ORIGINAL

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of:

UCLA RESEARCH REACTOR

Docket No. 50-142 OL

(Proposed Renewal of Facility License)

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	
UCLA RESEARCH REACTOR	Docket No. 50-142 OL
(Proposed Renewal of Facility License)	

Customs Courtroom
Federal Building, 8th Floor
300 North Los Angeles Street
Los Angeles, California

Tuesday, August 2, 1983

Hearing in the above-entitled matter was convened at 9:35 a.m., pursuant to recess.

BEFORE:

JUDGE JOHN H. FRYE, III, Esq.,
Administrative Judge

JUDGE EMMETT A. LUEBKE,
Administrative Judge

JUDGE GLENN O. BRIGHT,
Administrative Judge

APPEARANCES:

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Appearing for the Licensee

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C O N T E N T S

P R O C E E D I N G S

JUDGE FRYE: Good morning, could we go back on the record, please.

Any preliminary matters before Mr. Hirsch continues?

I take it not. Mr. Hirsch.

CROSS EXAMINATION RESUMED

BY MR. HIRSCH:

Q Yesterday, Mr. Hawley, you indicated that you wanted some time to think about the question of the positive graphite coefficient. And I was wondering if you have a response now on that issue, which deals with your answer 9 on page 14 of your testimony. The matter that we were discussing was whether SPERT would have merely a negative coefficient from that prompt heating of the water, whereas there would be a positive coefficient as well as a negative one for the Argonaut due to the graphite being present.

A Let me answer that question, and then let me elaborate on the answer I gave here. As I understand your question, no there would be no positive coefficient at SPERT because there is no graphite.

Now, in reference to my answer 9 here, the last sentence, talking about the prompt component of energy which would provide heating, I think the essence here is that that component would act more or less simultaneously because of the way this energy is being delivered, the gamma rays and neutrons.

But the effect of that energy would be much different. First of all, the prompt energy is about now approximately five percent of the total energy in fission, and that amount of energy delivered to the water and to the graphite does not produce the same type of heating --

Q Excuse me.

A -- and also the heat capacity --

MR. HIRSCH: Judge Frye, just a moment. I don't feel that is responsive to my question. I am only dealing with the prompt heating now, and the relative nature of that prompt heating for SPERT and Argonaut. The non prompt stuff, I think, is out of my question.

BY MR. HIRSCH:

Q So, if I understand your answer correctly, at SPERT the prompt heating would produce only a negative effect, but at the Argonaut the prompt heating would produce a negative and a positive effect; is that correct?

A Well, any prompt -- any heat delivered to the water in SPERT would produce the density change. It would heat up the water to some degree, and that would be a negative effect, yes.

Q And at the Argonaut there would be a negative effect for the water and a positive effect for the graphite?

A I think, technically or theoretically, I think the answer would be yes. But that effect in the graphite would be,

1 I think, very small for this prompt heating.

2 Q I turn you to page 16.

3 A Of?

4 Q Of your testimony. And I have a series of questions

5 about your use of your exhibit, the Analysis of Self Shut-down

6 Behavior in the SPERT I Reactor by Forbes et al. To begin

7 with, I would like to ask for your understanding of the correc-

8 tion factor. At the bottom of page 16, continuing on to page

9 17, the quotation that you include indicates that the power

10 or energy ratio at a constant reciprocal period has been shown

11 to vary inversely as the square root of the void coefficient

12 divided by the reduced prompt neutron lifetime. And my

13 question for you is is your understanding of that that is the

14 square root of the void coeficcient? And after that square

15 root is taken, do you divide it by the reduced prompt neutron

16 lifetime? Or is it the void coefficient over the reduced prompt

17 neutron lifetime and the square root of that?

18 A The latter.

19 Q And what numbers did you use in coming out with your

20 correction of .582? What input numbers for the void coefficient

21 and for the reduced prompt neutron lifetime?

22 A I did use in the material in my testimony, I did use

23 the 1.4 time 10^{-4} second prompt neutron lifetime. That is the

24 value I used in the Battelle study. And then dividing that

25 by beta would give you the value of the reduced number that

you asked for.

I also used a void coefficient which was approximately -- I think the first number was about 6, and the next one was time 10^{-4}, then it was delta K/K per cubic centimeter.

Q And the source of that number?

A Was my knowedge of the number of fuel plates in the Argonaut core, and the volume that is created by the space between the fuel plates and the number which gives the void coefficient in terms of percent void, or reactivity per percent void.

Q A few questions on that. Which number did you use for the void coefficient per percent void?

A I believe I used the .164.

Q You believe, but aren't sure?

A I would have to go back and check that part of it.

Q Do you have those calculations with you?

A No. I redid, you know, I looked back at what I would have to do to get to that one value. Yesterday your question involved, I think, the prompt neutron lifetime. And that is what I looked at.

Q But my question now is about the void coefficient.

A That is right. I would have to go back and look again is my response.

This method is simply presented in my testimony as that, another method. Had I had this at the time of producing

1 the original study, the Battelle study, I would have been
2 forced to evaluate these and perhaps compare them and contrast
3 them. But I presented it here as another method that I
4 found. And that is really the only basis, the only reason
5 that I have for presenting it in here. As if, here is another
6 method.
7 Q Are you saying that this is another method, or that
8 this is the correct method?
9 A I am saying it is another method. I did not --
10 Q And you are saying that at the time you --
11 A Excuse me. I did not evaluate this method, I just
12 said here is a method, here is what I did, and presented it.
13 Q Your testimony, then, is that this is an unevaluated
14 method by you?
15 A Yes, I simply followed their procedure.
16 Q But you did not evaluate to see how applicable it
17 might be for this particular case or what error bars there
18 may be in it?
19 A Not to produce this testimony here, no.
20 Q You did not, then, for example, check to see whether
21 this formula worked, comparing, for example, SPERT I-B with
22 I-D?
23 A I believe that was I-B with I-D. I believe I would
24 have to answer no to that.
25 Q Or SPERT with BORAX?

1 A Again, I believe I would have to answer no.
2 Q And SPERT with SL-1?
3 A And again I believe I would have to answer no.
4 Q When you say that this is a method, your ratio
5 of energy release is to three significant figures. Do you --
6 is it your understanding of this Forbes et al report that this
7 relationship they suggest is accurate to three significant
8 figures comparing different kinds of reactors?
9 A I don't think I can derive any exact inference from
10 that paper about how much, how many significant figures to
11 put on it, no.
12 Q In other words, your estimate based on this formula,
13 then, could be off either way by some unknown amount?
14 A It could be changed by how you change the input
15 parameters.
16 Q Or the error bars you have to give to the transforma-
17 tion formula itself?
18 A I don't think this method requires error bars, but
19 if that is how you want to determine, arrange, or something,
20 yes.
21 Q Is it your understanding that this relationship that
22 you quote from this study was intended as a method of accurately
23 and conservatively determining maximum energy release for
24 different reactors?
25 A As I remember, the document stressed that here was

1 a way to show that these cores behaved in a very similar
2 fashion. I do not believe it made any claims to accuracy in
3 terms of significant figures.
4 Q So it was a rule of thumb more than any --
5 A I don't think I can answer that. I would have to
6 talk to these people, I suppose.
7 Q Did you read any of the other SPERT literature that
8 discussed this method?
9 A The method in particular, no. I would have to answer
10 I don't think so.
11 Q So you are unaware of any caveat that may have been
12 discussed by the SPERT researchers as to limits to the use
13 of rules of thumb of this sort?
14 A Yes, I am unaware of any, if they exist.
15 Q Let's talk for a couple of moments about the input
16 numbers you used, and then return to the method, if we may.
17 On page 16 you have a correction for peak-to-average flux
18 for SPERT and the Argonaut UTR core. First of all, you say
19 that the Argonaut UTR core peak-to-average value is a maximum
20 of 1.5. Did you not yesterday testify that the UCLA hazards
21 analysis indicated that that ratio was 1.63?
22 A Yes, I saw in the hazard analysis where it does say
23 1.63.
24 Q If one used that ratio, would not your figure of 588
25 degrees C on page 17 then be higher?

A If you change the numbers, then yes, the result will change.

Q And on page 17 you used for the SPERT I-D core with a 7.2 millisecond period 9.32 megawatt seconds total energy release. I am talking about the first paragraph of your own text?

A Yes.

Q Isn't that true that in the Battelle study you used a figure of 12 megawatt seconds?

A That was for the Argonaut core.

Q Using a reactivity coefficient from SPERT I-D was it not, without correction?

A That is correct.

Q And if one used the 12 instead of the 9.32, again you would have more than the 16 you end up with?

A The SPERT I-D, if you look at the data, the listing of the experiments or runs as they were called, the run that had 7.2 milliseconds produced 9.32 megawatt seconds.

Q But in your study you took a look at the reactivity coefficient for a 7.2 millisecond period of SPERT I-D. And for conservatism purposes you concluded a 12 megawatt second release; is that not correct?

A I think, if you plug that in, that is what the number comes out to, yes.

Q I turn you to the Forbes et al document.

A Let me check and see if I have it.

Yes, I have it.

Q And I start you on what is listed as page 7, the beginning, introduction. And the second sentence indicates, does it not, that these data were accumulated from four aluminin cores and one stainless steel core all in the same reactor vessel.

A Yes, I believe that is correct. They were all in the same vessel.

Q So situations regarding presence of a graphite reflector or other changes that would occur by -- changes other than simply of the fuel plates -- were stable in this set of experiments.

A To the best of my knowledge, that is correct.

Q And for the aluminum core, is it not correct that the plates were identical. It was merely the bundles, cooling channel width, and elements that were altered?

A Do you mean like fuel composition?

Q Fuel composition, plate width, thickness.

A Again, to the best of my knowledge that is true. Although the A core did have the -- it was divided into three parts, I believe, with these stiffener bars.

Q But the plates were identical?

A To the best of my knowledge, yes. That is correct.

Q And the UCLA plates are somewhat thicker?

1 A I believe so.

2 Q So to your understanding there occurs in the next

3 few pages a discussion of a simple Fuchs model, an attempt to

4 determine whether or not it fits the data generated?

5 A I think that is generally correct, yes.

6 Q And I turn you to page 13. Is not the thrust of this

7 report, particularly as discussed here on this page, that the

8 shutdown coefficient for this particular reactor with these

9 particular cores appeared to have a weaker dependence than

10 would be predicted by the simple Fuchs model?

11 A I would have to give that some study to verify that.

12 Q The equations 3 and 4 on page 13, the zero delay

13 model and the long delay model, are these the equations from

14 which the general relationship used in your testimony of this

15 inverse square root rule, are these the equations from which

16 that general relationship are derived?

17 A As I remember that would correct.

18 Q And that is done so by the determination on page 12,

19 the third line from the bottom that the best fit could be

20 found when N was found to be between 1.5 and 2.0?

21 A Yes, I believe that is the range of that exponent.

22 Q And therefore, if one assumes it to be two, one has

23 the square root rule.

24 A Yes.

25 Q But if one assumes it to be 1.5, it would be a

1 different relationship, would it not?

2 A It would be slightly altered, yes.

3 Q The last paragraph on page 13, the third sentence

4 reads "Since N is found to be of the order of 2, this implies

5 that the dependence on the constant B, which is proportional

6 to the ratio of the void coefficient to the prompt neutron

7 lifetime, is weaker than the linear dependence predicted from

8 the simple Fuchs model." Does not that indicate a very rough

9 order approximately, where it talks about "implies" and "on

10 the order of 2"?

11 A That is basically what it says here.

12 Q And it goes on to say, "Therefore for similar reactors

13 it would be expected that the peak power would vary approx-

14 mately as the reciprocal of the square root of the void

15 coefficient over the lifetime." Does that indicate to you

16 a general approximation, or a detailed accurate formula that

17 can be used for different reactors?

18 A I think,as is described in this article, it indicates

19 a simple general model.

20 Q Is it your understanding that that model can be

21 used to approximate or to accurately estimate the energy

22 release?

23 A I think it can accurately estimate it as well as

24 any other method that I am aware of.

25 Q What other methods are you aware of for correcting

for differences between reactors for void coefficient differences and plate spacing differences and L-over-beta differences?

A I cannot remember any model or method that incorporates all of those factors you mentioned. I believe the early Duncan report or the GNEC material did use ratios to correct for some of those factors.

Q Why did you choose this method, rather than the GNEC method?

A Because this method was new to me, and I simply thought it would be a good idea to show it.

Q When it says for similar reactors it would be expected that this approximate variation in peak power would be observed. How similar does the reactor have to be for that approximation to hold?

A In my opinion the similarity that we have been discussing all along is valid between the SPERT core, SPERT I-B and the Argonaut. And these authors believe it is valid or at least within the guidelines of this model for the cores that they were discussing.

Q Weren't they discussing changing plate spacing within the same reactor vessel?

A Well, the vessel, to my knowledge, did contain these different cores. And these cores did have, I guess among other differences, different plate spacing, yes.

Q The last sentence, "This weakend dependence on B

1 is implicit in any reactor which displays a shutdown effect
2 that increases more rapidly than energy released, and is
3 therefore not unique to the analytical form used here."
4 In the Argonaut reactor, does the shutdown effect
5 increase more rapidly than the energy increase? I mean
6 energy to release,excuse me. Let me ask that question again.
7 In the Argonaut, does the shutdown effect increase
8 more rapidly than the energy release?
9 A Let me think about that.
10 Q I guess I have to say I am not sure about that. I
11 would think that the shutdown effect increases or appears as
12 the energy is released. Whether there is a -- if you have more
13 energy released in the plates, would the water turn to steam
14 more quickly? I would have to evaluate this further. As I
15 indicated earlier, I did not really evaluate this document.
16 I saw the method. I had seen other comments about void
17 coefficients, corrections. And I said, "Well, let's include
18 this."
19 Q Page 17 of the study, and when I refer to study I
20 mean again the Forbes, et al, fourth paragraph down. The
21 last sentence says, "The experiments were conducted to determine
22 the interaction effects of voids in various core locations,
23 and the combined effects of voids and temperature."
24 A I am sorry, would you quote me that paragraph again?
25 Q Fourth paragraph on page 17, last sentence. The full

1 paragraph itself discusses some detailed void coefficient
2 measurements done for the various SPERT cores?
3 A Yes.
4 Q Do you know whether for the Argonaut reactors detailed
5 measurements of this sort have been performed?
6 A No, I do not know that.
7 Q Turning to page 18, under the column marked "Core,"
8 at the very last line, is the beta -- there are two betas
9 listed in that ratio. Do you know if the top one is an error,
10 or should be there?
11 A I am not sure if it is an error or not. But I think
12 it may cancel out and be appropriate. But I would want to
13 go through some numbers to verify that.
14 Q On page 19, first paragraph, the second to last
15 sentence in that paragraph which reads, "A reactor with a
16 large negative void coefficient would be expected to shut
17 down with a smaller energy release than one with a small
18 negative void coefficient."
19 Void coefficient is a measure of how much reactivity
20 change there is when a certain amount of the moderator is
21 voided; is that correct?
22 A Yes, I can agree with that statement.
23 Q The shutdown mechanism is thus somewhat dependent
24 upon that void coefficient; correct?
25 A I am sorry, would you repeat that?

1 Q Let me ask it differently. A large void coefficient,
2 it indicates here, would shutdown with a smaller energy release
3 than one with a small negative coefficient, all other things
4 being equal; correct?
5 A If the amount of energy it takes to turn -- the
6 amount of energy it would take to turn a particular volume of
7 water, I think generally, I will say is identical. So much
8 water, you are going to need so much energy to turn it into
9 steam at identical conditions. If turning that volume into
10 steam, turning that water volume into steam, has a greater
11 effect, then I think that is the essence of this statement.
12 Q But it is also important, is it not, how quickly
13 that voiding effect comes into play, in addition to the
14 magnitude of the effect once it takes place?
15 A I can think of maybe some conditions where you have
16 extra pressure on the water, perhaps, and it is not quite
17 atmospheric pressure. But I would think that the time that
18 it would take would be relatively constant, unless you are
19 changing the situation inside the core.
20 Q The SL-1 analysis, was there any indication that part
21 of the reason for the large energy release was due to the
22 time delay and heat transfer to the coolant?
23 MR. CORMIER: Objection, Your Honor. What SL-1
24 analysis are we talking about?
25 MR. HIRSCH: SL-1 analysis referenced in your Battelle

study.

