spite of that or in light of that, is it still your opinion that it would not be important to have the CCDFs in the public record with regard to the siting of the plant?

A   (Witness Acharya) Well, I don't know what additional perspective the CCDF will provide with respect to the City of Philadelphia. First, the City of Philadelphia being farther -- quite --about twenty miles or so, it would have drawn the CCDF for Philadelphia -- two CCDFs would run much longer compared to the CCDFs that we have already

provided. In other words, it will overlay the CCDFs which

we have not calculated, which we would have calculated if

we did the analysis, and overlay those CCDFs for the City

of Philadelphia on the ones that we have already done for

the entire site region. Those CCDFs would run quite longer

compared to the ones we have already shown.

Besides, let me add one thing. If you stress the

same argument, your argument that was the City of

Philadelphia not considered important, it's not that we did

not consider it important, but we did not show the separate

analysis for Philadelphia. If we would have thought of

providing separate analyses for the various population

groups, we would have thought about Pottstown. That would have

come to mind much earlier before we would have thought about

Philadelphia.

Q   Is that because you have made some judgment that

in the offsetting factors of the important variables of

distance and population density, that Pottstown might be

a larger contributor to risk than Philadelphia?

A   We did not consider specifically along these

lines. We did not consider these elements at all. But

what I said is, if we would have considered it as absolutely

necessary to portray the consequence in the problem of

CCDFs to various population groups, then Pottstown would

have come immediately to mind, because this is the largest

mgc 21-3 1   population center and closest to the plant, and that is

2   a high-risk area. Then we would have picked up the other

3   ones.

4   Q   Comparably, isn't Philadelphia, while a greater

5   distance from the plant, a larger population density area?

6   A   It is also a much lower risk on an individual

7   basis compared to Pottstown.

8   Q   How about health effects?

9   A   What do you mean?

10   Q   In risk, you mean the probability and the

11   consequences?

12   A   You mean to society?

13   Q   Yes.

14   A   If you are interested in that, we will give you

15   the number, following the recipe in the FES without doing

16   an additional analysis.

17   Q   But is it true that for Philadelphia we might have

18   larger consequences in terms of you have many people that

19   would be exposed, and therefore you would have larger

20   numbers of latent fatalities?

21   A   As I said, it cannot be any larger. The CCDF for

22   Philadelphia won't be any larger. In other words, having

23   a bigger span in the figures we have shown in the FES, they

24   will be all lower.

25   Q   You are saying it can't be larger than the total;

mgc 21-4

1   is that correct?

2   A   The entire run of the CCDF block in the figures.

3   Q   But we don't know what percentage --

4   JUDGE BRENNER: Ms. Bush, excuse me. I don't

5   know where your question is, but as a general comment, it's

6   getting a little repetitive.

7   MS. BUSH: One final question.

8   BY MS. BUSH:

9   Q   We don't know what percentage Philadelphia

10   contributes to that total risk; is that correct?

11   A   (Witness Acharya) That is derivable from the FES

12   information. If you ask a question to show how, I will

13   answer that question.

14   JUDGE BRENNER: Why don't you answer it now?

15   WITNESS ACHARYA: Take, for example, the

16   contribution of the share of Philadelphia to the risk of

17   latent cancer fatalities. That was discussed yesterday.

18   We have one figure, maybe 5.4L, that was talked about

19   yesterday. Let me open that figure, okay?

20   Now the figure in -- the Figure 5.4L shows the

21   risk to an individual of latent cancer fatality from the

22   cancer of thyroid organ and cancers to all of the organs,

23   and on Page 102, the first full paragraph says, about the

24   third sentence from the beginning of the paragraph, "To

25   obtain risk curves for specific direction, all values on

the curve along the vertical axis must be multiplied by 16P where P is the average probability of the wind blowing towards the direction of interest."

Now the reason for multiplying by 16 there is as stated in the earlier sentence, that the risk curves, as a function of distance, assumed equal probability -- namely, 1 over 16 -- to various directions, whereas in the actual case, the 16 directions have different probabilities. So we multiply by 16 to take that factor of 16 out that was in the denominator, and introduce the P to reflect the probability of the wind in a particular direction.

Now turn to the Figure 5.4L. The City of Philadelphia is a span between 20 and 30 miles from the plant. And if you will look at the runs of the two risk curves, the risk to an individual at the 20-mile location is about 2×10^{-9}. If you go to 30 miles, if you look at the bottom curve, the value is 6×10^{-10}.

Now looking at the central distance of the City of Philadelphia -- namely 25 miles -- the risk for non-thyroid cancer is approximately 1×10^{-9}, and the risk of thyroid cancer is also approximately the same value, so you can add the two of them. The total risk for all forms of cancer is 2×10^{-9} to an individual.

Now that 2×10^{-9}, multiply that by 16P total and choose P of .16 for the east-southeast

direction and .11 for the southeast direction, then I have

also the population values for the City of Philadelphia

between 20 and 30 miles in the south -- excuse me -- in

the east-southeast, that is .75 million.

Now do this multiplication, 2×10^{-9} times 16 times

.16 times .75 times 10^{+6}, the answer comes

out to be 3.8×10^{-3}. That is for the risk of all cancer

fatalities in Philadelphia in the east-southeast direction.

When I do the similar calculation for the southeast

direction, the only difference is at .11 as a probability

and about one million people in that direction. The risk

comes out to be 5.2×10^{-3}.

If I add this to $3.8(10^{-3})$, I get 9×10^{-3} as

the total risk of all forms of cancer to the City of

Philadelphia. Now I take this number and compare it with

the two tables I had in Table L.1AB.

22rgl

1   In Table L.1A, if you look at the last column

2   there, the sum of the two cancer fatality risks in both

3   thyroid and nonthyroid, 4×10^{-2}, plus 1×10^{-2}, which equals

4   5×10^{-2} we had before. I just showed that risk of latent

5   cancer fatality to Philadelphia alone is 9×10^{-3}.

6   If you take the ratio of these two numbers, that

7   is 9×10^{-3}, divide it by 5×10^{-2}, you get 18 percent --

8   that is .18. That is Philadelphia's share of this

9   latent cancer fatality within a 50-mile region because

10   Table 1, L.1A is for the 50-mile region.

11   On the other hand, if I compare the Philadelphia

12   share with respect to the entire site region, I go to the

13   Table L.1B. Then the two numbers would add up to 8×10^{-2}.

14   Now I have the previous estimate of 9×10^{-3} for the City of

15   Philadelphia. I divide that by 8×10^{-2} for the entire

16   region. The answer is twelve percent.

17   So the City's contribution or the City's share of

18   the risk in relation to the risk of the entire region, is

19   twelve percent. One can do a similar calculation for early

20   injury and early fatality too.

21   JUDGE BRENNER: The approach you took in the

22   analysis that you just made for us on the record is similar

23   to the approach at page 23 and 24 of your testimony to the

24   extent applicable to deriving conditional fatalities.