BY MR. HIRSCH:

Q Do you know which one I am referring to?

A I believe so, the General Electric report?

Q Right.

A I would have to go back and read that.

Q On page 20, third paragraph -- I am still looking at Forbes, et al document. Do you have that, page 20?

A Yes.

Q I am referring to the third paragraph the second to last sentence in that paragraph, which reads, "The experimental data shows large scatter and straight-line fits are shown for comparison."

Does that not indicate that we have new data here, and that there is considerable variation in the actual measurements?

A This is for pressure. If you want to assume that all other measurements show the same, then I guess you can make that assumption.

Q Do you know whether the other -- whether there was scatter, for example, in Figures 12 -- actually, say again. You say for pressure. But it refers to Figures 11 through 13; does it not?

A Let's see, starting at the top of that paragraph on page 20. Okay, yes, I believe you are correct that those

1 refer to Figures 10 -- well, at least 11 through 13. And
2 most likely 10 also.
3 Q I turn you just for the moment to page 23 and to
4 Figure 13. So the lines, the curves that we have on this
5 figure do not indicate the data scatter; is that correct?
6 A No, it is quite a smooth line.
7 Q So the data scatter is not indicated?
8 A The scatter within -- or, excuse me, the scatter
9 for each of the cores or for each of the lines, no, is not
10 indicated. It is just a straight smooth line.
11 Q Also on page 23 for Figure 13, the lines cross over,
12 do they not, one over the other for the B-1640 core, A-1728,
13 and B-2432?
14 A Well, it is a little hard to say if they cross over,
15 except for the -- I guess the A-1728 and the 2432. The others
16 look like they may coincide.
17 Q But there is certainly no constant ratio of energy
18 release between the cores at different periods?
19 A No, but these are different cores. If you again go
20 back to something like mass of the core or some other normaliz-
21 ing factor, active volume, I think these would tend to coincide
22 a little bit better.
23 Q But your testimony is that by correcting for the
24 peak-to-average flux and the void coefficient and neutron
25 lifetime, the ratios -- you can correct from SPERT to Argonaut;

is that not correct?

A No. What I said was, if I use this method this is the answer I get. That is really all I did.

Q For Figure 13, you said that maybe the mass of the cores might explain the fact that the ratio of energy release varies at different periods? For these three cores that we have been referring to?

A Well, I think if you pick a period here and then look at the differences in that energy release, I think that may explain some type of normalizing factors that have been discussed earlier.

Q But the mass of the core remains constant, no matter what the period is; does it not?

A I don't think that is true for these cores. I mean, they have different plates.

Q Excuse me, for the same core. In other words, the B-2432 core did not change mass for these different excursions.

A Oh, no. I think I covered that the other day, where with different periods or reciprocal periods you may have different regimes of shutdown mechanism. Slight density changes as in water heating up, or tremendous density changes as in turning to steam. I think that explains the variation in the lines horizontally here, along a single core. I think I must have misunderstood your question.

Q So your testimony is that there are a number of

1 additional factors besides void coefficients, the reduced
2 prompt neutron lifetime, that must be used to normalize between
3 different cores?
4 A No, I don't think I said that or ever meant to imply
5 that. What I meant was if you take a period, you have a number
6 of different cores here. You take a reciprocal period and you
7 look at the value of energy release for each core. They are
8 slightly different, or different. And I think that it is very
9 reasonable to assume that that difference is based wholly or
10 in part on the mass or active volume of these cores. This is
11 sort of the vertical change as shown in this Figure 13.
12 Q A quantitative difference that can be quantified?
13 A Certainly given the accurate knowledge of the core
14 components, mass, composition, et cetera, then you can have
15 some quantitative figures to work with.
16 Q Do you have a quantitative method for compensating
17 for the differences between the Argonaut core and the SPERT?
18 A I do not, no.
19 Q Turning you to the previous page, at the bottom,
20 last sentence, which indicates that the variation of the void
21 coefficient divided by the lifetime for these several cores,
22 the maximum variation was approximately 50, and that therefore
23 the estimated range for the peak powers would be the square
24 root of 50 or approximately 7?
25 A I am not sure I follow.

1 Q The last sentence on page 22.

2 A If your question is 7 approximately the square root

3 of 50, then yes.

4 Q And doesn't this sentence indicate that the formula

5 would predict a 7-fold difference in peak power between the

6 cores with the largest and smallest B?

7 A That seems to be what it says here, yes.

8 Q And the sentence on the next page indicates that the

9 data show that the actual spread was 5.5; is that not correct?

10 A That is what it says here, yes.

11 Q Which they call "rather good agreement."

12 A Yes, that is here also.

13 Q So a spread of what turns out to be 5.5 when 7 is

14 predicted would indicate at least some error in the use of

15 this formula for different cores within the same SPERT vessel.

16 A There seems to be variation in here, yes.

17 Q And again on Figure 13, the ratio of energy-release

18 to this B varies with period; correct? It is not a constant

19 ratio?

20 A I am sorry, I think, I am not sure I see how B is

21 explicitly on this Figure 13.

22 Q Isn't Figure 13 a plot of energy release against

23 reciprocal period for the five cores?

24 A Yes, it is.

25 Q Isn't the purpose of this document to attempt to

1 explain the difference in energy release at the same period
2 for the five cores?
3 A I think it may have been one of the authors' aim,
4 yes.
5 Q And isn't the generalized conclusion that one can
6 explain the difference in energy release for the same period
7 based on the square root of B, which they define as the void
8 coefficient over the reduced lifetime?
9 A I believe that is correct.
10 Q And yet is it not true that that ratio of power
11 changes between the cores at different periods, that it is not
12 constant?
13 A That seems to be what is indicated in these paragraphs
14 we have been going over, yes.
15 Q Therefore, this approximation doesn't hold true for
16 all periods.
17 A I cannot draw a conclusion. If that is what you
18 derive out of this, and in going over this article right now
19 -- as I indicated earlier, you know, I did not do a detailed
20 evaluation as we are doing right now, it seems, of this
21 article. I used the method, I presented it, I described where
22 I got it from, and that is all there is to it. I mean, I
23 could --
24 Q Do you believe that it does apply equally in all
25 periods?

1 A Do I believe what applies?

2 Q The approximation used in your testimony of the inverse
3 square of the void coefficient -- excuse me, I keep doing that
4 -- of the inverse square root of the void coefficent over the
5 reduced lifetime?

6 A I will have to ask you just to repeat that once more,
7 please.

8 Q Do you believe that the approximation used in your
9 testimony -- and by approximation I mean the inverse of the
10 square root of the void coefficient over the reduced lifetime
11 -- do you believe that that approximation holds true at all
12 periods?

13 A No, not at all periods, because in some of these
14 periods I don't think the void coefficient may play that
15 tremendous role. I think at some of the smaller periods that
16 maybe just the density, change of the water loss, the remains
17 water.

18 Q For all periods -- when you say smaller periods,
19 define smaller periods for me, would you?

20 A As I understand the phenomena that is behind this,
21 it would be periods where these lines and these cores make an
22 abrupt angle.

23 Q In other words, from 10, reciprocal period of 10 on?

24 A Approximately from 10 or so over to what is given
25 here as 10^{-2}, in that direction.

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1 Q And is it your impression that the approximation
2 we have been discussing holds true for all periods within the
3 range you have just described?
4 A I don't really think I can answer that without sub-
5 jecting this article to more study than I have given it.
6 Q And are you aware in this study of any comparison
7 of actual energy release to this prediction, what I am refer-
8 ring to as the approximation, besides the one I referred to
9 you a moment ago about the estimation of a factor of 7 and
10 the data of 5.5?
11 MS. WOODHEAD: Objection. Mr. Chairman, I believe
12 that we have gone far outside the scope of the testimony. This
13 is an article referenced and used and cited in the testimony,
14 most certainly. But I think that we have gotten far away from
15 the focus of the testimony's reference into a very tedious
16 discussion of the contents of the reference itself,which is
17 not the testimony of Mr. Hawley.
18 JUDGE FRYE: Yes, I am inclined to agree with you.
19 We are going quite far afield.
20 MR. HIRSCH: If I may at least respond.
21 JUDGE FRYE: Yes.
22 MR. HIRSCH: Page 17 of Mr. Hawley's testimony says
23 that by using this method one "gets a temperature of 588 degrees
24 C, still well below the fuel meat melting point." And these
25 several pages in his testimony attempt to assert that by using

1 this formula the Argonaut is demonstrated to not melt.
2 588 degrees C is --
3 JUDGE FRYE: But as I understand it, it was simply
4 put in as comparison, or illustration, I suppose is better.
5 But he didn't study it. He just says he found it, and that
6 is what it said.
7 MR. HIRSCH. Well, that was actually my last ques-
8 tion, but I do want to make this very --
9 JUDGE FRYE: All right. Well, if that is the last
10 one, let's get the answer to that.
11 BY MR. HIRSCH:
12 Q My question was are you aware of any actual data
13 comparison against this model besides this factor of 7 against
14 the 5.5 that we see on pages 22 and 23?
15 A I think I understood the other question. But I am
16 not sure I understand this question.
17 Q Answer the previous one, then.
18 A I guess I have been trying to. I didn't subject this
19 document to a detailed evaluation. Again, I just presented
20 it as a method that I found.
21 MR. HIRSCH: Judge Frye, I know that the Staff when
22 it initially identified this exhibit did so for identification
23 purposes. I would like to inquire now whether they intend to
24 move it into evidence.
25 JUDGE FRYE: That is a fair inquiry. Ms. Woodhead?

MS. WOODHEAD: No, I only distributed it to the Board and parties for reasons of reference, if it is quoted in the testimony. It is only submitted as a helpful reference.

MR. HIRSCH: CBG, then, moves it into evidence at this time.

JUDGE FRYE: Any objections?

MS. WOODHEAD: No objection.

MR. CORMIER: No objection.

JUDGE FRYE: It will be then admitted, I suppose, as CBG C-10.

MS. WOODHEAD: Would it avoid complication to keep it as Staff 2 and accept it in as a Staff exhibit? I have no objection to introducing it as evidence, I just --

JUDGE FRYE: All right, we will then keep it as a Staff exhibit.

MS. WOODHEAD: All right. I think that will keep the numbers a little easier to deal with.

(The document referred to, having been previously marked for identification as Staff Exhibit 2, was received in evidence.)

BY MR. HIRSCH:

Q On page 18, bottom.

A Of which document?

Q Of your testimony -- A-13?

1 A Yes.

2 Q You indicate that the entire rabbit sample, giving
3 your understanding of the design of typical rabbit systems,
4 the entire rabbit sample would have to be filled with elements
5 such as boron, cadmium, et cetera, to have a significant
6 effect.

7 Is it your testimony that a cadmium foil around the
8 outside of the rabbit would not be sufficient to produce a
9 significant effect, as you define it here?

10 A In the rabbit systems that I am familiar with your
11 standard typical foil, 20, 30, 40, 50, 60 mils thick, several
12 square inches wrapped around one of the common radiation
13 devices, polyethylene vials. And in the systems that I am
14 familiar with I do not think the operator at the control panel
15 would be able to detect this sample insertion and removal.
16 I think the reactivity factor would be too small to notice.

17 Q If it were filled with cadmium they would be able
18 to notice it?

19 A I believe so, yes.

20 MR. HIRSCH: That concludes our cross-examination
21 of this witness.

22 JUDGE FRYE: I believe Judge Luebke would like to
23 ask some questions before we get to redirect.

24 MS. WOODHEAD: That is fine.

25 JUDGE LUEBKE: Mr. Hawley, you have been there a

long time. I have a few odds and ends that need a little clarification to me at least. One of the odds begins in Staff Exhibit 2, that is IDO-16528, the Forbes, et al report?

THE WITNESS: Yes.

JUDGE LUEBKE: And has been entitled on the record here as Analysis of Self Shutdown Behavior in the SPERT I Reactor. And in that report, if we go to page 14, and look at figure 6, we have there a diagram of the SPERT reactor and the reactor core located near the bottom of a reactor tank.

THE WITNESS: Yes.

JUDGE LUEBKE: And then going to page 15, at the top of the page it explains, or you can read it to the transcript, the first sentence.

THE WITNESS: This first paragraph?

JUDGE LUEBKE: First sentence.

THE WITNESS: "The SPERT I cores are contained in the open tank four feet in diameter and fifteen feet high."

JUDGE LUEBKE: All right, I use that for a foundation to now look at the transcript of yesterday on page 2178, if you have it.

THE WITNESS: I do not have it yet.

(Document proffered to witness.)

THE WITNESS: Yes, I have it here in front of me.

JUDGE LUEBKE: And go down to line 18, where Mr. Hirsch asks you the question,"Is the Argonaut an open tank."

1 And you answer was --

2 THE WITNESS: As it is stated here, "It depends on

3 how that is defined. As for example, a lot of your" -- that

4 should be TRIGA -- "TRIGA reactors may be called open-tank or

5 open-pool as opposed to tightly contained, and then have the

6 ability to pressurize. I would consider it an open-tank or

7 open-pool."

8 JUDGE LUEBKE: Thank you. That misspelling of the

9 word TRIGA reminds me that for the convenience of the reporter,

10 the first time people use peculiar words or names of authors

11 and such, it would be helpful, I think, for the reporter, to

12 take the time to spell them out. Then we get a better record.

13 Well, to go on with this, now, if we go to the

14 Battelle report, the blue one here, part of your testimony,

15 we look at page 2 it says here, which at the bottom has a

16 diagram of an Argonaut reactor.

17 THE WITNESS: Yes.

18 JUDGE LUEBKE: And down in the middle there is an

19 arrow that points to some little square things, six square

20 things called fuel box plugs.

21 THE WITNESS: Yes.

22 JUDGE LUEBKE: And having looked at other more

23 detailed designs of Argonaut reactors, located under those

24 plugs are what?

25 THE WITNESS: My understanding is that those plugs

s

1 contain a device called a deflector plate, and approximately
2 at the bottom of the plug there is an air space of some inches.
3 And between the bottom of this plug and the water there is an
4 outlet. And whether this outlet is completely filled with
5 water or only partly filled with water when the pumps are run-
6 ning I am not certain. But it is to my knowledge open to the
7 atmosphere, which is why I was calling it open-tank. It is
8 not pressurized.
9 JUDGE LUEBKE: And your understanding, then, is that
10 there is not any top to this square assembly called the fuel
11 box that has the four fuel assemblies in it?
12 THE WITNESS: I think there is a top to it, which
13 is this fuel box plug. I believe that there is a space in
14 there where this deflector plate resides, and that there is
15 an air space in there and an access out through this tube.
16 And I do not believe that that plate --
17 JUDGE LUEBKE: But the outlet is really part of the
18 primarily cooling system which goes to a heat exchange; is it
19 not?
20 THE WITNESS: Yes, it does.
21 JUDGE LUEBKE: And in principle, it is a closed
22 circuit primary coolant system with the outlets from these
23 six fuel boxes?
24 THE WITNESS: Yes, closed circuit with, in my under-
25 standing, the fuel box open to atmospheric pressure.

JUDGE LUEBKE: Therein lies the discrepancy. I am afraid my picture of it is that this primary coolant system at that point is not open to the atmosphere. But if that is your understanding --

THE WITNESS: Yes. Yes, it is.

JUDGE LUEBKE: -- then we will leave it that way.

In case of a power excursion, then, this is considered to be associated with the production of eventually bubbles in the water from boiling, and small bubbles go into big bubbles. And you have to make a place for the water to go. And your picture, then, is in the Argonaut reactor that water has a place to go?

THE WITNESS: That is correct.

JUDGE LUEBKE: And any amount of water, in other words, without limit? Or do you think there is a limit?

THE WITNESS: I think that the -- I do not have the diagram drawings to quantify this, but I believe given the volume of water in the fuel boxes and the volume of water that would be necessary to shut the reaction down, I believe there is sufficient pathways out the top or sides of this assembly. That is my understanding, yes.