25   In other words, it depends on what you are looking

1   for but you can divide up the analyses by much the same

2   approach, looking at the sectors and the value for P, and

3   deriving it against the distance from the appropriate CCDF

4   for the consequence you are looking for?

5   WITNESS HULMAN: Exactly.

6   JUDGE BRENNER: Ms. Bush?

7   BY MS. BUSH:

8   Q   I appreciate that information. That gives us some

9   sense of Philadelphia's risk, contribution of risk.

10   Is it correct that percentage contribution is a

11   mean value?

12   A   (Witness Acharya) That is correct.

13   Q   So it does not give for us the full range of the

14   contributions that Philadelphia might contribute?

15   A   (Witness Hulman) Range of what?

16   Q   Over all the probability distribution curve.

17   A   Range of what, though? Range of risk?

18   Q   Contribution to latent fatalities.

19   A   It gives you a mean value of risk.

20   Q   It doesn't give us a range of the contribution

21   Philadelphia would make to health consequences, such as

22   latent fatalities, early fatalities?

23   A   Yes, it does.

24   Q   It gives you the range?

25   A   (Witness Acharya) If by "range" you mean that

1 it doesn't give you the CCDF, we have said that before, it

2 does not. But as I said earlier, that if one drew a CCDF for

3 the City of Philadelphia, that will run lower than the

4 corresponding CCDF that is shown in the FES for that entire

5 region.

6 Q   I understand that. But we don't know that the

7 curve would be the lower curve for the City of Philadelphia

8 would be at the same distance from the overall curve at all

9 points down the curve, is that correct?

10 A   (Witness Hulman) That is correct. We don't know

11 that.

12 Q   With regard to your Answer 30, what evacuation

13 assumption did you use there?

14 A   I believe we described this previously in our

15 testimony. Let's see if we can find the exact reference.

16 A   (Witness Acharya) We used "evac reloc" emergency

17 response for there.

18 Q   Thank you.

19 Could you please tell us how you calculated the

20 conditional mean values for the population exposures in

21 Answer 31?

22 A   Okay, it is done like this. That is, the

23 conditional mean value of the cloud area, the area of the

24 cloud within 20 and 25 miles, that is over Philadelphia is

25 also calculated in another CRAC run and it is also the

1   same value -- I mean the cloud area for the distance 25 and

2   30 miles, that is also calculated.

3   I remember and that is shown in my worksheet that

4   the cloud area is 42 square miles, between 20 and 25 miles

5   over the city and it is 50 square miles over 25 and 30 miles

6   of the city. Whereas the area elements of the city in those

7   two distances in any sector is within 20 or 25 miles, it is

8   44 square mile and within 25 and 30, it is 54 square mile.

9   In other words, the cloud area does not cover

10   100 percent of the city area elements, but is quite close.

11   Then we have also the population estimates for

12   each area element from which we calculate the population

13   density for those two area elements, namely between 20 and

14   25 miles and 25 to 30 miles bounded by 22½ degrees to a

15   sector. So multiply now by 27 rems, that is the conditional

16   mean value, by 42 square miles. Multiply that by the

17   population density for that element -- you get the population

18   exposure for that element of the city area.

19   Next, do the same thing for the outer area element,

20   that is 16 rem (the dose) times 50 square mile, which is

21   the cloud area, times the population density for that area

22   element.

23   So you get the population exposure for the 25 - 30

24   mile area element of the city and we do this two times. One

25   is for the southeast sector. Another time for the east of

1   southeast sector and then when you add this, we get 18

2   million personrem for one sector and 13 million person rem

3   for another sector.

4   Q   How did you translate those numbers into the

5   numbers that you gave in 32, answer to 32?

6   A   Okay. I applied the central estimate method of

7   WASH-1400 for the calculation of cancer fatalities. The central

8   estimate is not used for the cancer of the breast and cancer

9   of the thyroid. For the balance of the organs, the central

10   estimate adjustment factor is used and when I do the

11   adjustments, I come up with a risk coefficient which is

12   58.6 cancer fatalities for all forms of cancer per one

13   million person rem, which is roughly, you may say, 60 cases

14   per million person rem. Now, 18 million person rem and you

15   have 60 cases per million person rem, so it is roughly 18 times

16   60. That is about 1100.

17   For the other one, it is 60 times 13, so that is

18   roughly about 800.

End 22.

mgc 23-1

1   Q   In the testimony that you gave earlier, you

2   talked about an uncertain factor that would be applied to

3   consequences.

4   Would that be a number that would be applied --

5   A   Not necessarily --

6   MR. WETTERHAHN: Objection.

7   JUDGE BRENNER: Wait a minute. The question has

8   not been completed.

9   BY MS. BUSH:

10   Q   Would that be a number that would apply to the

11   kinds of issues that go along with central estimates where

12   you use 58.6 and another range of values that might be used

13   for that conversion factor?

14   MR. WETTERHAHN: Objection. That misstates the

15   testimony. The witness testified -- should I repeat my

16   undestanding of it?

17   JUDGE BRENNER: Not too much, because I don't

18   want to put words in the witnesses' mouths, but I am not

19   sure where you're going. I will tell you what I would rule

20   right now, and then if you feel the need to fill it out

21   because I'm misunderstanding your objection, I will let

22   you do it.

23   Ms. Bush is asking the witness whether it would

24   apply. She's not stating that the testimony was that it

25   would apply to these types of factors. And to the extent

mgc 23-2

there may have been a misstatement in the question, I think the witness can straighten it out.

MR. WETTERHAHN: With that understanding, with the Board's statement of the question, I will withdraw any objection I had.

JUDGE BRENNER: I was going to say, particularly since we have had this dialogue, the witness can straighten it out without our continuing the dialogue, so that you give your view as to how it should be straightened out.

MR. WETTERHAHN: I was restrained in giving my view.

JUDGE BRENNER: I recognize the difficult line between making the point of an objection and saying too much, so when I make that comment, it's not a criticism. It's just an effort to get the result that I think should obtain on the particular objection.

Do you recall the question?

WITNESS HULMAN: We're not sure, based on the statement that was made, what the question is. Could we have the question restated?

MS. BUSH: I am just trying to get a sense --

JUDGE BRENNER: Restate the question.

BY MS. BUSH:

Q How would your uncertainty factor that you talked about earlier in terms of the consequence value apply to

1   the 58.6 value or any other value that it would be appropriate

2   to apply it to?

3   A   (Witness Acharya) I do not recall any time making

4   a statement about the quantities and the uncertainty on

5   the risk coefficients ever, the risk coefficient for

6   converting population exposure to the cancer fatality.

7   In fact, the risk coefficient that we have used here, which

8   is based on the central estimate model of WASH-1400, it is

9   fairly close to the BEIR-III linear quadratic model, within

10   a few percent.

11   A   (Witness Hulman) You may have misunderstood

12   Dr. Acharya's use of the words "risk coefficient" in the

13   previous testimony with "risk uncertainty." They are

14   different terms.

15   Q   What would that risk uncertainty as to

16   consequences apply to?