JUDGE LUEBKE: I see. So, again, the difference between my view of it and your view of it which might be clarified in future testimony is that it is open to the atmosphere, and almost any amount of water could blow out

1 someplace. And in my picture of it it is a closed system,
2 and what happens is that the amount of air in the upper part
3 of the fuel box becomes compressed and under pressure, and
4 there comes a point where there is no more place for the water
5 to go because the air pressure gets too high.
6 And so I just raise this as a question to resolve,
7 not necessarily by you, Mr. Hawley, but someplace in the pro-
8 ceeding.
9 New subject. The subject is dispersion. And I
10 refer you again to the Battelle report, near the end, page 47.
11 It begins a treatise with a subtitle "Dose Estiamtes."
12 THE WITNESS: Yes, I have it here.
13 JUDGE LUEBKE: And following that are several pages
14 of data and equations in which you calculate the dose to an
15 observer down wind. And I guess my question is have you ever
16 been on the roof of a building with an Argonaut reactor?
17 THE WITNESS: No, I have not.
18 JUDGE LUEBKE: Well, Judge Frye and I have been on
19 a roof of a building with an Argonaut reactor. And we found
20 ourselves surrounded by high-rise classroom buildings. And
21 we found that this exhaust stack fell far short of the top
22 of these classroom buildings. And when we looked around we
23 looked into the open windows of classroom buildings. And I
24 guess my question is would you say that your very elegant
25 calculations on the pages following page 47 would apply to such

a complex building situation?

THE WITNESS: At some distance away from that complex situation where these type of diffusion dispersion models do the apply. Close to a complex such as you describe there are other factors, building wake effects, eddies, turbulance, that is beyond my skill to estimate.

JUDGE LUEBKE: In other words, it would really be difficult to calculate what is going through the windows to those students in the mathematics class?

THE WITNESS: Without having seen the precise situation, I think that is probably a fair estimate. It would be difficult to calculate the concentrations very close into this complex.

JUDGE LUEBKE: This testimony doesn't necessarily apply to this. This testimony applies to a much neater situation where you have sort of open fields and winds in a preferential direction, and so on.

THE WITNESS: Yes, or at some distance away where these models are no longer affected. I mean, the wind returns to a nice stable --

JUDGE LUEBKE: And in this particular situation "some distance away" was all city with more high-rise buildings, et cetera?

THE WITNESS: In a situation like that, these types of surfaces do present greater area for particular matter to

1 fall out and plate out. And again, that is another factor
2 that we can consider. But it would be --
3 JUDGE LUEBKE: A somewhat difficult problem to treat;
4 is that correct?
5 THE WITNESS: Yes, it is.
6 JUDGE LUEBKE: I would like to change the subject
7 again to the Battelle report on page 15, which has the subtitle
8 "Excess Reactivity Accidents," and goes on for several pages
9 beyond page 15.
10 THE WITNESS: Yes.
11 JUDGE LUEBKE: And on page 21, the full paragraph
12 there, and do you see a sentence which says, near the top of
13 the paragraph, "The accidental addition of significant reactiv-
14 ity from external sources is not considered realistic?"
15 THE WITNESS: I am sorry, sir, I was on the wrong page.
16 JUDGE LUEBKE: Page 21.
17 THE WITNESS: Page 21, of the Battelle?
18 JUDGE LUEBKE: Yes, the blue-covered report. The
19 paragraph begins, "The maximum excess reactivity available --
20 THE WITNESS: Oh, yes.
21 JUDGE LUEBKE: --"inadvertent step-wise insertion
22 is 2.6 percent delta --
23 THE WITNESS: Yes, it is the following sentence.
24 Yes, I have it here.
25 JUDGE LUEBKE: And then you go on to say "The

1 accidental addition of significant reactivity from external
2 sources is not considered realistic."
3 THE WITNESS: I see it, yes.
4 JUDGE LUEBKE: Are you aware that it is generally
5 considered that the Argonaut university training reactors
6 and university training reactors by other names are viewed
7 and were designed to be so safe that they could be maintained
8 by idiots and operated by idiots?
9 THE WITNESS: Since most of the people that I know
10 were students, I don't want to imply that they were idiots.
11 But, yes, it is my impression that it is difficult to abuse
12 one of these reactors, yes. And I think that potential for
13 abuse is not well-founded.
14 JUDGE LUEBKE: If it were at all possible to make
15 a step-wise insertion of reactivity, the idiots might find a
16 way to do it? What I am getting at is I don't find the word
17 "idiot" any place in your testimony. Is that correct?
18 THE WITNESS: Yes, I don't use that word in here.
19 JUDGE LUEBKE: You would agree to that. Well,
20 really the same thing applies to power reactors, large electric
21 generating power reactors. We have had some episodes where
22 you could justifiably say that problems resulted from mainten-
23 ance and operations by sort-of idiots. It is not far-fetched.
24 And if it happens there, it will happen in research reactors
25 and training reactors.

So I think when you draw these conclusions, I think everybody who reads the transcript should know that we are thinking of idiots doing the maintenance and idiots operating these reactors.

THE WITNESS: May I just add that in the years of experience I have had operating research reactors with students and some of the professors who I might classify in a different category than students, I have never seen or participated in or felt the effects from an accidental addition of reactivity which was significant. I guess we had a couple, but they were not significant in the sense of causing a power rise or a pulse or even -- they didn't even get us in trouble with the NRC. So that is --

JUDGE LUEBKE: Well, maybe you were fortunate.

THE WITNESS: I would like to think I am conscientious. But fortunate may play a role, yes.

JUDGE LUEBKE: Thank you for your excellent responses.

JUDGE FRYE: Why don't we take about a 15-minute break, and then I think we will be ready for redirect.

Off the record.

(Recess.)

JUDGE FRYE: We will go back on the record, please.

Ms. Woodhead?

MS. WOODHEAD: Yes. I need one moment.

xxx

REDIRECT EXAMINATION

BY MS. WOODHEAD:

Q Mr. Hawley, will you locate the excerpt from the article that Mr. Hirsch showed you yesterday entitled "Experimental Study of Transiet Behavior in a Sub-cooled Water Moderated Reactor" by Schroeder, et al.

A I am sorry, I think I gave that back to him yesterday.

Q All right, let me give you my copy and refer you to Figure 20 on, I believe it is page 111, it is the last page of the document.

A Yes, I have Figure 20 here.

Q Will you read the title of Figure 20.

A It says, "Instantaneous Excess Reactivity During a Seven Millisecond Period Transient Test, also shown are reactor power and energy release."

Q In Figure 20 I believe it shows an energy release of 23 megawatt seconds to the right of the graph?

A Yes.

Q And what reactor is this graph referring to?

A It is a SPERT I-A, I believe.

Q At what period is the 23 megawatt second pulse shown?

A Seven milliseconds.

Q Can you explain why that quantity of energy was released?

A I think it is primarily a function of the size of

the core as this relates to periods in other reactors.

Q And can you compare the size of the SPERT I-A core to the SPERT I-D core?

A Not quantitatively, but it was quite a bit larger, I believe, yes.

Q Which was larger?

A The SPERT I-A was quite a bit larger than the Argonaut. I have to check those numbers to provide a quantitative answer, but that is right.

Q Yesterday there was a great deal of discussion about the range of variables in different Argonauts. Can you explain how the Battelle study accounts for the variables among the five Argonauts?

A Okay. I think basically the range of these variables is, in a sense, accounted for by the conservative assumptions that we make. Therefore, if there is an uncertainty in some of these variables, I believe that the effect that this uncertainty would have when we look at the entire study, the conservatisms outweigh the uncertainties. I think that is a fair answer.

Q All right. Now, would you turn to page 13 of your testimony.

A Yes.

Q The last sentence of the first paragraph indicates that you have calculated, according to the previous discussion,

1 that a thyroid dose equivalent would be approximately 4.1
2 millirem of iodine 131. Could you clarify how you came to
3 this conclusion?
4 A Yes, that is an error. The figure is closer to Mr.
5 Hirsch's figure of 4 rem than mine of 4.1 millirem. I did
6 a hand calculation using significant rounding off. And I came
7 up with about 4.3 rems. So that is a mistake.
8 Q So would you like to correct your testimony at this
9 time?
10 A Yes, I would.
11 Q And instead of 4.1 millirem, what number should be
12 inserted?
13 A I would be happy to go with Mr. Hirsch's number.
14 I am sure he had more time and used more significant figures
15 than I did in my rounding off.
16 Q So your testimony should read 4 rem instead of 4.1
17 millirem?
18 A That is correct.
19 Q Yesterday there was discussion also on cross examina-
20 tion of your 2.7 percent release fraction and the effects of
21 gaps in fuel plates, et cetera. How does the fact that MTR
22 plates have no gaps between the fueling clad affect the 2.7
23 percent release fraction that you use?
24 A May I ask you to just repeat that.
25 Q All right. Is it not true that MTR paltes have no

gap between fueling clad?

A They are not -- in the manufacturing process, yes, they have no gap. I do not have any knowledge or material in my possession which indicates that there is a gap either during manufacture or at some subsequent period. I don't know of any effects on the fuel that would produce a gap. Therefore I do not believe that there is a gap in the fuel.

Q Right. And isn't it true that in the calculation of your 2.7 percent release fraction you assumed a gap?

A Yes. We assumed all the material from this release death would accumulate in the gap. And then when the cladding is peeled away or otherwise removed, this amount of material escapes. So, if there is no gap, then there really is essentially no release by the process we described. I am sure that if you had an irradiated fuel element and denuded the meat of the cladding, undoubtedly there would be some small amount of noble gasses, iodine molecules on the surface which would come off. But that is -- I do not have that number. But I do not have that number. But we are talking just single molecules, as opposed to this shallow material. So it would be much reduced in the real situation.

Q All right. In the area of excursions or fast transients, what is the most significant parameter in determining the extent of fuel damage?

A As I was used in the Battelle study, I think that

can be accurately described by the work of Ivins or Ivens,(ph) where it was the amount of energy deposited per mass of material, the sort of energy density or the amount -- not the total energy, but the amount of energy deposited within that mass of fuel, core fuel material.

Q All right. Yesterday Mr. Hirsch pointed out to you that the Battelle studies of Argonauts and TRIGA's contained two different dispersion factors. Can you explain the significance of the difference between these two dispersion factors in these two studies?

A Okay. Well, first of all, yes, there is a sort of an absolute difference in the ratio between the two. But when these are applied to the process by which we are using in these studies and in these reports, the difference does not become that significant because we have a lot of other conservative factors that we use. So, again, I think this relates maybe to the question earlier, where if we do have some variability in these there are other factors which I think compensate for that variability.

Q All right. Now, would you turn to page 54 of the Battelle study.

A Yes, that is a page of references, yes.

Q The sixth reference down is entitled "Activity and Thyroid Dose from Radioiodine." The author is R. L. Kathren. And it indicates it was published in Nucleonics, Volume XXII.

1 Is this the reference which you used at page 48 as
2 the conversion factor for the radionucleides on table 4?
3 First of all, I will let you turn to page 48, and identify
4 table 4 which is entitled "Activity and Dose Equivalents From
5 Maximum Credible Fuel-handling Accidents."
6 A Yes, Ron used -- Mr. Kathren used his own publication
7 for that purpose.
8 Q So the conversion factor used to produce these
9 numbers on page 48 can be found in that reference on page 54?
10 A Yes, that is correct.
11 Q Now, in reference to a question asked by Dr. Luebke
12 a few minutes ago as to the air space above the fuel boxes and
13 the amount of area into which moderator could be discharged,
14 can you give me a rough idea of how much of a moderator would
15 have to be discharged during a transient to create shutdown?
16 A Yes. If we take the amount of reactivity as three
17 times 10^{-2} delta k/k or 3 times 10^{-2} rho and divide that by
18 the void coefficient of the reactor which I use here for this
19 illustration as 6 times 10^{-6} delta k/k per cubic centimeter,
20 then that indicates, with no other compensating factors, you
21 would have to create a void -- a total void, it may be bubbles,
22 it may be an entire volume devoid of liquid water -- it comes
23 out to about 5,000 cubic centimeters, which is about five
24 quarts of water. And that would be distributed over all three
25 boxes. I mean, some would be a little more, some would be a

1 little less.

2 JUDGE FRYE: Excuse me, I missed what you said.

3 That would be distributed over --

4 THE WITNESS: Well, I think that that five quarts

5 could be distributed over the core in some fashion. It would

6 not be five quarts per fuel box is what I wanted to make clear.

7 BY MS. WOODHEAD:

8 Q So you stated that a total of five quarts would be

9 sufficient to create shutdown during an excursion. I mean,

10 five quarts of voiding whether it is water discharged or

11 steam expansion or whatever?

12 A That is a very -- it is an approximation. If you

13 want to be quantitative, you can probably do that. That is

14 the approximate figure, yes.

15 Q And is it your understanding that the Argonaut, the

16 area above the fuel boxes in an Argonaut has sufficient space

17 to accommodate that much discharge?

18 A Again, I would have to look at blueprints perhaps

19 to quantify that. But, yes, I feel that that space could be

20 found, yes.

21 Q All right. Regarding your dispersion factor in the

22 Battelle study, and I believe we are back at page 48, if you

23 would like to refer to it --

24 A Yes.

25 Q You state there at the bottom of page 48, the footnote,

1 footnote B, the X(Chi) over Q is a one-hour release time and
2 a factor of .01.
3 A Yes, the X over Q is .01.
4 Q Referring to a description of the particular area
5 around UCLA Argonaut, what effects would the presence of
6 buildings, tall buildings close by, have on your dispersion
7 factor?
8 A Again, to provide a quantitative answer would
9 require much work on my part. But generally speaking, and
10 these factors are included as general factors in other pub-
11 lications, that the effects of building weight and other
12 turbulence normally reduces concentrations in the vicinity
13 of such complex situations. But, again, to provide a quanti-
14 tative answer would require more work.
15 Q So do I understand you correctly that if the doses
16 that you calculated on page 48 were applied to the UCLA
17 reactor, given the nearby building effect, et cetera, that
18 the doses on page 48 would be lower because of the effects
19 of building dispersions?
20 A I feel that is a reasonable deduction or assumption
21 here. Again, to prove or quantify it would be beyond me. But
22 because of the value of X/Q is certainly in Mr. Kathren's
23 experience and in my experience from other calculations and
24 measured values a very high number for X/Q and that generally
25 these buildings, the effect of these buildings do tend to

reduce X/Q, then assuming that those effects also reduce this X/Q, then our doses would be less, because our X/Q would be less, yes.

Q Let me clarify one thing. You stated that your X/Q is extremely conservative, and I believe that there is some confusion about where you calculate the dose or the recipient of the dose. Is this nearby the reactor building, or is this a certain distance away? Can you give us more of a benchmark as to a place where this dose is postulated to be received?

A As used in here, of course it was chosen to be chosen irrespective of distance because we did not have site-specific factors, nor did we really wish to go into that level of detail. But if, based on my preceding answer, if the effects from the building wake, turbulence, decreased this value, then it is reasonable, given what we were describing about the situation, if decreased here, then any additional travel will reduce it even further, according to the diffusion and dispersion of the material and the radioactive cloud or plume. So the closer you get the closer it would be to this 10^{-2} number.

Let me try to shorten it just a bit. We use a value of 10^{-2}. If we take credit for building wake effects, that reduces this number. Then to get back to this number, we would have to be at some other location. And to the best

of my knowledge, that location would be much closer to the release point, or very -- you know, or closer to the release point, in other words, to the building vent or stack or whatever the aperture is considered to be in this case.

Q You said "that point." Do you mean the point of the --

A The release point.

Q -- the recipient of the dose? In other words, the dose calculation is that which is very close to the source, no matter where?

A No, I was saying that this X/Q of 10^{-2}, if that value is adjusted because of factors attributable to the building complex which reduce it -- and generally those factors do, then to get back to this 10^{-2} number we would have to get closer and closer to the point where the material is being released. That is the most concentrated point. That is what I was trying to say.

Q All right, thank you. Now, I would like to ask you one final question. And that is in your opinion, based on your experience in operating university reactors and in doing an analysis both of Argonauts and TRIGA's, is it your opinion that the Argonaut reactor is a fail-safe instrument?

A Yes, that is my opinion.

MS. WOODHEAD: No more questions.

Q Finally, with respect to the fission products that are released, the noble gases and the radio iodines, is it not true that the radio iodines are chemically quite reactive with substances such as aluminum?

A I -- I know that they are chemically reactive, and -- but to specify aluminum, I -- I think that goes a little beyond the knowledge I do have. But I -- sesium is one that has been in the literature and is quite -- it does react to that, sesium iodide.