17   A   You cannot apply a risk uncertainty estimate to

18   consequences only. It's to the product of the two. And

19   we have no estimate of the uncertainty of either, just

20   their product.

21   JUDGE BRENNER: I think if I can interject, what

22   she is getting at might be related, but related in the

23   sense that it's an uncertainty range, although a different

24   one. I don't have it in front of me, I can't find it, but

25   I think the central estimate of 168 latent cancer fatalities

mgc 23-4

1   per million person-rem -- that's the central estimate you

2   started with, correct?

3   WITNESS ACHARYA: That is the central estimate

4   based on the lifetime exposure. The central estimate that

5   I used, that is the same that was used in the WASH-1400,

6   that was based on thirty years plateau, according to which

7   it is 135, and the central estimate introduces something

8   less than -- something like a factor of two reduction.

9   So that 168 you mentioned earlier, that is based on lifetime

10   plateau, and if one would introduce a central estimate

11   reduction factor of approximately two, that will be about

12   80 cases per person-rem, and I have used 60 fatalities per

13   million person-rem. So that's about 30 percent, the

14   difference between 80 and 60.

15   JUDGE BRENNER: Let me stay with that for a

16   minute. Then I will return to what I think Ms. Bush is

17   getting at.

18   Using the 135 in your previous answer, you said

19   you applied appropriate reduction factors. Going from

20   135 to approximately 60 is a reduction factor of something

21   greater than two.

22   Now why is it appropriate to use that   or for

23   the case being examined in Answer 31 and 32?

24   WITNESS ACHARYA: The dose -- we have the mean

25   dose as 27. WASH-1400's central estimate, the way it is

exhibited in the consequence code as reflected in WASH-1400

actual calculations where the exposure is less than 30 rems,

divide the dose by five. In other words, reduce the risk

associated with that dose by five.

JUDGE BRENNER: Right. But you did not divide

by five. So what did you do?

WITNESS ACHARYA: Okay. Let me give a little

more detail.

According to WASH-1400, without an adjustment of

the central estimate, 135 cases of cancer fatalities of all

forms. Now when this is applied to a central estimate

adjustment, the following is done: Out of 135, subtract

about 13 cases of thyroid cancer fatality to which we don't

apply the central estimate. The balance is 122.

From 122, subtract 26 for the breast cancer to

which we do not apply central estimate adjustments. The

balance is 96.

So 96, we divide -- well, it is 96 cases per

one million person-rem. Each person is getting now less

than 30, because it is 27. Now here we bring in the

central estimate adjustment correction factor.

So that 96 divided by 5, the number of cases, if

the dose is below 30 rems per million person-rem -- so 96

divded by 5 -- I'm going through the steps -- 96 divided

by 5, plus 26, plus about 13 -- the whole thing, the

mgc 23-6 1

S2BU

result of the sum multiplied -- divided by 10^6 power --

that is in so many cases per million person-rem -- that

answer is 58.6 cases per million person-rem.

JUDGE BRENNER: I have a couple of other things

before I get back to the initial point.

You have used the term "central estimate." I guess

WASH-1400 uses it. SARA uses it, and the Applicant's

witnesses used it when I asked them similar questions.

What does "central estimate" mean as compared to

terms such as average, mean, median?

WITNESS ACHARYA: I do not think that is a precise

correlation of the central estimate to average, medium or

low. See, WASH-1400 uses terminology -- one thing is called

a central estimate; the other is called a lower bound

estimate, another is called the upper bound estimate. And

both the upper bound and lower bound were not followed

through. They were rejected in the final analysis of

WASH-1400, and all the results portrayed, they were in

terms of central estimate.

Was your question, what does it mean? Or am I

going in the right direction?

JUDGE BRENNER: Well, you are helping me, but I

do want you to also get to what it means.

WITNESS ACHARYA: All right. Now as you see,

being the central estimate, I have your 60, and in the

mgc 23-7 1

CRAC-2 version they have got 168. It would take roughly

2 a factor of slightly more than a factor of two lower, that

3 is roughly about, I should say, 80, whereas the BEIR-III

4 linear quadratic model would give something like 70, 76 or

5 so.

6 So these are within about maybe 20 or 25 percent

7 of one another.

8 Now what that central estimate really means,

9 that the WASH-1400 health effects experts determined that

10 dose -- the low dose delivered at the low rate is not very

11 effective in producing cancer fatality, so unless the dose

12 is very much high level, like say above 300 rems, certain

13 corrections are needed, because the uncorrected risk

14 coefficients were based on the linear extrapolation of the

15 Japanese data to extremely low levels of radiation. That's

16 all that it means.

End 23 17

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1   JUDGE BRENNER: Give us one moment, please.

2   (Board conferring.)

3   JUDGE BRENNER: Let me tell you what the

4   difficulty I have with your explanation. As I understood it,

5   after you got the central estimate, you would still apply

6   certain reduction factors as appropriate, as described in --

7   I think it was page 10-15 of SARA, as mentioned by the

8   Applicant's witness today and as also pointed out by you in

9   the way that you derived your conditional mean values for

10   latent cancer fatalities.

11   However, when you were explaining to me what the

12   central estimate was, thought you were telling me that that

13   was derived by applying these adjustment factors to using

14   the biologists' collective judgment to what the linear line

15   fitting the data would get you.

16   So are there two adjustment factors?

17   WITNESS ACHARYA: No. See, the only adjustment

18   factor which is coming from the central estimate methodology

19   as I pointed out, it was 96 numbered fatalities of cancers

20   to organs other than breast and thyroid, to which we applied

21   the central estimate correction factor because the dose is

22   less than 30.

23   One can do either way. One can reduce the

24   population rate by that factor for calculation of the

25   breast cancer or one can have already a central estimate

1   adjustment risk coefficient in the manner I derived and then

2   multiply and multiply the calculated personrems by the

3   adjustment factor. It is simply one of the two alternative

4   methods of where to place the adjustment factor in the

5   denominator of what, the denominator of population explosion

6   or denominator of risk coefficients.

7   WITNESS HULMAN: Appendix 6 to WASH-1400 is the

8   reference. If you would like a specific page number, we can

9   provide that. We don't happen to have a copy of Appendix 6

10 in front of us, but it is in the room.

11 JUDGE BRENNER: Their reference would explain the

12 definition of central estimate?

13 WITNESS ACHARYA: That is correct. It is

14 Appendix 6, Section 9, I guess and other other appendixes

15 referenced there.

16 JUDGE BRENNER: While Mr. Hulman is looking that

17 up, Ms. Bush was asking you about the uncertainty in the

18 result you present of latent cancer fatalities for 18 million

19 personrem in one sector, and we will stay with that as an

20 example, the southeast sector.

21 You explained why the other uncertainty factor did

22 not apply here. In conjunction with the central estimate

23 in WASH-1400 of 168, and I understand why you used 135 --

24 WITNESS ACHARYA: WASH-1400 is 135. The 168 is

25 a post-WASH-1400 in some cases.