Q Based on all these elements of conservatism, those which you took into account and those which we've just been discussing, isn't it quite unlikely that there would be any release in the event of a fuel-handling accident?

A You might be able to detect a release given in a very sensitive instrument, but a release of the magnitude which we described here, no, I really do not think that would -- that would occur, but we were being conservative.

MR. CORMIER: Thank you.

No further questions.

JUDGE FRYE: Mr. Hirsch?

FURTHER RECROSS EXAMINATION

BY MR. HIRSCH:

Q Mr. Cormier's questions about recoil essentially ending after the fission process stops -- isn't the presence

1 of fissioning unrelated to your use of the recoil concept?
2 A As he was describing it, that was a -- a new
3 thought, yes. I was not --
4 Q As you used it in your study, you were not consider-
5 ing release of radioactivity by recoil occurring at the
6 time of the accident, were you?
7 A No, and I do not think that -- that did not
8 make the -- a difference in the -- in other words, whether
9 it occurred before or up to that point, and we're still --
10 got all that material in that volume.
11 Q You were simply trying to estimate the volume
12 from which there would have accumulated gases that could
13 be released if that surface area were exposed?
14 A We -- we took the volume, and let's take all
15 this material into a gap and --
16 Q And you tried to find out how much would get
17 in this --
18 A Yes.
19 Q -- presumed gap?
20 A But I -- I do not see it makes a difference
21 if we -- if it's already in the gap or, you know, it just
22 gets into the gap. I mean, it -- it seemed like that
23 would not make that big of a difference.
24 Q In other words, if the reactor had been shut
25 down, it still would have accumulated the material that

had accumulated over the fissioning process from every core distance?

A Right, until natural or radioactive decay decreased it, yes.

Q Where does the gas go, the fission gases go, in uranium-aluminum fuel plates like UCLA's?

MS. WOODHEAD: Objection. I think we're beyond the scope of redirect.

MR. HIRSCH: I -- I disagree very much. We've been having testimony about this factor 20, of 20 difference, and the assertion that nothing will come out of a fuel-handling accident in his judgment.

JUDGE FRYE: Yes, I think the -- Mr. Cormier was beyond the scope of redirect, but now that that's in, I think I have to permit this.

THE WITNESS: Okay. I do not think in the fuel matrix of this kind, solid piece of metal, that you would find a -- a gas. I think you would find individual atoms or molecules of the fission fragments.

I think in the ceramic fuels, like power reactors, UO2-type fuels, there are cracks in structures, cracks in micro voids, or whatever else they call them, where these individual atoms can accumulate and produce a gas, but as to what chemical compound or psuedo-chemical compound is formed in the fuel plate, I -- I have no -- I do not know.

BY MR. HIRSCH:

Q Your reading of the Weber and Hirsch article on this matter is -- is that the size of the particle is important in reducing the amount of matrix that's damaged through those reforms?

MS. WOODHEAD: Objection. This is even beyond the scope of the cross examination question.

MR. HIRSCH: I do not believe so again. We have the unfortunate matter of Mr. Cormier raising this. I think I should be able to pursue it if he raised it.

MS. WOODHEAD: The answer the witness gave was that it sounded reasonable; he knew nothing more about it. And I do not believe we can go into documentation to inquire further.

MR. HIRSCH: I'm attempting to understand why he believes it reasonable.

JUDGE FRYE: Yes, I think to that extent it's appropriate. See -- let's see if you can get through this part of it --

MR. HIRSCH: I'll do it quickly --

JUDGE FRYE: Yes.

MR. HIRSCH: -- if the objections are --

THE WITNESS: I -- I just do not know how a atom or molecule of the particular radio iodine, radio iodine compound or krypton or xenon gas -- molecule or atom, now,

not -- not a volume of gas -- can find its way out of a piece of metal if it's embedded, as I think this factor of 20 was -- when I suggested that I understood the reasonableness of it -- if it's embedded in this cladding, then how does it find its way out? I do not know of any mechanism except when you heat it up and diffusion, but diffusion of gases in metals based on my knowledge is very, very slow at room temperatures. And in fact, I'm not even sure you can measure it.

I -- well, I guess you can measure it, but I -- I think it's very, very small.

BY MR. HIRSCH:

Q But we're not talking about diffusion for your recoil analysis, right? That's a surface release.

A Well, in -- in understanding the -- this factor of 20, I think that's where -- what we're talking about now, as I indicated, I believe, yesterday, we used the -- certainly, it appears in Weber and Hirsch and I'm -- that's probably exactly where it came from, and they report that value of the fission fragment range in aluminum, and we made no reference to damage of the fuel matrix. We just said everything from this distance within is going to get out.

Q You did that for conservatism purposes because you do not really know what would happen in terms of the

1 material being released?

2 A Oh, it -- it goes back to diffusion of -- of

3 gas through metal at -- at room temperature. So it's not

4 really a question of -- of not knowing qualitatively. It's

5 a question not knowing quantitatively.

6 Q Okay. One last question on this, and then I'll

7 move on.

8 When you say there's a recoil distance, that's

9 the distance of the fission fragment track?

10 A I would accept that definition based on my know-

11 ledge. Yes.

12 Q If that track is cut, can the fission fragment

13 get out? If a crack occurs along the fission fragment

14 track.

15 A Do you mean if it -- if it encounters a -- a

16 void of some kind?

17 Q If there's a fuel-handling accident which somehow

18 cracks the fuel and cuts it across the fission fragment

19 track, can that molecule get out by that track now being

20 exposed to surface?

21 A Do you mean is -- is there a little tunnel created

22 by which it comes back to surface? Does that mean --

23 Q My question is can it get out by the fission

24 fragment track if that track is open to the surface?

25 A (Pause.) I -- I guess I'd have to say that I --

I may be -- well, most of the time where they look at fission fragment tracks, they have to batch the material to create such a -- a visible track. I -- I do not know if a -- a tunnel or -- or a void-type space were -- extends back from this embedded fragment to -- to the surface. I do not know if that really exists.

Q Okay.

A No.

Q On the matter of X/Q, you were asked by Counsel for the NRC Staff where your .01 was assumed to be in your study, and I'm not sure that an answer was given. At least, I did not hear it. I'd like to ask you again: In your Batelle study, where -- at what distance diameter was X/Q of .01 assumed?

A We assumed it -- simply Mr. Kathren answered in one of his interrogatories, irrespective to distance.

Q But X/Q is indeed dispersed over distance?

A Well, it's a measure of the dispersion from the source to wherever you are taking your measurement. It's -- becomes a measure of how the material has behaved in the atmosphere.

Q But you had no assumption of where this X/Q would appear. You said that would require size-specific measurements or so?

A It would not require site-specific to use a -- some of the models that exist, but we just picked the X/Q which in Mr. Kathren's experience and knowledge and mine was a very high number, high meaning conservative, a very large X/Q.

Q And you were asked the question about this TRIGA estimate. Again, the X/Q from the -- that you used in the TRIGA study was 50 per cent higher than the X/Q used here, and that was at 100 meters down wind?

A I'd have to look at that again, but yes, I -- I think that's what it said in there. It was about 100 meters.

Q So X/Q at .01 would be some distance beyond 100 meters if that other figure is right?

A I -- I guess I'd have to produce an -- you know, an exact situation, you know, the same meteorology --

Q Given the same meteorology.

A Okay, would you repeat the question then?

Q If you have a X/Q of 1.5 times ten minus two at 100 meters, X/Q of 1.0 times ten minus two would occur some distance beyond the hundred meters?

A According to the model, if there's no other factors -- excuse me -- it's just building wake. However, I think if you were to go between your release point and 100 meters and calculate X/Q's and present these to health physicists,

other people who are very knowledgeable in these matters, I do not think they would accept that -- that value either, because the models really have to have a relatively known, or at least based on experiments and parameters that are very well known, that describe this diffusion in a simple fashion.

Q Mr. Hawley, I'm not sure if I'm asking the question. If the X/Q you used in the TRIGA study were correct at 100 meters --

A Well --

Q -- given the same meteorology, would not the X/Q you used in the Argonaut study be at some distance greater than 100 meters?

A I'm sorry. I was thinking of another way to answer your question. Would you repeat that again, please.

Q If the X/Q that you used in the TRIGA study were accurate at 100 meters, would not the X/Q that you used in your Argonaut study occur at some distance greater than 100 meters down wind from the source?

A If you use the mathematics of the equation, then you can produce X/Q's that become very large, and I think that that's -- you know, if you used -- you know, you can use that any fashion you wish, but is it really applicable? Okay. Yes, as you go within a given model or a given calculation, the further you go out in your distance, the smaller

1 the X/Q's become for ground-level releases without any
2 other factors that I -- that I know of.
3 Q And also --
4 JUDGE FRYE: I understand the answer correctly
5 as yes?
6 THE WITNESS: For a -- for a given calculation,
7 yes.
8 JUDGE FRYE: Okay.
9 BY MR. HIRSCH:
10 Q And inversely, if X/Q at .01 occurred at some
11 distance greater than 100 meters, concentrations closer
12 to the reactor, maximum concentrations, would be greater
13 than those assumed in your study?
14 A If you did not have a fact such as building turbu-
15 lance or -- or building wake effects, which as I've indicated
16 tend to reduce such concentrations.
17 Q Is it not true that the standard dispersion models
18 for which the X/Q of .01 is applicable have already con-
19 sidered building wake effects?
20 A I believe that that's a factor that can be applied
21 after you've done the calculation.
22 Q And are there not other factors peculiar to par-
23 ticular locations for in-close dispersion which tend to
24 increase concentrations rather than decrease it, for example,
25 channeling?

1 A It's a very complex situation, enclosed buildings.
2 I do not have tremendous expertise in that area. And it
3 is -- it is a complex situation.
4 Q Is your answer yes, there could be wake effects
5 which increase dispersion --
6 A There -- there --
7 Q -- and yes, there could be channeling which de-
8 creases dispersion?
9 A There could be a lot of effects with which I
10 am not aware of.
11 Q And dispersion from a reactor room into corridors
12 in the same building?
13 A That's way outside what we were describing here.
14 Q Okay.
15 You were asked a question based on your experience
16 with research reactors generally, based on the work you
17 did on the Argonaut study and the TRIGA study whether in
18 your opinion the Argonaut is fail-safe, and I believe your
19 answer was that yes, indeed, you believe it is fail-safe.
20 Is that correct?
21 A I do not know if those are the exact words used,
22 but in essence, yes.
23 Q As to safety margins -- I should preface that.
24 We're here to find out if this facility is safe by a wide
25 margin. In your experience from the reactors you've worked

on, TRIGA --

A Worked -- worked at.

Q Worked at.

A I guess I did do -- I guess I did do a little work on some of them. Okay. Yes.

Q The reactors which you worked at, the TRIGA study you did and the Argonaut study, can you rank those safety margins?

MR. CORMIER: Objection, Your Honor. We're asking for a comparison between the Argonaut and the TRIGA reactor. The TRIGA reactor is outside the scope of this proceeding.

JUDGE FRYE: Yes, I'm inclined to agree on that one, Mr. Hirsch.

MR. HIRSCH: Just for the record, we're going to define safety margins; we need a touchstone. The only case law is the Columbia case, and I think it will be useful for the record to have some touchstone for safety margins -- is why I pursued it.

MR. CORMIER: That goes entirely against the whole purpose of this analysis from day one, which was to examine the Argonaut reactor systematically, as Mr. Hawley said in his Batelle Report. It has nothing to do with comparison with the TRIGA reactor.

MR. HIRSCH: One last point. I'm a little confused on why Counsel for Staff asked him based on his experience

at a non-Argonaut, based on his authoring of a TRIGA study, but for the record, we --

JUDGE FRYE: Well --

MR. HIRSCH: -- do think that comparison is important for the Board to have the information necessary.

THE WITNESS: I -- I think -- excuse me. I think there was some questions about the capabilities of operators and students. I assumed that's why the question was asked, which is why our -- that's just my interpretation, if that helps.

JUDGE FRYE: Mr. Hawley --

MS. WOODHEAD: That's right. That --

JUDGE FRYE: -- let me just ask you a question. How, based on your study of the Argonaut and your experience with the TRIGA, is it? Am I correct?

THE WITNESS: TRIGA, yes.

JUDGE FRYE: Which -- which one do you think is the more safe, if you can answer it?

THE WITNESS: (Pause.) I -- I guess I --

JUDGE FRYE: You may not be able to.

THE WITNESS: I -- I do not think I would really answer that. Ranking would know.

JUDGE FRYE: Okay.

Let's move on.

///

BY MR. HIRSCH:

Q You were asked a question about the Kathren article reference in your study, and if I may, I'd like to make sure we're talking about the same reference.

MS. WOODHEAD: I believe that is the exact title which I read into the record.

MR. HIRSCH: I'd just like to present it to the witness, Your Honor.

THE WITNESS: Yes, it's -- says it's authored by Ron Kathren, and yes, I believe Ron showed me this.

BY MR. HIRSCH:

Q And that's well, one page, those conversion factors?

A The entire article here is on one page, yes. But --

Q And I'm not sure I that I understood the import of -- of Counsel's question. So I want to make clear in that one page, is there consideration of doses for teenager, children or infants?

MS. WOODHEAD: Objection. That's outside the scope of redirect.

MR. CORMIER: And further objection. Counsellor, CBG's representative, has not presented Counsel for the University with a copy of that so we can look at it, see what we're talking about.

JUDGE FRYE: Well, show it -- show it to Counsel.

1 Then I'll permit the question.

2 MR. HIRSCH: As soon as Mr. Hawley's finished

3 looking at it, okay.

4 (Witness examines document.)

5 THE WITNESS: Okay, it said --

6 MR. HIRSCH: Wait -- I -- I'll show it to

7 Mr. Cormier.

8 THE WITNESS: Okay, then, can I -- can get it

9 back when he's finished?

10 MR. HIRSCH: (Affirmative nod.)

11 THE WITNESS: Okay, thank you.

12 (Counsel examines document.)

13 MS. WOODHEAD: We discovered we have another

14 copy. So the witness can have his very own.

15 THE WITNESS: Ready?

16 JUDGE FRYE: Yes, would you answer.

17 THE WITNESS: As is indicated here, the mass

18 of the thyroid, which in my understanding again is the

19 principal difference for the converson factors among the

20 ages of individuals -- it says here the values for the

21 mass -- I'm paraphrasing -- are given in another reference.

22 This is an International Commission on Radiation Protection

23 reference. And without going back to that reference and

24 seeing what values are given and then doing those calculations

25 to produce these numbers, I cannot say for sure what thyroid

he -- he did use, based on what I read here.

I believe that -- that Ron was thinking of an adult thyroid. But -- but based on this -- just based on this, I cannot tell.

BY MR. HIRSCH:

Q Okay.

On this issue of the amount of water necessary to be converted into voids, is it your testimony that five quarts of water over the six boxes needs to be converted into bubbles?

A Bubbles or some form of void.

Q And --

A And bubbles sounds very logical, yes. Yes.

Q And did I understand you to say that it's your understanding that the pipe from which the exit water leaves is out through the plug?

A No. It's my understanding it's out through the fuel box itself.

Q And do you know precisely how much space there is?

A I believe I've already said that I do not have a -- a quantitative answer.

Q Okay.

Do you -- did you review SPERT literature as to the different effect of open tanks and sealed systems?

1 MS. WOODHEAD: Objection. This is beyond the
2 scope of direct. It seems to be relevant, though, to
3 Dr. Luebke's question.
4 JUDGE FRYE: Yes, I think it is. Permitted.
5 THE WITNESS: I'd -- to answer your question,
6 to my knowledge, the closed tank experiments, and I may
7 be confusing BORAX and one of the later SPERTS -- I'm not
8 positive -- were done at -- at pressures, at high temperatures
9 and pressures. Now, I'm sure they did a range, and maybe
10 that little range approximated atmospheric pressure and
11 room temperature. I -- I do not know.
12 But based on my general knowledge of those other
13 tests, they were all at very high -- relative to this type
14 of operation, relatively high temperatures and pressures.
15 MR. HIRSCH: That's our recross.
16 JUDGE LUEBKE: Mr. Hawley, I'd like to get back
17 to the five quarts of water.
18 THE WITNESS: Okay.
19 JUDGE LUEBKE: It's so intriguing. And since it
20 has not been clarified in the redirect, I'm going to assume
21 it's a closed system. If you permit me that, are you familiar
22 with the reactor process on this chugging?
23 THE WITNESS: Yes, I believe that was observed
24 in the BORAX test.
25 JUDGE LUEBKE: And could you conceive -- grant

me the situation that this is a closed system, that you could have chugging in an Argonaut reactor in a power excursion situation?

THE WITNESS: If it is a closed system, then there is no -- I mean, the water cannot escape that system. It can turn into steam, say, in the center regions, force water up through the top. Perhaps these bubbles can collapse. Water can flow back down.

That, I think, describes chugging.

In a situation like that, with a closed system, it seems that if it survived the first chug or first excursion, then it could survive the others until the water ultimately stressed something, leaked out, or --

JUDGE LUEBKE: But would you not say it's a kind of disagreeable operating situation and gets far above the specified 10 -- or this is 100 kilowatt power level? In other words, you -- unless somebody does something, this thing will just keep chugging away.

THE WITNESS: In this type of closed system that I'm envisioning, yes.

JUDGE LUEBKE: Thank you.

MR. HIRSCH: May I follow with one question on that?

JUDGE FRYE: Well, let's -- first -- (Pause.)

MS. WOODHEAD: May I redirect?

REDIRECT EXAMINATION

BY MS. WOODHEAD:

Q Mr. Hawley, is the Argonaut a closed system?

A In my opinion and based on my knowledge, no.

MS. WOODHEAD: Thank you.

No more questions.

JUDGE FRYE: Mr. Hirsch?

FURTHER RECROSS EXAMINATION (RESUMED)

BY MR. HIRSCH:

Q The question that Dr. Luebke asked you about chugging, you indicated that if it survived the first excursion, it should be able to survive the --

A Speaking theoretically here, yes.

Q Well, speaking theoretically, would not the energy release be the sum of the energy release of each excursion?

A Yes, and you know, at some time there would be other effects which would be -- would begin to take effect. Production of xenon poisoning is -- is one. Heating up of the fuel plates --

Q Eventually, the chugging would stop is what you're saying.

A That seems -- you know, given this hypothetical or theoretical situation, yes, it seems likely that eventually, it -- it would. It would stop yes.

Q My question is, however --

A And -- and be -- well, we have to allow for, you know, heat transfer out of it somehow. Otherwise, you know --

Q It melts.

A -- if you -- if you keep producing the energy, you know, you -- ultimately you've used up all the energy and all the uranium atoms, or you've produced sufficient poisons that it -- it dies --

Q I'm not making my question clear. I'm not talking about chugging that goes on for weeks. I'm asking if you have an excursion not sufficient to cause melting but sufficient to cause chugging so that there are two or three additional excursions that follow in short order --

A But -- but then, the water temperature keeps increasing, and I think the magnitude of the succeeding pulses may be decreased. Perhaps eventually, you can turn some of the water into steam at -- at -- at some pressure.

Q I'm still not making my question clear. Is not the amount of heat generated in the plates a function of the energy release through this series of excursions?

A Yes, that sounds reasonable.

Q So that if the first one did not cause melting, though, the second excursion which may add enough energy to cause melting?

A In this theoretical situation, yes, that -- (Pause.)

MR. CORMIER: Judge Frye, you overlooked my one attempt for --

JUDGE FRYE: I'm sorry.

MR. CORMIER: -- cross examination question on Dr. Luebke's question.

RECROSS EXAMINATION (RESUMED)

BY MR. CORMIER:

Q Mr. Hawley, could you explain why the UCLA system would be regarded as an open system?

A Again, based on my knowledge of the structure of the Argonaut core components, it operates at atmospheric pressure, and as changes occur, there are sufficient pathways -- I do not believe that this fuel plug is, you know, welded or that tight of a seal that would allow sufficient pressure, which therefore, I guess, would imply a closed system, to build up. And I'm not positive, but I do believe that the return line or outlet line, at least on the drawings I've seen or illustrations, diagrams, shows that it's -- it's just at about the same level at the water and fuel boxes.

So there is another pathway. And depending on the course or shape of that pipe, it may or may not provide additional pathways. But I believe it does.

And that's my interpretation of what the open -- I mean, why the Argonaut core is -- is open.

JUDGE FRYE: You are speaking of Argonauts generically now, not the --

THE WITNESS: That -- that's correct. It --

JUDGE FRYE: Yes.

THE WITNESS: -- that is generic, yes.

JUDGE LUEBKE: Well, Mr. Hawley, these things are happening in milliseconds. Do you expect water to go around corners in milliseconds?

THE WITNESS: If there -- if this pipe, for example, has water in it, then I would expect that as water is forced in one end, the room would be made for it, and so it could accommodate some -- some volume of water in that time period. Yes, I believe that.

JUDGE LUEBKE: I guess that differs from my impression which is this is sort of a small explosion, and it's going to go straight up.

THE WITNESS: I -- I guess if it's -- exhibits a certain amount of pressure, it would seek whatever opening is -- is available, straight up or sideways or -- (Pause.)

JUDGE FRYE: No further questions from any of the parties?

MS. WOODHEAD: No. No further questions.

JUDGE FRYE: Okay. So then, I take it we're through with Mr. Hawley.

MS. WOODHEAD: Yes. Mr. Hawley would like to

be permanently excused, if that's all right with the Board, and go back to Richland.

MR. HIRSCH: We have our motion still pending -- our motion to strike this testimony, which you suggested we should raise at the end again.

JUDGE FRYE: Okay.

MR. HIRSCH: Which we would like to.

JUDGE FRYE: And I would like to -- to deal with that, I think, in -- in writing, and probably in the decision would be the appropriate time to do it.

MR. HIRSCH: Excuse me. Do you -- do you want our motion in writing? Is that --

JUDGE FRYE: No, no, I would like to. I do not think you need to make it in writing unless you want to more fully elaborate it.

MR. HIRSCH: Just to make sure that we made the motions that we made --

JUDGE FRYE: Yes.

MR. HIRSCH: -- at the beginning and particularly in light of the testimony that followed.

JUDGE FRYE: Yes.

Fine. Well, Mr. Hawley, thank you very much.

THE WITNESS: You're welcome.

JUDGE FRYE: I appreciate you being here.

(Whereupon, the witness was excused.)

JUDGE FRYE: Before we break for lunch, you have three more witnesses, Ms. Woodhead, is it?

MS. WOODHEAD: That's correct.

JUDGE FRYE: What are the -- in light of the fact that we're now through with Mr. Hawley's testimony -- have any time prognostications for the remaining three?

MR. HIRSCH: I dislike making estimates that may be in error. But I think you'll be home early.

JUDGE FRYE: I would like to be able to cancel the room at the Hilton if --

MR. HIRSCH: No problem.

JUDGE FRYE: Okay. We shall do that then, and -- and make the appropriate changes. And we will not plan to have a Saturday session in that event.

Why do we not break for lunch and come back at about 1:20.

(Whereupon, at 12:05 p.m., proceedings in the above-entitled matter were recessed for lunch, to reconvene at 1:20 p.m. that same day.)

A F T E R N O O N S E S S I O N

(1:30 p.m.)

JUDGE FRYE: On the record.

I guess we're ready for your next witness, Mr. Neogy.

MS. WOODHEAD: All right. Staff calls Dr. Partha Neogy to be sworn.

Whereupon,

PARTHA NEOGY

was called as a witness herein, and after being first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MS. WOODHEAD:

Q Dr. Neogy, would you state your name and your place of employment for the record.

A My name is Dr. Neogy. I work for the Department of Nuclear Energy at Brookhaven National Lab. Excuse me.

Q Dr. Neogy, I'm going to hand you a document entitled, the "Testimony of Parthy Neogy," which is four pages long, and attached to which is a statement of professional qualifications.

(Document proffered.)

Would you examine this document and tell me if this is the document which you prepared.

A It is.

Q And are those your professional qualifications attached?

A They are.

Q Do you have any additions or corrections that you wish to make to your testimony?

A I do not.

Q Or to your statement of professional qualifications?

A I do not.

Q Dr. Neogy, is your testimony and your statement of professional qualifications true and correct to the best of your knowledge?

A They are.

MS. WOODHEAD: At this time, Staff moves that the Testimony of Dr. Partha Neogy be incorporated into the record as if read.

JUDGE FRYE: Any objections?

MR. HIRSCH: No objection.

JUDGE FRYE: Mr. Cormier?

MR. CORMIER: No objection.

JUDGE FRYE: Fine. It will be incorporated in the record.

(The Testimony of Partha Neogy and attached Statement of Professional Qualifications follows:)

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
THE REGENTS OF THE UNIVERSITY OF CALIFORNIA	)	Docket No. 50-142
	)	
(UCLA Research Reactor)	)	(Proposed Renewal of Facility License)

TESTIMONY OF PARTHA NEOGY

Q.1. Please state your name and place of employment.

A.1. My name is Partha Neogy. I am employed by Brookhaven National Laboratory (BNL) as a staff scientist in the Department of Nuclear Energy. A statement of my professional qualifications is attached to my testimony.

Q.2. What is the purpose of your testimony?

A.2. The purpose of my testimony is to explain and clarify the bases and methods used in the analysis I performed and reported in the BNL Memorandum to J.F. Carew, dated November 3, 1981 titled "Transient Analysis of the UCLA Argonaut" which I hereby adopt as my testimony.

Q.3. Please explain why you chose $3.00 reactivity insertion for your analysis.

A.3. The choice of a positive reactivity insertion rate of $3.00 in .25 seconds was provided by NRC staff based on a conservative estimate

for an incident at UCLA such as a strong neutron absorber falling out of the reactor core under gravity.

Q.4. Does the use of clad temperature rather than the peak meat temperature lead to non-conservatism?

A.4. The RETRAN code provides the fuel center line temperature as well as the clad surface temperature at the hot spot at all time steps. The maximum values of these two temperatures differed by less than 1°F. The use of peak clad temperature rather than the peak meat temperature does not, therefore, lead to non-conservatism.

Q.5. Is not the utilization of a computer code (RETRAN), designed to model LOCAs and other transients for BWRs and PWRs, for analysis of reactivity accidents in small research reactors of unproven validity?

A.5. RETRAN is a modern flexible and versatile systems transient code. It has been successfully applied, apart from power reactors, to many diverse systems such as the Semiscale and LOFT experimental facilities and the General Electric Two-Loop Test Apparatus (TLTA); and to a number of separate effect experiments on pressure drop, heat transfer, critical flow and multi-dimensional flow. In an analysis of the Standard Problem 8, as performed by Energy Incorporated using the RETRAN model for Semiscale Test S-06-3, the predicted maximum value of the cladding temperature was within 40°F of the measured value of 1614°F. The system pressure was predicted within 2% of the measured pressure during the first 10 seconds of

the transient. These numbers are typical of the accuracy of prediction achieved with the RETRAN code. The point kinetics neutronics model used in RETRAN has, in fact, better validity for a small, tightly-coupled core such as that of SPERT or Argonaut than for a large, modern light water reactor.

Q.6. Does not the use of an adjusted LAMBDA constitute little more than a "fudge factor?"

A.6. LAMBDA in RETRAN is an input parameter determining the magnitude of a well-defined physical quantity, namely, the fraction of the heat flux utilized in producing subcooled voids. It is not a "fudge factor." The value of LAMBDA used in our analysis corresponds to a value of 0.18% for this fraction. In an earlier analysis of the SPERT transients, Sastre and Kouts used values of 0.2% and 0.5% for this fraction and found that the peak core power is altered by less than 5% for a variation of a factor of 2.5 in this parameter. Our independent determination of this parameter is therefore in good agreement with the previous determination by Sastre and Kouts.

Q.7. What are the bases for the void coefficient, prompt neutron lifetime and delayed neutron fraction used in the analysis?

A.7. The void coefficient used in the analysis, -0.18% delta k/k/% density change is a measured value supplied to the NRC staff by UCLA. The prompt neutron lifetime used, 18. 8×10^{-5} seconds, is the value computed for the UCLA Argonaut by C. Marotta using the KENO code. The effective delayed neutron fraction, B_{eff}, is known to lie

between .0068 and .0074. A value of .00714 used in the present and earlier analyses of the SPERT transient, lies well within this range and was used in the analysis of the Argonaut transient also. The results of the analysis are not sensitively dependent on small variations in the delayed neutron fraction because the reactivity insertion rate was expressed in $/second.

References

1. C. Sastre and H. Kouts, "Computations of SPERT III Transients" in Reactor Kinetics and Control, Lynn E. Weaver, coordinator, April 1964.

PROFESSIONAL QUALIFCATIONS OF DR. PARTHA NEOGY

1980 - Present:	Staff Scientist with the Department of Nuclear Energy, Brookhaven National Laboratory, specializing in Reactor Physics and Reactor Safety Analyses.
1976-80:	Engineer and Senior Engineer with the Nuclear Engineering Division of American Electric Power Service Corporation, specializing in fuel management, core follow, and power distribution and control analyses.
1972-75	Scientific Officer, Variable Energy Cyclotron Project, Bhabha Atomic Research Centre of the Department of Atomic Energy, India.
1970-72	Lecturer, Saha Institute of Nuclear Physics, Calcutta, India.
1966-70	Graduate Research Fellow at the Tandem Accelerator Laboratory of the University of Pennsylvania, Philadelphia. Awarded Ph.D. in physics in 1970 for 'A Study of the $^{21}Ne(d,p)^{22}Ne$ and $^{18}O(^{7}Li,t)$ ^{22}Ne Reactions and the Nuclear Structure of ^{22}Ne'.
1965-66	Graduate Teaching Assistant at the Department of Physics University of Pennsylvania.
1963-64	Post-M.Sc. Fellow at the Saha Institute of Nuclear Physics, Calcutta. Awarded the Post-M.Sc. Diploma of the Institute in 1965.
1961-63	Post Graduate Student at the Calcutta University. Awarded a First Class Master's Degree in Physics in 1964.
1959-61	Graduate Student in Science at the Calcutta University. Awarded a First Class Bachelor's Degree in Science with Physics Honours and the M.M. Roy Medal of the Calcutta University in 1962.

1 BY MS. WOODHEAD:

2 Q Dr. Neogy, I'm handing you a document entitled,
3 "Brookhaven National Labor Memorandum, Subject: Transient
4 Analysis of the UCLA Argonaut." Would you examine this
5 document and state whether this is the document that you
6 prepared?

7 (Document proffered.)

8 A It is.

9 Q And are the contents of this document true and
10 correct to the best of your knowledge and belief?

11 A They are.

12 MS. WOODHEAD: Staff would submit the Brookhaven
13 Memorandum entitled, "Transient Analysis of the UCLA Argonaut"
14 as Staff Exhibit No. 3.

15 (The document referred to
16 was marked for identification
17 as Staff Exhibit No. 3.)

18 JUDGE FRYE: Are you offering it in -- in evidence?

19 MS. WOODHEAD: I'm offering it into evidence,
20 yes.

21 JUDGE FRYE: Any objections?

22 MR. HIRSCH: No objections.

23 MR. CORMIER: No objection.

24 JUDGE FRYE: Fine. Staff Exhibit 3 will then
25 be admitted.

(The document referred to was received in evidence as Staff Exhibit 3.)

BY MS. WOODHEAD:

Q Dr. Neogy, I'm going to hand you a document entitled, "Computations of SPERT-III Transients," authoried by C. Sastre and H. Kouts.

(Document proffered.)

Would you examine this document and tell me if this document is referenced by your testimony.

A It is.

MS. WOODHEAD: At this time, Mr. Chairman, the Staff offers into evidence for identification only, the article entitled "Computations of SPERT-III Transients."

JUDGE FRYE: Identification only?

MS. WOODHEAD: Correct.

(The document referred to was marked for identification as Staff Exhibit 4.)

MS. WOODHEAD: Staff has previously distributed the copies of the exhibits and the testimony of Dr. Neogy to the Board parties and has provided the Court Reporter with sufficient copies so the --

JUDGE FRYE: Good.

MS. WOODHEAD: At this time the Staff witness

is available for cross examination.

MR. CORMIER: No questions.

JUDGE FRYE: No questions.

Mr. Hirsch?

CROSS EXAMINATION

BY MR. HIRSCH:

Q Dr. Neogy, I'd like to begin with a couple of questions about the RETRAN code, if I might. I turn you to page five of the evaluation of Transient Behavior of Argonaut Reactors, and to reference III.

(Document proffered.)