1   JUDGE BRENNER: Thank you.

2   Let me restate that, then, and I believe it was

3   page 10-15 of SARA, which is in evidence or at least one of

4   those pages of the Applicant's SARA document, which uses the

5   central estimate of 168, it is reported that the range of

6   estimates is 50 to 500, if I recall correctly. Is that

7   correct?

8   WITNESS ACHARYA: They may have so stated in

9   SARA, but the tables in the BEIR-III I did not get an

10   indication of the uncertainty to that effect, however we have

11   made a statement in the FES, in the content.

12   May I draw your attention to a particular page I

13   am looking for? Page 5-67 of the FES, or maybe 5-66 of the

14   FES, last paragraph that begins on that page.

15   It says, "Most authorities agree --"

16   JUDGE BRENNER: All right. You have gotten to it

17   more directly than I was going, I think. Let me ask to make

18   sure.

19   If Ms. Bush had been asking you as to a range of

20   uncertainties surrounding your estimate of the number of

21   latent cancer fatalities per million personrem, you would

22   point her to that discussion that you have just -- to which

23   you just referred in the FES, correct?

24   WITNESS ACHARYA: Uh-huh.

25   WITNESS: Mr. Chairman, I offered a suggested

1   reference to the central estimate for latent cancer fatalities.

2   It is specifically Appendix 6, Chapter 9, Section 9.3.3 on

3   page 9-25 of WASH-1400, NUREG 75/014.

4   MR. WETTERHAHN: And hopefully to fill in some

5   information on page 10-25 again of Applicant's Exhibit 152,

6   there at the bottom paragraph is the range, 50 to 500

7   cases. It should read "per million manrem," which is the

8   one you were referring to.

9   JUDGE BRENNER: Yes, thank you. I was going to

10   interject and you did that my page 10-15 was an incorrect

11   reference. It should be the page Mr. Wetterhahn just

12   referenced.

13   In that WASH-1400 reference, I want to end this

14   rather than belaboring it, is there a concise sentence or

15   two that describes the central estimate that you could

16   read into the record?

17   WITNESS HULMAN: No.

18   JUDGE BRENNER: Okay. I will leave it at that.

19   I will leave it at that because more importantly I now have

20   Dr. Acharya's good explanation of what you did in Answers

21   31 and 32 as well as an answer to where I think Ms. Bush

22   was going earlier.

23   I am sorry for that long interruption. I will

24   turn it back to you.

25

mgc 25-1

WITNESS ACHARYA: If I may add one thing, there is on thing in the FES on the top of Page 5-67. That is the -- there is in the second line on the top. "Although zero is not excluded by the data."

JUDGE BRENNER: Okay. Thank you.

Ms. Bush?

BY MS. BUSH:

Q   Is it your testimony, then, that there is currently a controversy as to -- within the field of biologists and much activity in this regard as to what the appropriate conversion coefficient should be?

A   (Witness Acharya) There are different shades of opinion that are reflected in that range. But when the BEIR Committee summarized its findings -- they are documented in various tables -- and for the linear quadratic model, the number quoted is 76 cases per million person-rem for all forms of cancer fatalities.

A   (Witness Hulman) In addition to Dr. Acharya's answer, there is some controversy among radiobiologists and health physicists about that subject. But there is a consensus, we believe, in the profession.

Q   There was a disagreement by the Chairman of the BEIR-III Committee as to the appropriateness of the coefficient that resulted from the committee; is that correct?

MR. WETTERHAHN: Objection. I believe we have now

gotten clearly into a contention which was rejected by the

Board with regard to whether the central estimate or some

other estimate should apply, and I believe the Board's

ruling was clear that it was not going to delve into the

controversy of which estimate of the BEIR Committee was

correct or not correct.

So I think, although we may have touched on it

before, I will not object to this line of questions.

MS. BUSH: I don't think it's correct that we

may have touched on it before. There has been linking

questioning. It's true, I am talking about that, but it is

because it has been brought up on the record and statements

have been made. It is my view that I am entitled to

cross-examine on what is brought into controversy by the

parties, even if it touches something Your Honor has stated

is not in controversy. Statements are made.

JUDGE BRENNER: Well, it's not in controversy.

We have ruled that there was no basis in terms of the

materiality of what we had to decide on severe accident

contentions, to admit a contention examining the basis for

the BEIR report and differences of opinion within it.

What we have touched on here is, given the best

estimates of the consensus presented, whether it be in BEIR

or other documents referred to, you are certainly entitled

to explore to some extent the range on those estimates of

1   uncertainty, and we have done that, and that is appropriately

2   in the FES also. It is reference, as well as in the reference

3   page of SARA.

4   Beyond that, we allowed some questions of

5   Dr. Godman, as I recall, on that subject, who had credentials

6   in the area. But we are not going to delve any further into

7   controversies as to whether totally different numbers should

8   be used, for the reasons we expressed at the time we

9   rejected that contention.

10   I didn't want to cut it off so coldly that you

11   could not explore the uncertainties of those best consensus

12   estimates presented, and therefore we have had the questions

13   and answers we have had. But now you are going beyond that.

14   Whether I should have cut it off earlier or not

15   is a moot point here, but we will cut it off at this point.

16   MS. BUSH: I appreciate being able to develop

17   the uncertainties. My continuing concern is their

18   statement that it is not controversial on the record.

19   JUDGE BRENNER: I think that misstates --

20   MS. BUSH: I will abide by your ruling.

21   JUDGE BRENNER: I think that misstates their

22   testimony. We did allow you to elicit an answer as to

23   whether or not there was a controversy. You got it of

24   this witness. As I recall, somebody obtained some

25   answers from some other witnesses -- it may have been

mgc 25-4

Mr. Elliott -- but it's on the record, and you were here.

MS. BUSH: This is my last area of cross-examination.

BY MS. BUSH:

Q   Mr. Acharya, do you recall providing to the City a frequency distribution tabulation for whole-body doses for the case that you ran for the City of Philadelphia, II-T/WW?

A   (Witness Acharya) Yes.

Q   And does that document portray the twenty to thirty mile range around the plant in intervals denominated 19 and 20?

A   That's right.

Q   And does that table, similar to Table 4 in your testimony, have probabilities in the columns on the right and magnitudes in the column on the left?

A   That's correct.

Q   And is it correct that these intervals, 19 and 20, the probability values there, as well as the magnitudes, would apply in any direction around the plant, but in the twenty to thirty mile distance?

A   That's correct.

JUDGE BRENNER: Ms. Bush, this isn't something the Board has, is it?

MS. BUSH: No. I am at this moment going to ask

mgc 25=5

that it be marked for identification as City Exhibit 1.

(Counsel distributes documents.)

I have provided copies to the Board, and I have provided copies to the parties.

JUDGE BRENNER: We will mark this one-page table as City Exhibit 1 for identification. It's entitled "Frequency Distributions," Roman II-T/WW, WB, I guess, DS, "Versus Distance."

(The document referred to was marked City Exhibit No. 1 for identification.)