Is Reference III the source for the program that you used for this analysis?

A Yes, it is.

Q Is it -- am I -- is it correctly identified in that Reference III, the EPRI numbers and the date?

A As far as I know, yes.

Q Are you familiar with an EPRI publication, MP-408 entitled, "RETRAN, a Program for One-Dimensional Transient Thermal Hydraulic Analysis of Complex Fluid Flow Systems," dated January 1977?

A I believe so. I'll have to take a look at the document before I can say it, but I definitely do.

Q If --

(Document proffered.)

BY MR. HIRSCH:

Q Is this the version -- these are only a few pages -- but is this from the version of the RETRAN code that you used?

A No, but could I clarify something?

Q I'd appreciate it. Maybe if I can ask -- give a foundation for my question so that it can be clarified.

If I were to tell you that the document you have listed as Reference III cannot be located in nuclear science abstracts or energy abstracts and the EPRI's library is unaware of its existence, could you explain such a potentiality?

A Perhaps I could. I'll try.

When EPRI documents or codes such as RETRAN -- usually two sets of documents are put out: one for general release, and I believe EPRI NP408 is the one for general release. The other set of codes which are in the form of manuals, hard-bound cover, are released with a copy of the magnetic tape that goes -- that contains the program. And that is the document that are referenced here.

Essentially the same set of documents, different numbers. It's -- it's a policy that EPRI follows.

Q And so this Reference III might not be listed in the nuclear science abstracts or energy abstracts, and the EPRI library might not have a record of it.

A I -- I do not know that for a fact. So I would

not like to comment on that.

Q Okay.

But it is your understanding that this NP version is the same, then, as the version you used?

A As far as I know, yes.

Q Okay.

I'd like to ask a couple of questions about the philosophy of RETRAN, if I may. And I call your attention to this -- the forward in the material presented to you. And the -- would like you to read the first two sentences, if you would, in that forward to us.

A The first two sentences read:

"The RETRAN computer program described in this report is the result of an extensive co-development effort sponsored by the Electric Power Research Institute over the last three years. The effort was initiated as RP342 in response to the utility need for a more realistic appraisal of the blow-down phase of the design basis loss of coolant accident."

Q Is it your understanding that that developmental history relates also to the RETRAN code that you used?

A I would think so, yes.

Q And when it says that it was developed in response to the utility need for a more realistic appraisal of design basis loss of coolant accidents, do you understand that to mean realistic as opposed to conservative in the sense those terms are used in nuclear safety analysis?

A No. By "realistic," I mean more realistic in the -- in the -- well, a better set of calculations, or a better set of models. That's what I understand --

Q I see.

A -- by the word "realistic."

Q Did RETRAN come out of the Relap series of codes?

A I believe so, yes.

Q Relap-four or Relap-five?

A (Pause.) I'm not sure. It -- it -- I will not know the answer to that question.

Q Do you know if the Relap codes have been revised since the production of RETRAN?

A By Relab codes, which -- which version do you mean?

Q Either Relap-four or Relap-five.

A The answer to the question is I do not know.

Q And the next page, iv, could you read the -- that last paragraph.

A The entire paragraph?

Q If you would, because I'd like to ask you about

1 it.

2 A The last paragraph reads:

3 "The RETRAN code is currently undergoing

4 verification by the EPRI/Utility System Analysis

5 Working Group through pre-release concept.

6 There are approximately 16 utilities

7 participating in the pre-release working

8 group. The purpose is to develop a

9 verified version of RETRAN which can be

10 used with confidence by the Utility Industry.

11 Verification of RETRAN will involve using

12 a pre-release version of RETRAN and comparing

13 it against measured data and calculations.

14 To accomplish these comparisons, a comprehensive

15 test matrix has been developed, and the

16 various components of the matrix will be

17 completed with the participating utilities.

18 The results of the previous verification

19 will be documented by EPRI as Volume 4,

20 described above."

21 Q My question to you is was the version that you

22 used of RETRAN that you say you believe is the same as

23 this that pre-release version of RETRAN?

24 A It's sort of a yes or no answer. Could I explain?

25 Q Please.

1 A When EPRI sends a code to a licensee or a national
2 laboratory, any changes that are made to the code always
3 are communicated to the users. And the basic code was
4 the one that I had reference in -- in my memorandum as
5 Reference III. This code was updated when and as the changes
6 were received at Brookhaven.
7 Q So the version that you used was an updated version?
8 A Yes.
9 Q And when it says that there -- the RETRAN code
10 was undergoing verification, can you describe what verification
11 was done of those aspects of the RETRAN code that you relied
12 on for your power excursion modeling.
13 And if you want to refer to your written testimony,
14 that's fine.
15 A I -- I cannot -- could not give you a complete
16 and comprehensive answer right now. But I think a partial
17 answer to that question would be found as Answer 5 in my
18 written testimony.
19 Q Do any of the applications of RETRAN mentioned
20 in Answer 5 deal with power excursion modeling for non-
21 power reactors?
22 A You mean for neutronic power rather than electrical
23 power?
24 Q What I mean, power excursion in terms of reactivity
25 actions.

A Mmm-hmm. The answer is no.

Q Was the RETRAN code originally designed to model power excursion reactivity accidents for non-power reactors?

A The RETRAN code was not designed exclusively to do that, if that is your question. But it has the capability of designing power excursions in non-power reactors.

Q Is your use of it for modeling power excursions in a non-power reactor the first application of which you were aware of the RETRAN code for such a purpose?

A Of which I am aware, yes.

Q I turn you now to the next page in that, which is an astract for RETRAN code and ask you to read the first two sentences. It should say, "Abstract" -- it's -- I'm sorry.

A The first two sentences in the abstract read:

"RETRAN are present in new computer code approach for analyzing the tunnel hydraulic response of nuclear steam supply systems, to hypothetical loss of coolant accidents and operation of transients. In contrast to conservative approach, RETRAN provides best estimate solutions to hypothetical lookers (ph.) in operation of transients."

Q I ask you what your understanding is of the assertion that RETRAN provides best estimate solutions in contrast

1 to the "conservative" approach.

2 A I think it's fairly obvious. I really would --

3 it refers to state of the art models.

4 Q As opposed to conservative models?

5 A And older models, yes.

6 Q To model a power excursion at a non-power reactor,

7 is it correct that you utilized a computer model because

8 power excursions are a complex phenomena which require

9 relatively sophisticated modeling to predict consequences

10 from?

11 A I would agree with that.

12 Q And the computer, thus, has in it the analytical

13 method, and the user thus plugs in values into the computer

14 code to obtain the results?

15 A Yes.

16 Q And the results thus are dependent on the validity

17 of the model, is that correct?

18 A Yes.

19 Q And the accuracy of the input numbers?

20 A Yes.

21 Q And your testimony is that in Answer 7 on page 3 --

22 that your source for the void coefficient was a value supplied

23 to NRC Staff by UCLA?

24 A Yes.

25 Q And if that the true value were lower than that,

are you able to determine without rewriting the computer program what the effect quantitatively would be on your final temperature?

A You have to specify how much lower, and all I would be able to offer is in -- is an educated guess.

Q To get a more accurate number, you would have to plug a different void coefficient into your computer model?

A Yes.

Q And the same would be true if a different prompt neutron lifetime were used?

A Yes.

Q And a different beta effective?

A Yes.

Q Have you compared the values you used listed in A7 to other values recorded for the UCLA reactor?

A Reported where?

Q In the application, for example? The Application for License Renewal. Sorry.

A Let me check that.

Is that the same as the UCLA Final Safety Analysis Report for License Renewal?

Q Does it contain three charts with core parameter data?

A Yes, it does.

Q So you did review --

A Yes.

Q -- those sheets?

A I did.

Q And is not the void coefficient listed on that last chart smaller than the figure you used listed in A7?

A You mean the column listed 1980?

Q Correct.

A And the number 90.164 per cent rule, or per cent void?

Q Right. Is not that value lower than the value you used -- smaller, excuse me.

A In magnitude, yes.

Q Which would be the more conservative value to use?

A To -- number listed in the column marked "1980."

Q Of the application?

A Yes.

Q And the prompt neutron lifetime that you used -- would you make the same comparison with the 1960 column?

A Yes. The prompt neutron lifetime that are used is larger than the value listed in column under 1960, 1.14 minus four second.

Q Which would be the more conservative value?

A The number given in column marked 1960.

Q And one more question along this line: The value for beta that you used was .007.4?

A Yes.

Q And again on that chart, if you would, that you were looking at, the value of beta provided in the application?

A Which column do you want me to look at?

Q Nineteen-eighty.

A Yes.

Q And which value -- what is the value that you see there?

A Point-zero-zero-six-five.

Q And which would be the more conservative value?

A It's not obvious to me which one would be.

Q Okay. To -- and again, to determine the effect of using different values would require rerunning the program?

A No.

Q Excuse me?

A I said no.

Q You would not need to rerun the program to --

A I guess I would like you to define determining the effects.

Q Oh, I'm sorry.

A To be able to come up with a temperature rise estimate for power excursion at UCLA Argonaut, using not the input numbers you used in your program, but using other

values, such as the ones we've just discussed, to come up with a quantitative number, would that not require re-running the code?

A To come up with an exact evaluation, yes.

Q And if one were to assume that the insertion did not occur in .25 seconds but was more rapid, would that also to accurately and quantitatively estimate the effect require rerunning the code?

A True.

MR. HIRSCH: We're finished with cross.

JUDGE LUEBKE: Mr. Neogy, I'm looking at your written testimony prefiled, November 23rd Transient Analysis of the UCLA Argonaut.

THE WITNESS: Yes.

JUDGE LUEBKE: In the first sentence there we find the word "ramp," R-A-M-P.

THE WITNESS: Yes.

JUDGE LUEBKE: It has always been my understanding in the trade that that word meant in connection with reactivity effects that would be sudden, instantaneous change and not a change which takes a quarter of a second. So I would say from my previous knowledge of reactor calculations, this would be a mischaracterization.

THE WITNESS: I -- I -- excuse me, Judge Luebke, I do not agree with that.

JUDGE LUEBKE: You do not agree with that?

THE WITNESS: No.

JUDGE LUEBKE: To you a ramp is 20 -- happens in 25 seconds?

THE WITNESS: No. Ramp is something that goes up linearly with time.

JUDGE LUEBKE: That is your definition?

THE WITNESS: That's what I understand it to be.

JUDGE LUEBKE: I was looking at some of the diagrams in the back of your testimony of the power plant, and the answer to Question 3 of your prepared testimony says something about that the .25 seconds comes from an incident of a strong neutron absorber falling out of the reactor core. Are you familiar enough with the reactor to know there is a vertical test hole from the bottom it can fall out of?

THE WITNESS: No. I -- before doing this calculation, I discussed the reactor with the insertion rate with the NRC Staff and with Dr. Ostrander of UCLA.

JUDGE LUEBKE: But you did not learn anything about a vertical test hole that's out of the bottom that something can fall out of?

THE WITNESS: I -- I did not ask for that information.

JUDGE LUEBKE: Now, in doing computer code calculations, it's sometimes customary to do variance calculations. Did you do any variance calculations in this case?

THE WITNESS: Could you please explain what you mean by that?

JUDGE LUEBKE: Oh, specifically, you might look at the problem as given to you that .25 seconds is a long time, and you might get -- that's 250 milliseconds -- and you might get curious all by yourself as to how it would look if were point -- if it were 25 milliseconds or 10 milliseconds. So that would be a variance in the time of the transfer.

THE WITNESS: Yes. I think you're saying did I study the sensitivity of my results to various parameters.

JUDGE LUEBKE: Correct.

THE WITNESS: And the answer is no.

JUDGE LUEBKE: That's all I have.

JUDGE BRIGHT: Dr. Neogy, the inclusion of this Sastre and Kouts Computations of SPERT-III Transients -- I am making an assumption -- is it fair to say that this was included merely as a demonstration of how the RETRAN code can be used?

I mean what I'm trying to get at is this has no direct application to the UCLA reactor as such, or does it?

1 THE WITNESS: No. Its obligation is to my cal-
2 culation of the SPERT transient that I did, using the RETRAN
3 code.
4 JUDGE BRIGHT: Okay. So it would be fair to
5 say that this was trying to demonstrate that the code could
6 translate from one reactor to another using the proper
7 variables?
8 THE WITNESS: Perhaps I should explain something.
9 Sastre and Kouts did not use the RETRAN code in their analysis,
10 but they used a certain parameter: the fraction of the
11 heat flux utilized in producing sub-cone (ph.) boiling,
12 and the value of that parameter is close to the value of
13 the parameter that I used in my analysis, and I was presenting
14 the people with Sastre and Kouts mainly as evidence of
15 that.
16 JUDGE BRIGHT: So it only had to do with that
17 particular parameter, coefficient, whatever you want to
18 call it.
19 THE WITNESS: Yes.
20 JUDGE BRIGHT: Well, I was a little puzzled because
21 the SPERT-III cores were not aluminum cores even, as I
22 recall them, and I just wanted to find out what -- what
23 this was doing here, really.
24 That's all I have.
25 JUDGE FRYE: Ms. Woodhead, redirect.

REDIRECT EXAMINATION

BY MS. WOODHEAD:

Q If you would go back to the different data in the UCLA application which Mr. Hirsch pointed out to you and review those.

A Yes, I've got it now.

Q Can you tell me what the differences there that you see between those and the data for the numbers used in your study would make to your ultimate conclusion.

MR. HIRSCH: Objection. Dr. Neogy testified that to know quantitatively, he would have to redo the computer program. I think to ask for guesses on such an important matter would -- I think we've had too many guesses already in this record.

JUDGE FRYE: Well, I think we can probably accept that, with the understand that he has previously testified, but in order to know accurately, he would have to redo the computer program.

THE WITNESS: When I choose the set of parameters that I did for doing the calculations, I was aware of the other set of parameters that existed. I believe that the set of parameters that I chose were the best available. And the differences between the values of the parameters that I chose and the values listed in either of these two columns are sufficiently small to have really no impact

on my conclusions.

Q All right.

Can you explain what the term "ramp insertion" means and -- and the relation of that to one of a more of a -- one of instantaneous insertion.

A Well, I believe a ramp is an incline, something that goes up linearly, either with distance or with time. And in this case since the reactivity inserted went up linearly from zero to three dollars in .25 seconds, I thought a ramp insertion was the proper and the best description for the insertion of the reactivity.

Q And how did you happen to choose a ramp insertion rather than an instantaneous insertion for your study?

A I think I mentioned this before -- I discussed with the NRC Staff and with UCLA on what would be a proper reactivity insertion to study, and the suggestion was that this would be a proper one to look at.

Q Could you clarify what you mean by "proper," a proper reactivity insertion to study. What do you mean by that?

A The conservative estimate of the maximum reactivity that could be introduced into the reactor core.

Q Yes, you're referring now, I believe, to your choice of three dollars.

A That's right.

Q Is that correct?

A That's right.

Q My question is why did you believe after discussing the hypothetical accident with Staff and with UCLA -- why did you happen to choose a ramp insertion rather than an instantaneous insertion?

A Let me refer to a page in the Brookhaven study. Page five --

Q Pardon me?

A Page five of the Brookhaven study.

Q All right.

A Second paragraph. And let me read this:

"The transient studied was a ramp insertion of three dollars of reactivity in .25 seconds. The postulated incident is that of a strong neutron absorber such as a cadmium sleeve falling out of a reactor core under gravity."

I think that probably answers your question.

Q Well, no, because my term -- my -- my question is -- let me rephrase this.

Is it not true that the hypothetical accident and its parameters was described by a member of the NRC Staff? In other words, this -- this hypothetical as to ramp insertion and the particular dollar value was established

for you by the Staff, and this was not your own idea.

A I do not know whether it was established by the Staff or it was suggested by Dr. Ostrander of UCLA. But NRC Staff was aware of this particular reactivity characteristic being used in my calculation.

Q All right. Thank you.

MS. WOODHEAD: If I could have one moment, please?

(Pause.)

MS. WOODHEAD: Staff has no more questions.

JUDGE FRYE: Any recross?

MR. CORMIER: One question.

RECROSS EXAMINATION

BY MR. COPMIER:

Q Dr. Neogy, you heard Dr. Luebke describe an instantaneous insertion of reactivity. I've heard the expression "step insertion." Is -- can you explain that and the distinction between step and ramp?

A Yes. A step insertion or the step function is a function that changes its value instanteously. And a ramp insertion is something that changes its value gradually.

MR. CORMIER: Thank you.

JUDGE FRYE: Mr. Hirsch?

MR. HIRSCH: No questions.

JUDGE FRYE: No questions.

MR. HIRSCH: No more questions.

JUDGE FRYE: Dr. Neogy, thank you very much for being with us. Appreciate you being here.

(Whereupon, the witness was excused.)

JUDGE FRYE: Are we prepared now to go with Dr. Cort?

MS. WOODHEAD: Yes, I would like to -- the Staff would now call Mr. Edward Cort to the stand to be sworn.

MR. CORMIER: Judge Frye?

JUDGE FRYE: Yes?

MR. CORMIER: Could I ask for a five-minute recess?

JUDGE FRYE: Fine. Good point to take a short break.

(Whereupon, a five-minute recess was taken.)

JUDGE FRYE: Shall we go back on the record, please.

I see Dr. Cort is at the stand.

MS. WOODHEAD: Yes, and he has not yet been sworn. Whereupon,

GEORGE EDWARD CORT

was called as a witness herein, and after being first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MS. WOODHEAD:

Q Mr. Cort, will you state your name and your place of employment for the record, please.

A My name is George Edward Cort. I am employed with Los Alamos National Laboratory.

Q I am going to hand you a document of 14 pages entitled, the "Testimony of G. Edward Cort," attached to which is a three-page statement of professional qualifications, and I ask you if you prepared these two documents.

(Documents proffered.)

A Yes, I did.

Q Are there any additions or corrections you wish to make to your testimony or to your statement of professional qualifications?

A No.

Q Are these -- is your testimony and the statement of professional qualifications true and correct to the best of your knowledge and belief?

A Yes.

MS. WOODHEAD: At this time the Staff moves that the testimony and professional qualifications of Mr. Cort be incorporated into the record as if read.

JUDGE FRYE: Any objections?

MR. HIRSCH: No objections.

MR. CORMIER: No objections.

JUDGE FRYE: Fine. It will be incorporated into the record.

(The Testimony of G. Edward Cort and attached

1 Statement of Professional Qualifications follows:)

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
THE REGENTS OF THE UNIVERSITY OF CALIFORNIA	)	Docket No. 50-142
	)	
	)	(Proposed Renewal of Facility License)
(UCLA Research Reactor)	)	

TESTIMONY OF G. EDWARD CORT

Q.1. Please state your name and place of employment.

A.1. My name is G. Edward Cort. I am employed by the Los Alamos National Laboratory (LANL) in the Design Engineering Division's Technical Engineering Support Group. A statement of my professional qualifications is attached.

Q.2. Please explain your professional responsibilities and activities at Los Alamos National Laboratory.

A.2. I am the Associate Group Leader for Engineering Analysis in the group named above and have responsibility for supervising and carrying out various heat transfer, fluid flow and thermodynamic calculations and related design studies that affect many research projects at Los Alamos.

Q.3. Have you had any experience specifically in the study of graphite used in reactors?

A.3. Yes. Before my employment at Los Alamos National Laboratory, I was a senior engineer at the Westinghouse Astronuclear Laboratory where I participated for more than ten years in the successful development of a hydrogen-cooled graphite reactor. Also, more recently, I have carried out heat-transfer and fission product release calculations for a graphite High Temperature Gas Cooled Reactor (HTGR) in a hypothetical loss-of-forced-circulation accident.

Q.4. What is the purpose of your testimony?

A.4. The purpose of my testimony is to explain and clarify the underlying bases of a document I wrote entitled "Fuel Temperatures in an Argonaut Reactor Core Following a Hyopthetical Design Basis Accident," dated June 1981 with the NUREG/CR-2198 Classification.

Q.5. Why did you write this document?

A.5. I wrote the document as a report to NRC Staff of my analysis of the maximum fuel temperatures which could result after an earthquake causing loss of water coolant combined with core crushing in an Argonaut like that at UCLA. The report was written in performance of the contract between NRC and LANL for this analysis. I personally performed the heat transfer analysis in NUREG/CR-2198 and hereby adopt it as my testimony.

Q.6. Please briefly summarize in laymen's terms, the contents of NUREG/CR-2198.

A.6. This analysis was intended to predict the temperatures that will exist in the fuel elements if all of the water were to be drained from the core after it had been operating at full power (100 kW) for a very long time. The long operating time ensures that the quantity of radioactive fission products in the fuel is at the theoretical maximum, thus ensuring maximum possible heat generation and maximum fuel temperatures. The loss of water will ensure that the reactor goes subcritical, and so the only source of heat is the decay of these fission products (or "decay heat"). Because of the loss of water, the fuel and surrounding structure will heat up at a rate that depends on their mass and specific heat capacity (a fundamental physical property), as well as the decay heating rate. As the temperatures increase, heat will be lost from the fuel to the surroundings through the combined mechansims of conduction, thermal radiation, and natural convection of the air. The rate of heat loss will increase, and the heating from the fission products will decrease. At some time during the transient, the heat loss from the fuel will exactly balance the decay heat from the fission products, and the fuel temperatures will therefore pass through a maximum and then decrease.

This transient heat-up was calculated with conservative assumptions for the Argonaut using an existing two-dimensional

computer program. Various assumptions were made about the extent of crushing of the fuel and the presence or absence of buoyancy-generated air flow through the core. In all cases, it was assumed that the conduction heat loss from the fuel can occur only in the two most difficult directions: vertically where the distance that heat must be conducted from the fuel to the surroundings is long and perpendicular to the fuel plates where successive layers of low-conductivity air between the fuel plates inhibit heat transfer. No heat was allowed to be lost from the edges of the fuel plates, which is a relatively short and easy conduction path.

In these various cases, the hottest fuel temperatures were reached when the air flow was assumed to be entirely blocked. No mechanism was postulated to seal off the air completely; it is merely a conservative extreme.

Likewise, when the fuel assemblies are not crushed, the volume of low-conductivity air to inhibit heat conduction between the layers of fuel plates is at a maximum, and the heat transfer from the center of the fuel is more difficult than when the core is crushed.

Therefore, as expected, the calculations showed that the peak fuel temperature during the transient is highest when it is assumed that the fuel is uncrushed and the air flow is simul-

taneously blocked. For these conditions, the fuel plates reach their maximum temperature of 631 K (358°C) or about 300°C less than the melting point. All other cases with various degrees of crushing and with or without air circulation resulted in lower calculated temperatures.

Q.7. Briefly explain the scientific reliability of your analysis in terms of methodology and conservatisms.

A.7. I believe I have included most of the conservatisms in the answer to the previous question. There are basically three ways that the reliability of the analysis might be adversely affected (but are not).

a. The basic physical phenomena that occur might not be included in the model (or vice versa).

b. The behavior of these phenomena could be translated incorrectly into computer statements.

c. The details of the particular problem such as physical dimensions and material properties could be incorrectly specified or put into the computer.

While there never can be absolute guarantees when human beings are involved, there are many ways in which confidence in the conclusions from an analysis can be certified as accurate.

For example, one could carry out tests, conduct a similar analysis by a different individual using a different computer program, or conduct a peer review wherein many technically competent individuals study the methods and the results and attempt to validate or find flaws in it. Often, one attempts to place bounds on the result by doing conservative analyses. For example, I could state that "the fuel temperatures can be no higher than so many degrees centigrade because I have not allowed the air to move in the analysis model, even though we know that it will." Sometimes, the general public is confused by this approach, tending to view the conservative analysis as being what is actually expected. This is, of course, not at all the correct understanding of the objective of a conservative, theoretical analysis. The computer program I used for my heat transfer analysis (Ref. 2 of NUREG/CR-2198) has been in use at Los Alamos and other places for 10 years to solve many different kinds of heat-transfer problems without any questions of invalidity by the users.

Q.8. Did you consider any accumulated adverse effects from irradiation on the thermal conductivity of the reactor fuel or graphite reflector in your analysis?

A.8. I did not consider reduction in thermal conductivity in the fuel or graphite due to irradiation because it would not affect the fuel temperatures significantly.

Q.9. Why?

A.9. The major mechanism for heat transfer from the fuel, moving heat by a moving fluid (gas or liquid) is convection airflow through (or around) the fuel elements. This is shown clearly in Fig. 4 of my report NUREG/CR-2198. Although it is not explained in the report, it should be obvious that crushing the fuel elements will not block off all of the airflow that can cool them. This assumption was made in the analysis only as a limiting case to see the worst that could possibly happen, however remote. Any air that circulates between the fuel elements themselves, the fuel elements and the fuel boxes, or the fuel boxes and the graphite will be effective. As an analogy, the air flow after core crushing would exist to some extent in the same way one discovers in attempting to make a perfect seal when calking the cracks in a drafty window. In a reactor that has been damaged by an earthquake with channels for coolant flow built into the design, it is inconceivable that significant air passages would not be present. In fact, it is much more likely that the airflow would be greater in a damaged core than in an undamaged one. Therefore, the effect of irradiation on the graphite is not important since air circulation alone would prevent fuel temperatures from rising significantly.

Q.10. What significance would irradiation effects on the graphite in an Argonaut have if there were no air flow?

A.10. If it were assumed that through some mechanism, all of the airflow through the pile of rubble or the undamaged fuel is completely blocked in order to eliminate air convection entirely, it would also be necessary to suspend the laws of physics to prevent the air from circulating in a closed loop from the hotter regions to the cold ones and back again. One or the other of two situations must exist. Either there are passages within the damaged materials so that the air can circulate or the passages are so tightly restricted that the fuel is in close physical contact with the graphite. Graphite, even when irradiated, is one of the most effective heat absorbers known. It is used, for example, in re-entry nose cones for missiles, where it must endure high heat fluxes, high surface temperatures, and a high flow of a corroding gas. Problems that have occurred in other reactors, such as the Windscale fire, occurred partly because graphite was used in proximity, or actually made part of, the fuel. The situation is very different when it is used as a reflector as is the case in the Argonaut. This is an important difference, because of the greatly reduced fast (high energy) neutron flux (the number of neutrons passing through a given area per unit time) in the reflector.

Q.11. Explain the consideration of graphite in your analysis.

A.11. Some of the analyses described in NUREG/CR-2198 addressed the hypothetical situation in which airflow is completely blocked.

This postulate is extremely conservative in relation to the graphite in the reactor because heat conduction to the graphite was only considered in the direction perpendicular to the fuel plates, where low-conductivity air gaps impede the heat transfer. At the request of NRC we subsequently did another calculation for a 500-kW Argonaut with no airflow, where the heat can flow in both horizontal directions. The results of that study support and verify the conclusions in NUREG/CR-2198. In the study of the 500 kW reactor, which is more realistic for the case of no air flow, the peak fuel temperatures are only 493 K. (220°C) This is a temperature increase of only 193°C from the initial value, rather than over 600°C that would be necessary to cause melting. For a 100-kW Argonaut like UCLA's, the temperature increase would be less than 40°C. The thermal conductivity of the graphite is, of course, important for this calculation, but note that the stagnant air gaps, which are included in this model, have thermal conductivity 5000 times less than that of unirradiated graphite. Even when irradiated so that its thermal conductivity is reduced by a factor of 10, the graphite is still a much better heat conductor than brick, stone, or concrete.

Q.12. Please explain the correlation of irradiation damage with dosage units such as reactor energy, energy generated in adjacent fuel elements, or integrated thermal neutron dose.

A.12. None of these units can be directly related to the total number of atomic displacements (atoms being knocked out of their regular position caused by collisions with the neutrons) that have occurred within the graphite. These dosage units are not useful generally when one tries to compare the damage in different reactors. The irradiation damage is caused by high energy neutrons, whose maximum flux (the number of neutrons passing through a given area per unit time) in the Argonaut is a hundred times less than the thermal (or low energy) flux, as reported in the UCLA application at p. III/6-3. For the same thermal-flux exposure, the actual radiation effects in graphite, which are approximately proportional to the fast flux, will vary greatly depending on the location of the graphite in the reactor. In the reflector of any reactor, including all the graphite in the Argonaut, the fast neutron flux will fall off rapidly with distance from the fuel. This is related to the purpose of the reflector--to convert the fast neutrons, which originate in the fuel, into thermal neutrons that are reflected back into the fuel. For verification of this, one should refer to the book "Nuclear Graphite" by R. E. Nightingale, at pp. 226-227.

Q.13. What is your opinion of the possible reduction of conductivity of graphite in an Argonaut?

A.13. Even though there may be some effect on the graphite's thermal conductivity in a thin layer adjacent to the fuel, the graphite

is still a much better heat conductor than stagnant air. However, the major mechanism for heat removal is air convection and the effects of radiation on the graphite reflector's thermal conductity therefore are not significant.

Q.14. What correlation, if any, is there between the fuel temperatures you describe in your report and Wigner energy in graphite.?

A.14. My report NUREG/CR-2198 states on p. 11 that the maximum graphite temperature for a 500-kW reactor is 340 K (67°C) and the peak fuel temperature corresponding to this is 633 K (360°C). Since the Wigner threshold for graphite is more than 100°C, there is no reason to consider Wigner energy, because none could be released.

Q.15. Are there any other reasons to discount irradiation effects on graphite in relation to your analysis?

A.15. There are many additional conservatisms built into my calculation of maximum fuel temperature that will tend to make the reported maximum temperatures much hotter than they will be in actual fact. In addition to those mentioned previously, I assume, as noted on p. 9 of NUREG/CR-2198, an equilibrium inventory of fission products, the result of operation for a very long time (thousands of continuous hours) rather than the Argonaut's normal five percent (5%) per year operating limitation (438 hours total) that exists. If we say that the reactor only runs continuously for 10 hours at a time, then the inte-

grated decay power in the fuel (over a 2.8-hour period from shutdown) is only about 54 percent of the value I used in my calculation. An additional conservatism in my analysis is omission of the time for the coolant to drain out of the Argonaut. My analysis (p. 9) assumed that all of the water is completely drained in less than 1 second. If it takes 100 seconds for the water to drain, the heating rate in the fuel at the start of the transient will be only 53 percent of the value I used. The net effect is that the actual reactor would have only about 29 percent of the heating that I used at the start of my analysis.

Q.16. Please summarize your reasons for believing your analysis is reliable and credible.

A.16. In summary, the following factors substantiate the reliability of my analysis in NUREG/CR-2198 of the maximum fuel temperature after loss of coolant combined with possible core crushing in an Argonaut.

a. Air flowing through the core caused by natural bouyancy as it is heated and rises is more than sufficient to prevent the fuel from melting, regardless of what happens to the graphite.

b. Although some of my analyses included the worst-case assumption that the airflow is completely blocked, there

is no credible mechanism to accomplish this. Although the fuel elements can be crushed in a building collapse, it takes only one air passage somewhere near the fuel to provide this cooling, and it is difficult to imagine a pile of rubble without significant spaces for air to flow.

c. Even if the air is completely blocked from the outside, air can still circulate in a closed loop through the coolant ducts and/or the rubble pile to cool the fuel.

d. If, nevertheless, it is assumed that the air is prevented from contacting the fuel this necessarily implies that the fuel elements are in contact with the graphite which (when it is highly irradiated) is still a thermal conductor hundreds of times more effective than stagnant air. Also, it necessarily follows that if the damaged core were air-tight, allowing no air circulation, the fission products would be trapped within the rubble pile, unable to escape, even if some of the fuel melted, which, in my opinion, based on my analysis, is not possible.

e. All of the above is affected by the fact that the decay heating rate and thus the actual temperatures are likely to be considerably less than calculated because of the actual intermittent reactor operation compared to my assumption

of long-term continuous operation and the expected delay in drainage of the cooling water.

Q.17. What is your expert opinion of the possibility of fuel melt in the event of loss of coolant with or without core crushing in a 100 kW Argonaut-UTR?

A.17. In my opinion fuel melting in an Argonaut-UTR 100KW as a result of this event is not possible.

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Education : B. Mech. Eng., 1960, M. Nucl. Eng. 1961; Carnegie Institute of Technology.

Present Position : Associate Group Leader, Fluid Flow and Heat Transfer Section, Technical Engineering Support Group at Los Alamos.