JUDGE BRENNER: Let's make sure, Dr. Acharya, that this is the table you referred to earlier.

WITNESS ACHARYA: That's correct.

JUDGE BRENNER: Have you shown him a copy of what you gave us, because he has his own?

MS. BUSH: Yes, I did. I gave it to him during the break.

JUDGE BRENNER: Thank you. You may proceed.

BY MS. BUSH:

Q   The probability figures shown --

MR. WETTERHAHN: I would comment, it would have been nice to know that this was other than a handout, that it was going to be used in cross-examination more than one minute in advance.

mgc 25-6

1   JUDGE BRENNER: Yes, that's true.

2   MS. BUSH: I apologize.

3   JUDGE BRENNER: You know, We've long had a

4 procedure here, absent the cross-examiner not wanting to

5 reveal something, that all references and all items that

6 would be used in cross-examination should be turned over.

7 Here you can't claim wanting to surprise somebody, because

8 it's a table that they provided to you. So let's not do

9 this again.

10   MS. BUSH: I think the company has had it for

11 several days, but they didn't know I was going to put it in

12 as an exhibit.

13   JUDGE BRENNER: Let's see where it goes, and if

14 there's a problem, I will hear from you on it,

15 Mr. Wetterhahn.

16   BY MS. BUSH:

17   Q   Is it correct that that the probability figures

18 under Interval 19 and 20 are conditional probabilities?

19   A   (Witness Acharya) That's correct.

20   Q   And these are values associated with the analysis

21 that you discuss on Page 23 of your testimony; is that

22 correct?

23   A   That's correct. Let me add, the area under the

24 CCDF identified for the Interval 19 is 27 rems, and the

25 area under the CCDF provided for the Interval 20 is 16 rems.

mgc 25-7

1   These are the numbers that are used.

2   Q   In the testimony?

3   A   That's right.

4   MS. BUSH: Your Honor, could we go off the record

5   for a moment, please?

6   JUDGE BRENNER: I would rather stay on, if it's

7   anything to do with this litigation.

8   MS. BUSH: I just want to ask how -- I want to

9   identify another exhibit. I have talked to the other

10   parties about it. I have no further cross-examination

11   questions.

12   There is another exhibit that I would like to

13   identify which is the map, the PEMA August '83 map, that

14   does have Philadelphia, as well as the fifty-mile circle

15   around the plant, and for illustrative purposes, I think

16   it is important to have that in the record.

17   I think the parties will stipulate to the

18   authenticity of those. I have identified the other one.

19   JUDGE BRENNER: Why don't you give us copies

20   while we hear from the other parties on it?

21   (Counsel proceeds to distribute the document.)

22   JUDGE BRENNER: Applicant?

23   MR. WETTERHAHN: I have a relevance problem.

24   It's nice to have a map of Philadelphia, but for what

25   purpose will it be employed? I don't want to be again

mgc 25-8

1   surprised in proposed findings by somebody taking

2   measurements for something. But if it's just for the

3   general interest of the Board --

4   JUDGE BRENNER: What do you need it for,

5   Ms. Bush? We know which sectors are applicable. It's been

6   all through the written testimony and the cross-examination.

7   MS. BUSH: I don't think there is any prejudice

8   to anyone, as you indicated. We do know what sectors are

9   here. The incremental value that it adds is that it is a

10   visual demonstration of Philadelphia in the two sectors.

11   It was helpful for me to be able to see Philadelphia,

12   citing its size within the sectors, and I think that it's

13   important to have it on the record for that reason.

14   JUDGE BRENNER: With that explanation, Applicant

15   has no objection to its identification as just what was

16   identified. But if it is not put in for any evidentiary

17   purpose or weight, we can't have any objection to its

18   mere identification.

19   MS. BUSH: I intend to ask that both these

20   exhibits to be admitted, so the issue is whether they can

21   be admitted.

22   JUDGE BRENNER: In evidence?

23   MS. BUSH: Yes.

24   MR. WETTERHAHN: Objection. Irrelevant.

25   JUDGE BRENNER: I don't think we need a map. I

mgc 25-9

will hear from the Staff if they have a different view --
to show that the southeast and east-southeast sectors
would be the sectors applicable to Philadelphia. It's all
through the testimony.

MS. BUSH: I don't think that's in controversy.

JUDGE BRENNER: So why do you need the map?
I don't understand.

MS. BUSH: Because there is a visual value to
having a map that you can look at, that you can see
Philadelphia's relationship to the plant, you can see the
shape of Philadelphia, you can see where it is situated
in relation to the plant. I mean, we have different medias
of communication because different medias have value, and
I think that the map does have a value, incremental value.

JUDGE BRENNER: All right. We are not going to
use the map for any precise measurements or arguments as
to the scale or that kind of business?

MS. BUSH: No.

JUDGE BRENNER: Staff?

MS. HODGDON: We don't see the relevance of this
map and objection to any use to which it might be put,
beyond -- well, almost any use to which it might be put.

We have no objection whatsoever to our CRAC
runs here, City Exhibit 1.

MR. WETTERHAHN: Are we doing one at a time?

mgc 25-10[1]

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End 25   4

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I just addressed the map.

     JUDGE BRENNER: Wait a minute.

     (The Board confers.)

xxx

1   JUDGE BRENNER: First of all, we have marked the

2   map as City Exhibit 2 for identification.

3   (The document referred to

4   was marked City Exhibit

5   No. 2 for identification.)

6   JUDGE BRENNER: Taking #2 first, since we have

7   discussed it, we just don't think it is an important matter

8   either way. We don't think it serves any purpose beyond

9   what is in the testimony, but to the extent that the City

10   thinks it is helpful for somebody to have a visual look at

11   it, we will admit it into evidence.

12   It is going to be limited to the very limited

13   purpose that Ms. Bush expressed and it is not going to be

14   used for any substantive facts that are not already in

15   evidence.

16   In other words, somebody cannot take the map and

17   say, if you look at this northwest corner of the way

18   Philadelphia is shaped, this is what we would calculate

19   from that, because that is the type of thing that a witness

20   should have been asked about, and Ms. Bush, you are nodding

21   yes.

22   MS. BUSH: I agree. I am not going to use it for

23   any purpose other than what was stated.

24   JUDGE BRENNER: Other than what you stated, to be

25   more accurate.

26rg2

xxx

1   MS. BUSH: How you summarized what I stated.

2   JUDGE BRENNER: I don't think it adds anything

3   but I will let it in.

4   (The document previously

5   marked for identification

6   as City Exhibit No. 2

7   was received in evidence.)

8   JUDGE BRENNER: How about City Exhibit 1, which

9   as I understand, a motion has been made by Philadelphia to

10 admit that into evidence?

11   MR. WETTERHAHN: I have some questions on it,

12 which I will take in turn, I assume.

13   JUDGE BRENNER: I'm sorry. I didn't hear you.

14   MR. WETTERHAHN: I have some questions on

15 foundation as to what this represents, since we were somewhat

16 surprized with it and did not have an opportunity to consult

17 with the Staff.

18   JUDGE BRENNER: Do you want to take a break? I

19 am not sure I understand fully what it represents either

20 given the limited question asked about it, although in

21 general I think we have got the picture.

22   MR. WETTERHAHN: If the City -- the City is now

23 finished --

24   MS. BUSH: I am finished with my cross-examination.

25   MR. WETTERHAHN: I think a break would be

1   appropriate.

2   JUDGE BRENNER: How much time do you need?   How

3   much time are we going to have?

4   MR. WETTERHAHN: Not more than 10 minutes for the

5   Applicant.

6   JUDGE BRENNER: But for City Exhibit #1, you have

7   no questions?

8   MR. WETTERHAHN: That is correct.

9   JUDGE BRENNER: Staff, do you --

10   MS. HODGDON: I doubt that we will have more than

11   a question or two, possibly less.

12   JUDGE BRENNER: All right, we will take a five

13   minute break at this point, until 5 o'clock on that clock.

14   And then if it is going to run much longer, we are going to

15   recess.   We will see how it goes.

16   (Recess.)

17   JUDGE BRENNER: We are back on the record.

18   Mr. Wetterhahn, the question is whether or not

19   to admit City #1, which is the Table provided by the Staff,

20   into evidence.

21   MR. WETTERHAHN: Does it have a number?

22   JUDGE BRENNER: City Exhibit 1.

23   MR. WETTERHAHN: City 1?   Subject to my right of

24   cross-examination, we have no objection.

25   JUDGE BRENNER: All right.   We will let Ms. --

1   Staff, do you have any problem with that?

2   MS. HODGDON: No.

3   JUDGE BRENNER: We will admit City Exhbit 1

4   into evidence.

5   (The document previously

6   marked for identification

7   as City Exhibit No. 1

8   was received in evidence.)

9   JUDGE BRENNER: You may cross-examine,

10   Mr. Wetterhahn.

11   CROSS-EXAMINATION

12   BY MR. WETTERHAHN:

13   Q   Do you have City Exhibit 1 before you, the

14   document?

15   A   (Witness Acharya) Yes, we have it.

16   A   (Witness Hulman) We have a copy in front of us.

17   Q   The designation II-T/WW, is that one of the

18   release categories that is presented in the Final Environ-

19   mental Statement?

20   A   Yes. It is also the one referred to in our

21   testimony.

22   Q   How many other release categories are there that

23   you summed?

24   A   Approximately 20.

25   Q   So the contribution of this release category has

26rg5

1 already been considered in your entire analysis in the FES,

2 is that correct?

3   A   Yes.

4   Q   So therefore there is nothing in this table that

5 is inconsistent with any of your statements made in the FES

6 or in your testimony, is that correct?

7   A   That is correct.

8   JUDGE BRENNER: Mr. Wetterhahn, while we are on

9 the exhibit, when I read the title I was looking at it for

10 the first time and I did it badly. I now realize some of those

11 designations are abbreviations and we have -- what it is

12 is frequency distributions. it is the release category

13 presented, which is II-T/WW and then I take it the rest of

14 that line is an abbreviation of whole body dose versus

15 distance?

16   WITNESS HULMAN: That is correct.

17   JUDGE BRENNER: I am sorry I didn't get it right

18 before. Go ahead.

19   BY MR. WETTERHAHN:

20   Q   If you will turn your attention to Interval 19,

21 does that represent either a portion of a segment or the

22 annular ring from a distance 20 to 25 miles away from the

23 subject reactor?

24   Well, that part of the annular ring contained in

25 the sector?

1   A   (Witness Acharya) A reference to any annular ring

2   will be irrelevant. The dose versus distance is conditional

3   upon wind blowing, so in whichever direction the wind will

4   be blowing away from the reactor along the downwind direction

5   of the wind, this will be the dose versus distance relation.

6   Q   But it also can -- if you took out the probability,

7   the conditional probability of the wind blowing direction,

8   this would also represent the magnitude of the whole body

9   dose in the entire annulus, correct?

10   A   It could be applied to any direction in the

11   annulus, between 20 and 25 miles. That is at Interval

12   number 19.

13   Q   Okay. The Interval calculates these probabilities

14   in magnitudes for some distance between 20 and 25 miles and

15   then applies it to the entire distance, 20 or 25 miles, is

16   that correct?

17   A   Well, the way the CRAC or CRAC-2 models work, all

18   numbers estimated for an Interval are appropriate for midpoint

19   of the Interval, so though Interval Number 19 is spanning

20   from 20 to 25 miles, the numbers are calculated at 22½

21   miles.

22   Q   Okay. With regard to Interval 20, that is the

23   Interval of 25 to 30 miles, is that correct?

24   A   That is correct.

25   Q   And again, it would be actually calculating for

1   some midpoint 27½ miles away?

2   A   That is correct.

3   Q   Let's take Interval 19. For each magnitude as

4   far as dose and rem, there is an associated probability, is

5   that correct?

6   A   Conditional probability, yes.

7   Q   Conditional probability. So taking the first one,

8   the first column, the probability that there will be a dose

9   about one rem is 97.8 percent?

10   A   One rem or greater is 97.8 percent.

11   A   (Witness Hulman) Given the accident.

12   Q   And the wind blowing in that direction?

13   A   (Witness Acharya) That is correct.

14   Q   And then for the last entry, the probability

15   is .022 -- that is two percent?

16   A   That's right.

17   Q   That the magnitude of the dose would be 100 R or

18   larger?

19   A   That is correct. It cannot be very much larger

20   than 100. It is close to the peak.

21   Q   Okay.

22   Now the CRAC-2 code takes into account the

23   probability of occurrence of these various magnitudes in

24   estimating what the effect is in the population in that

25   interval, does it not?

1   A   (Witness Hulman)   The CRAC-2 code or the CRAC code?

2   Q   The CRAC code, excuse me.

3   A   (Witness Acharya)   Yes.

4   Q   And that it does by in effect summing probabilities

5   to get what the mean or the probability of -- I'll use the

6   term "mean dose" in that area, or does it sum it up

7   separately and the only thing you have presented the mean

8   dose in your testimony?

9   A   In the CRAC health effects calculations, each of

10   these is handled separately.

11   Q   Okay, so when you presented the mean of 27R, that

12   was for illustrative purposes and the CRAC code already has

13   taken into account the variation of the possible outcome

14   along with the associated possibility?

15   A   That is very correct.

16   Q   So this adds the fact -- the fact that it is

17   presented adds nothing to the ultimate results and your

18   ultimate conclusions, is that correct?

19   A   No, whatever conclusion can be derived from there

20   is already included in the FES.

21   Q   And one could present similar frequency distribu-

22   tions where every other of the sequences besides II-T/WW,

23   is that correct?

24   A   That is correct.

25   Q   Would that add significantly if you decided to

1   disclose this in your FES and attach such charts increase

2   significantly the size of the FES?

3   A   It would increase significantly to the size.

4   Just wait -- that is because this is only part of the complete

5   output.

6   There are 34 intervals -- here you see intervals --

7   only from 15 to 31. There are three emergency response

8   modes, so you would get three times as much output for each

9   release category so the number of pages would be quite --

10   you can calculate, say, the report pages to release category

11   for one emergency mode, so there will be 12 pages for all

12   three emergency response modes and there are some 20-some

13   accidents, so 20 times 12 pages like this.

14   Q   To run a complete CRAC output as far as your

15   base case or the case that Philadelphia wanted?

16   A   Right.

17   Q   What would be the cost to the taxpayer? Computer

18   time only?

19   MS. BUSH: Objection. I don't understand the

20   question or his characterization.

21   JUDGE BRENNER: Wait a minute. Did you finish

22   the question?

23   MR. WETTERHAHN: I finished the question.

24   JUDGE BRENNER: Let me hear the objection. Then,

25   if necessary, I will let you address it, okay?

1   MR. WETTERHAHN: Certainly. That is the correct

2   order.

3   MS. BUSH: I don't understand or agree with

4   Mr. Wetterhahn's -- well, I don't understand it and I don't

5   agree with his ability or his right to characterize what the

End 26.   6   City of Philadelphia has requested that the Staff do.

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JUDGE BRENNER: You know, I tell you, I've had a continuing problem in understanding what the City wanted, which was not helped by the cross-examination, because when you wanted to go into the analyses performed, you were delving into, more to state it generally, different breakdowns, than when Dr. Acharya said, "If I did it just for Philadelphia, I assumed you'd want all the same things." Then you started -- then the shoe was on the other foot, so to speak. You started to say, "Well, I don't know if I wanted all of that."

So I agree with you, it's not clear as to what the City wants, and I think you can clarify the question in that regard.

BY MR.WETTERHAHN:

Q   Take a look at Table 4 in your testimony.

JUDGE BRENNER: Remember, Mr. Wetterhahn, you are the one who decried the importance of this whole subject.

MR. WETTERHAHN: But I was overruled.

JUDGE BRENNER: That's right.

MR. WETTERHAHN: And I have the right now and I have the obligation to explore it a little bit. This hopefully will be my last question.

JUDGE BRENNER: I agree with your observations, but I want to put the whole thing in context.

MR. WETTERHAHN: Yes.

JUDGE BRENNER: Okay.

BY MR. WETTERHAHN:

Q   Table 4, to reproduce this table for only zeroing out the population other then the City of Philadelphia and to reproduce the CRAC run that resulted in this table with the similar options that you used in getting Table 4, can you give me an estimate of the cost of that?

A   (Witness Hulman) Let's see if I understand the question. You only want to know what it would cost to develop a table like Table 4 for just the City of Philadelphia?

Q   That's correct. Computer time.

A   Just the computer time? Probably a few thousand dollars.

Q   And professional time?

A   Probably three days worth of time. To put it into the context of the FES would require considerably longer.

Q   And do you see any value in doing such a run?

MS. BUSH: Objection. The question has already been answered.

MR. WETTERHAHN: I will withdraw the question. No further questions.

JUDGE BRENNER: The Board has no questions.

mgc 27-3 1   Does the Staff have any redirect?

2   MS. HODGDON: The Staff has no redirect.

3   JUDGE BRENNER: Ms. Bush, any follow-up? Give

4   me a time estimate, if the answer is yes.

5   MS. BUSH: I have no follow-up.

6   JUDGE BRENNER: All right, gentlemen, we have

7   come to the end of your testimony. We do appreciate your

8   presence here on the other contentions and on these

9   contentions.

10   Without commenting on the substantive merits of

11   anything you have told us, I have been impressed with your

12   ability to know where in the FES certain information has

13   been, given the size of the portion of the document relative

14   to this contention, such as figures and charts and so on.

15   We appreciate that, because the references to the existing

16   FES, along with the explanation, is very helpful, as opposed

17   to just getting the explanation on the transcript, and then

18   we have to do the work of trying to match it up.

19   So we appreciate that. Thank you for your time

20   here.

21   (Witnesses excused.)

NBU   22   JUDGE BRENNER: Ms. Hodgdon, you were going to

23   report on further contact with Mr. Romano?

24   MS. HODGDON: Yes. I spoke with Mrs. Romano

25   during the first break this afternoon and left a message

1 that the Board had indicated should be given to Mr. Romano

2 earlier -- that is, that if he wishes oral argument, he

3 should be here at nine c'clock tomorrow morning, and that

4 if he does not wish oral argument, he should inform Staff

5 counsel at their hotel this evening. And I was assured that

6 Mr. Romano would get that message.

7   Staff counsel would be happy to notify the

8 interested parties, should they hear fro⸱ Mr. Romano at an

9 appropriately early hour.

10   JUDGE BRENNER: As far as we are concerned, you

11 can tell us at nine o'clock on the record. Whatever

12 arrangements you and the other parties want to work out,

13 you can, and I am sure some of them might appreciate your

14 kind offer in that regard.

15   MR. WETTERHAHN: Ms. Hodgdon also told me, as

16 relevant to this, that Mr. Romano has stated that he did

17 not receive Applicant's reply findings. We checked with

18 the delivery service. They attempted delivery yesterday.

19 They attempted delivery again today, and they are again going

20 to attempt delivery today for a third time. In any event --

21   JUDGE BRENNER: I don't understand the problem.

22   MR. WETTERHAHN: There has been nobody at the

23 place he has designated on the service list to receive --

24   JUDGE BRENNER: Which is his home address,

25 I believe.

MR. WETTERHAHN: Home address.

JUDGE BRENNER: Why don't they just leave it there?

MR. WETTERHAHN: They can't do that.

MS. HODGDON: You should give it to the --

MR. WETTERHAHN: We will handcarry a copy up to him as soon as we can.

JUDGE BRENNER: Get somebody who is willing to leave it there, over and above the delivery service, or convince the delivery service to leave it; if they cannot get their signed receipt, you will hold them harmless, et cetera, et cetera.

MR. WETTERHAHN: I will attempt to do that. But it wasn't until this afternoon that Mr. Romano indicated to Ms. Hodgdon that he didn't have our copy, and I was mislead by a statement --

JUDGE BRENNER: I want to ask Mr. Vogler something relevant to this.

MR. WETTERHAHN. I was inadvertently misled by a statement that Staff counsel had made, that he was examining our findings as well as theirs.

JUDGE BRENNER: Yes, I had the same inference. But it may not have been particularly covered.

In any event, Mr. Vogler, when you had what you termed difficult conversation with Mr. Romano yesterday, did he indicate at that time that he had not received

mgc 27-6

Applicant's findings?

MR. VOGLER: No, sir, he did not.

JUDGE BRENNER: The impression I got from your report was that he needed time to review the findings of both Applicant and Staff. Was that what you had told us?

MR. VOGLER: That's correct. That's clearly what he told me.

MS. HODGDON: Excuse me. Yes, Judge Brenner, and when I was speaking about that matter earlier today, I said that I thought it was appropriate to give him an opportunity to indicate later whether he would want to argue, present argument, because he needed time, being a pro se intervenor, to review those filings. I didn't mean to say that he had indicated that he had them, although I did not know that he did not have them.

I was told by Mrs. Romano this afternoon that it was a problem because he didn't have the Applicant's findings, and it was at that time that I conveyed it to Applicant's cousel.

JUDGE BRENNER: Okay, you have given us the facts. And if it becomes a problem raised by anybody tomorrow, we will apply those facts.

But get it to him today somehow, please.

All right. I think that completes that subject. We will find out more at nine o'clock tomorrow morning.

mgc 27-7 1

Perhaps the Staff will find out earlier than that.

2   MS. HODGDON: Perhaps.

3   JUDGE BRENNER: Well, you should, and if you

4   don't, we'll hear about that also at nine tomorrow.

5   On the other subject, is there anything to report

6   on the emergency planning implementing procedures, or should

7   we take it up tomorrow morning?

8   MR. WETTERHAHN: We will take it up tomorrow

9   morning. There were discussions going on late today.

10   JUDGE BRENNER: Okay, we will take it up tomorrow

11   morning.

12   On the subject of the City's contentions, I want

13   to make one preliminary comment, and then I think it might

14   be useful if we perhaps go into it at a little greater

15   length tomorrow, but not much greater length.

16   We had hoped that these issues could be settled,

17   given what we perceived to be the problem of the issues

18   being -- one of the threads, at least, running through the

19   City's issues that we saw was one of disclosure of the

20   analyses as they might apply to Philadelphia, and we have

21   encouraged negotiations which the parties undertook. And

22   the impression that we had is that they worked diligently

23   and hard at them.

24   Unfortunately, the negotiations did not lead to

25   even a very meaningful partial settlement, and certainly they

mgc 27-8 1   did not lead to a full settlement.

2   I have presided over other cases where matters

3   were litigated with great vigor by the parties; however,

4   after the matter was litigated but before the proposed

5   findings were filed, the issue was settled either because

6   of new information disclosed in the course of the litigation

7   or because the parties were not on the same wavelength in

8   the negotiations and did not realize it, and only came to

9   realize that in the course of the litigation. It's possible

10   that some of that may be applicable here. We don't know.

11   We are just stating that it's possible, and it may be that

12   there is room to still settle these issues, given disclosure

13   on the record, without any party giving up for any purposes

14   beyond this particular hearing their litigative positions

15   as to what may or may not be necessary in an FES or NEPA

16   analysis.

17   We are going to direct the parties to negotiate --

18   that is, the City, the Staff and the Applicant -- at least

19   once. We're not going to specify how many times you should

20   try, because we know, given the parties we have before us,

21   particularly governmental parties such as the City, that if

22   there is some optimism on the first negotiation session,

23   which we will require, that on your own, you use your good

24   judgment as to whether or not to pursue it further.

25   We won't set a timeframe, but you should do it

mgc 27-9 1

soon so there is room to flesh out any details. The

findings are going to be required very shortly after that

week in June. So you have a little bit of time, but not

much time, because if you don't settle it, you will have to

be very quickly working on your findings.

We think that there is room for settlement. That

doesn't mean it will be settled. That doesn't mean we will

be upset if it's not settled. It's just that we think it's

worth a try by the parties. Although you have done a lot

of work on it, there is still a lot of work that you can

avoid.

More important than the work you might save

yourselves would be the fact that when parties have the room

to craft a settlement among themselves, they can sometimes --

usually, in fact, adjust the relief so that all the parties

are happy, whereas when you toss it up, so to speak, for a

Board decision, you will get a decision, but you might end

up not having the sensitivity to detail in such a decision

on the merits up or down that you might be able to get in

a settlement. And I think there is a lot in this record

that can be applied to a settlement, which settlement

agreement can be made part of the record and referred to in

any decision by us, if that is the parties desire, even

though it is settled, which would be a published decision

and so on. So there is a lot of room for ingenuity as to

mgc 27-10

form as well as substance.

Now it may be that you can settle some things and not others. It may be that you can settle nothing. But we think it's worth a try, and we are ordering you to make that attempt.

If the parties think it appropriate to include LEA in attempting to settle some of LEA's issues, we would welcome that attempt also. We won't order it, because as we understand it, the thread running through some of LEA's issues is not quite the same as the City's, but on some of the subparts of LEA's contentions, there is a relationship, and our view is that LEA also is a reasonable party, represented by able counsel on this issue, and you might want to give that a try also.

If you need to discuss this further, we can do it tomorrow morning. If not, the only thing I want to take up in the morning would be the page estimates for findings, because that might take a little bit of time. I would like to defer that until the morning, if that's okay with all counsel present.

Ms. Bush?

MS. BUSH: I have thought that it might be helpful for the City to respecify its issue, at least 13, given your indication of its not being clear, and it wasn't drafted that well.

1   JUDGE BRENNER: You are delving into a whole new

2 area, and we can talk about it some more tomorrow. But the

3 place to re-pecify it now would be as part of a settlement

4 or in findings, if you don't settle it.

5   But the litigation has run its course on the

6 issue as admitted.

7   MS. BUSH: I just thought it might be helpful to

8 have it more formally, that the Staff could really look at

9 it and see what they would be willing to do.

10   JUDGE BRENNER: Do it as part of the settlement

11 negotiations. It might be very helpful in that context.

12 Beyond that, it certainly might be helpful to your litigative

13 position, if you don't settle it, to state what the gravamen

14 of your issue is as you see it.

15   Now we may disagree that that was in the contention

16 as admitted, but you can do that in the findings. But

17 your suggestion, I think, would be very useful in the context

18 of settlement negotiation, and you've got the assistance

19 of Mr. Finlayson, and I think that might help in

20 negotiations, to the extent you can discuss it with him,

21 and you've had that assistance all along. And I think

22 you should continue to apply it.

23   The main message is, do not let the inertia of

24 a litigation take away the opportunity of having another

25 negotiating session, and we are interjecting ourselves to

mgc25-12 1 stop any such inertia that might have existed.

2   We will be in recess now. We will come back

3 at nine tomorrow. We can take care of the findings matter

4 on this first thing, so that Ms. Bush would not have to

5 stay very long, and then we will go to the argument on

6 the welding finds, if Mr. Romano appears and desires such

7 argument.

8   So we will be back in this room at nine o'clock

9 tomorrow morning.

10   (Whereupon, at 5:25 p.m., the hearing was

11 recessed to resume at 9:00 a.m., Thursday, May 31, 1984.)

End   12

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This is to certify that the attached proceedings before the

NRC COMMISSION

In the matter of: Philadelphia Electric Company

Date of Proceeding: Wednesday, 30 May 1984

Place of Proceeding: Philadelphia, Pennsylvania

were held as herein appears, and that this is the original

transcript for the file of the Commission.

_____Mimie Meltzer_____
Official Reporter - Typed

_____
Official Reporter - Signature