Awards : Pi Tau Sigma
Sigma Xi
AEC Fellowship (1960-1961)

Organizations : American Society of Mechanical Engineers
American Nuclear Society (Past)
Registered Professional Engineer, State of Pennsylvania
New Mexico Citizens for Clean Air and Water-Past Chairman of Local Chapter, Present Member of Board and Editor of Environmental Newspaper Column.

Experience and Responsibilities:

April 1978 - Present Associate (Assistant) Group Leader for a section of eight professionals involved in a variety of projects in support of research at Los Alamos. Specialities include heat transfer, fluid flow, hydrodynamics of shock waves and detonations, chemical process design, waste management, and tritium handling systems. Projects have included design studies for fusion reactor blankets, development of computer codes for heat transfer and fluid flow analyses, prediction of explosive initiation by impact of hypervelocity projectiles, and computer analysis of loss-of-coolant accidents in nuclear reactors.

May 1974 - April 1978 Staff Member in program support group at Los Alamos. Responsible for heat and mass transfer analysis for underground coal gasification, parametric one-dimensional supersonic flow for deuterium loop in 14 MeV intense neutron source, prediction of heat transfer and fission product release from High Temperature Gas-Cooled Reactor in loss-of-forced circulation accident, blanket design for advanced fusion reactors, etc.

August 1972 - May 1974 Senior Engineer and Fellow Engineer at Westinghouse Electric Corporation Astronuclear Laboratory, on assignment to Los Alamos as Industrial Staff Member for Rover Nuclear Rocket project and Subterrene project for development of underground tunnelling and drilling by rock melting.

February 1963 - August 1972 Senior Engineer at Westinghouse Electric Corporation Astronuclear Laboratory. As part of large team attempting to develop a hydrogen-cooled graphite-fueled nuclear rocket for space vehicle propulsion (NERVA), was the lead engineer responsible for the thermal and hydraulic design and analyses of fuel elements, including probabilistic analysis of maximum temperatures and corrosion; planning and conducting optimization studies, and specification of flow orificing to achieve optimum temperature flattening for five successful reactor tests in Nevada. Also have worked on temporary assignments to Westinghouse Nuclear Energy Systems (for PWRs) and Westinghouse Advanced Reactor Division (for LMFBRs) on specific heat transfer and fluid flow problems.

RECENT PUBLICATIONS AND REPORTS

1. R. A. Krakowski, R. L. Hagenson, and G. E. Cort, "First Wall Thermal/Mechanical Analyses of the Reference Theta-Pinch Reactor (RTPR)" Nucl. Technol. 34, 217 (1977).

2. T. C. Wallace, G. E. Cort, J. J. Damran, M. C. Cline, D. B. Court, D. E. Hall, and R. W. Meier "Development of Pyrolytic Graphite/Silicon Carbide Composite Materials for Rocket-Nozzle Applications, Vols. I, II, and III" Los Alamos National Laboratory Reports LA-UR-77-2042, -2444, and -2679, for Air Force Rocket Propulsion Laboratory, Director of Science and Technology, Air Force Systems Command, Edwards Air Force Base, California (1977).

3. N. E. Vanderborgh, J. P. Bertino, G. E. Cort, and P. Wagner, "Heat Transfer Through Coals and Other Naturally Occurring Carbonaceous Rocks," Proc. 15th International Thermal Conductivity Conference, Ottawa, Canada (August 24-26, 1977).

4. N. E. Vanderborgh, E. M. Wewerka, J. M. Williams, J. P. Bertino and G. E. Cort, "Heat and Mass Transfer Through Southwestern Subbituminous Coals" Proc. 3rd Underground Coal Extraction Symposium, Stanford Sierra Lodge (June 6-10, 1977).

5. G. E. Cort and R. A. Krakowski, "Heat Transfer in the Lithium-Cooled Blanket of the Reference Theta-Pinch Reactor" Proc. 6th International Heat Transfer Conf., Toronto, Canada (August 1978).

6. J. H. Pendergrass and G. E. Cort, "Lithium Boiler High Temperature Fusion Reactor Blanket Concept" Proc. of 6th American Nuclear Society Winter Meeting, Washington, DC (November 12-17, 1978).

7. L. A. Booth, M. G. Bowman, G. E. Cort, K. E. Cox, D. J. Dudziak, R. A. Krakowski, J. H. Pendergrass, and A. S. Tai, "Production of Electro-Thermochemical Hydrogen Using a Fusion Source of High-Temperature Process Heat" Proc. 3rd ANS Topical Meeting on the Technology of Controlled Nuclear Fusion, Santa Fe, New Mexico (May 9-11, 1978) (also Los Alamos National Laboratory report LA-UR-78-1459).

8. Nicholas E. Vanderborgh, Guy R. B. Elliott, and G. Edward Cort, "Concurrent Heat and Mass Transfer During Drying of Blocks of Subbituminous Coal," Proc. 4th Underground Coal Conversion Symposium, Steamboat Springs, Colorado (July 17-20, 1978).

9. G. E. Cort, R. L. Hagenson, R. W. Teasdale, W. E. Fox, P. D. Soran, C. G. Bathke, H. S. Cullingford, and R. A. Krakowski, "Engineering Design of a Direct-Cycle Steam-Generating Blanket for a Long-Pulse Fusion Reactor" Transactions of the 5th International Conference on Structural Mechanics in Reactor Technology, Berlin, FRG. (August 1979).

10. D. R. Peterson, J. H. Pendergrass, and G. E. Cort, "A Tritium Self-Sufficient 1600 K Process Heat Fusion Reactor Blanket Concept," Trans. ANS 33, 74 (1979) (also Los Alamos National Laboratory report LA-UR-79-1721).

11. G. E. Cort, R. L. Hagenson, and R. A. Krakowski, "A Direct-Cycle Steam Generating Blanket Design" Trans. ANS, 33, 76 (1979) (also Los Alamos National Laboratory report LA-UR-79-1734).

12. R. L. Hagenson, R. A. Krakowski, and G. E. Cort, "The Reversed-Field Pinch Reactor (RFPR) Concept," Los Alamos National Laboratory report LA-7973-MS (August 1979).

13. H. S. Cullingford and G. E. Cort, "Fundamental Understanding of Matter: An Engineering Viewpoint," Proc. 3rd International Conf. on Alternative Energy Sources, Miami Beach, Florida, (December 15-18, 1980).

14. G. E. Cort and J. H. M. Fu, "Numerical Calculation of Shock-Induced Iniation of Detonations," Proc. 1980 JANNAF Propulsion Systems Hazards Subcommittee meeting, (CPIA Publication 330) Monterey, California (October 29-31, 1980) (also Los Alamos National Laboratory report LA-8816-MS, April 1981).

15. K. H. Duerre, G. E. Cort, and T. D. Knight, "Pretest and Posttest Calculations of Semiscale Test S-07-10D with the TRAC Computer Program," Proc. ANS Specialists meeting on Small Break Loss-of-Coolant Accident Analyses in LWRs, Monterey, California (August 25-27, 1981).

BY MS. WOODHEAD:

Q Mr. Cort, I'm going to hand you a document entitled, "Fuel Temperatures in Argonaut Reactor Core Following a Hypothetical Design Basis Accident," and ask you if this document was prepared by you.

(Document proffered.)

A Yes, it was.

Q Is this document true and correct to the best of your knowledge and belief?

A Yes.

MS. WOODHEAD: Staff moves to be received into evidence the document prepared by Mr. Cort entitled, "Field Temperatures in Argonaut Reactor Core," previously identified as Staff's Exhibit 5.

(The document referred to was marked for identification as Staff's Exhibit 5.)

JUDGE FRYE: Any objection?

MR. HIRSCH: No objection.

MR. CORMIER: No.

JUDGE FRYE: It will be received.

(The document referred to was received in evidence as Staff's Exhibit 5.)

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BY MS. WOODHEAD:

Q Mr. Cort, I'm handing you yet another document entitled, "Fuel Temperatures in a 500 Kilowatt Argonaut Reactor Following a Loss of Coolant Accident," and ask if this document was prepared by you.

(Document proffered.)

A By myself and Mr. Ben Como, yes.

Q Is this document true and correct to the best of your knowledge and belief?

A Yes, it is. Let me spell that name, B-E-N-C-O-M-O.

MS. WOODHEAD: At this time the Staff moves to be received into evidence the document just described as Staff's Exhibit 6, previously been marked.

(The document referred to was marked for identification as Staff's Exhibit 6.)

JUDGE FRYE: Objections?

MR. HIRSCH: No objection.

MR. CORMIER: No objection.

JUDGE FRYE: It will be received.

(The document referred to was received in evidence as Staff' sExhibit 6.)

MS. WOODHEAD: The exhibits and the testimony

of Mr. Cort has been previously served on the Board and parties. The Court Reporter has been provided with the appopriate number of documents.

At this time the witness is available for cross examination.

JUDGE FRYE: Mr. Cormier, any questions?

MR. CORMIER: Just a couple.

CROSS EXAMINATION

BY MR. CORMIER:

Q Dr. Cort, I'd like to refer you to page 10 of your testimony. Your Answer 13 at the bottom of the page.

A Okay. Yes.

Q Could you explain what you mean by thermal conductivity of the graphite?

A Yes, thermal conductivity is a fundamental physical property that relates the temperature difference across the unit thickness of material for a given heat flux or thrust-- that is, amount of heat transferred through a unit area, across that material. And it is measured experimentally in most cases, although it can be calculated.

Q Can you tell us what the -- the thermal conductivity of graphite is, if not in absolute terms, then qualitatively?

A May I refer to some notes?

Q Certainly.

MS. WOODHEAD: Excuse me. Can you tell me the

1 page again?

2 JUDGE FRYE: Page 10 of the written testimony.

3 THE WITNESS: The conductivity of various graphites

4 depends somewhat on how they're manufactured, but typical

5 values for low -- or that is, high purity dense graphites

6 such as used in Argonauts or other reactors ranges from

7 about 120 to 200 watts per meter per degree centigrade.

8 That's at room temperature.

9 BY MR. CORMIER:

10 Q Can you compare that to other substances? Is

11 that a high thermal conductivity?

12 A It is high. Copper has at the same temperature

13 thermal conductivity of 375. So that is higher. On the

14 other hand, stainless steel has a thermal conductivity

15 of 17 in the same units. Water has a thermal conductivity

16 of .6, and air, .026.

17 Q If you were to apply heat to one side of a graphite

18 block, does that expression of thermal conductivity suggest

19 that the heat would flow through the block, that it would

20 be conducted way and tend to even out as opposed to staying

21 on the side of the block?

22 A Yes.

23 Q Also on page 10, at the bottom of your Answer

24 12, you discuss the phenomena of the fast neutron flux

25 falling off with distance from the fuel. You make reference

1 to the work by Nightingale, which has come up several
2 times in this proceeding. Is the Nightingale approach
3 to the fast flux fall-off phenomena the best approach for
4 conducting thermal conductivity effects?
5 A The -- the question that you have reference to
6 here is -- is an illustration in Nightingale that shows
7 that the thermal -- the -- the fast neutrons which are
8 generated in the fuel are changed into lower energy neutrons
9 which are called thermal neutrons and -- and that the purpose
10 of the reflector is simply to -- to convert these and reflect
11 them back into the fuel.
12 My point was that the further away the graphite
13 is from the fuel, the lower this fast-flux would be. I
14 read Dr. Pearlman's testimony from last week, and I believe
15 he made the same point.
16 Q Can --
17 A However, there are other cases where Nightingale
18 uses a method of comparing damage in -- in materials, graphite
19 in particular, based on thermal flux or equivalent burn-
20 up per ton of fuel. And I -- I think that method has been
21 superseded by more recent ways of -- of relating the damage.
22 MR. HIRSCH: Objection.
23 BY MR. CORMIER:
24 Q Page 8 --
25 MR. HIRSCH: Excuse me. Objection. The last

1 half of Mr. Cort's answer goes far beyond the scope of
2 his testimony into the area of Wigner energy and Dr. Pearlman's
3 testimony.
4 His testimony before us is on the effects of
5 a loss of coolant accident at this facility, and I object
6 very strongly to any attempt by Mr. Cormier to move this
7 into an area outside the scope of Mr. Cort's study.
8 MR. CORMIER: Judge Frye, most of these questions
9 on pages 7 through 8 have to do deal with the radiation
10 damage effects in graphite. On page 8, for instance, they
11 specifically talk about the WINDSCALE File -- Fire -- and
12 further down the situation is different in the case for
13 Argonaut when the reflector is graphite as opposed to having
14 a graphite moderator.
15 Continued on page 9, ending up with page 10,
16 where we again are talking about thermal conductivity effects.
17 This neutron transport problem is the same problem, producing
18 the same effects in graphite, one of which is -- is the
19 radiation damage directly. Another effect is the Wigner
20 energy.
21 I did not ask Dr. Cort about Wigner energy. I'm --
22 I'm concerned about the thermal conductivity, the fast
23 neutron transport problem, which is clearly raised in this
24 part of the testimony.
25 MR. HIRSCH: If I may?

1 JUDGE FRYE: Go ahead.
2 MR. HIRSCH: It's a very important point.
3 JUDGE FRYE: I was just about to ask the witness
4 if he can confine his remarks to the thermal conductivity
5 point.
6 MR. HIRSCH: Okay.
7 THE WITNESS: Yes.
8 MR. HIRSCH: May I ask about those last two sentences
9 that I asked to be struck, that go to the method that
10 Dr. Pearlman used for computing energy storage rather than
11 thermal conductivity of the graphite?
12 JUDGE FRYE: I think we can disregard those.
13 MR. HIRSCH: Okay.
14 JUDGE FRYE: I take it that was the part of the
15 answer that went beyond your question.
16 MR. CORMIER: I do not believe it did. I thought
17 Dr. Cort was explaining with reference to his statement
18 at the bottom of page 10, the reference to the Nightingale,
19 that there are other methods, superior methods if I understood
20 correctly, for computing or calculating the neutrons that
21 reach the graphite reflector, which is a key point, because
22 throughout this proceeding, we've only talked about Nightingale's
23 method and various formulas, modified by New Gard, modified
24 by several other people.
25 And what Dr. Cort is telling us for the first

1 time that there are other methods for calculating that,
2 if I understood his testimony correctly.
3 MR. HIRSCH: Judge Frye, a response?
4 Pages 226 to 227 of Nightingale were never mentioned
5 by Dr. Pearlman -- do not deal with energy storage. They
6 deal with the effects of the -- I might say that the coolant
7 channels are not at all the calculational method dealt
8 with by Dr. Pearlman, and that was what Mr. Cormier asked
9 about in his question.
10 JUDGE FRYE: Well, I think -- I think we can --
11 hold for a minute -- I think we can sit through this till
12 we get the transcript without any difficulty.
13 If you make that point, you know, in your proposed
14 findings, that should cover it, I would think, and argue
15 about the relevance of it.
16 MR. HIRSCH: Okay. We still do move to strike
17 those two sentences, but at least we want --
18 JUDGE FRYE: All right. Well, we'll --
19 MR. HIRSCH: -- no further than we have already --
20 JUDGE FRYE: We'll -- we'll hold that under --
21 take that under advisement.
22 MR. HIRSCH: Okay.
23 BY MR. CORMIER:
24 Q Dr. Cort, with reference to page 8 of your testimony,
25 the bottom of your Answer 10 there, you talk about a greatly

1 reduced fast neutron flux in the reflector. Could you
2 explain why there is a greatly reduced fast neutron flux
3 in the graphite reflector of a reactor like the Argonaut?
4 A Yes. Again, the fast neutrons are generated
5 in the fuel, travel away from the fuel. As they do this,
6 they impact with other atoms in the water or in the aluminum.
7 Primarily in the water with the hydrogen atoms, they lose
8 energy, and before they get to the graphite, many of them
9 are reduced to much lower energy where they do not cause
10 the type of damage that affects thermal radiation -- I
11 mean thermal conductivity -- and other changes in the graphite.
12 I do not know the exact number for the Argonaut,
13 but I believe it is fairly significant, and it means that
14 comparing damage, radiation damage, and -- and the graphite
15 in the Argonaut with some other reactor where the graphite
16 is in intimate contact with the fuel is not valid.
17 MR. HIRSCH: Judge Frye, again, I ask that that
18 comment be restricted to the thermal conductivity.
19 THE WITNESS: I'm referring specifically to thermal
20 conductivity.
21 ///
22 ///
23 ///
24 ///
25 ///

JUDGE FRYE: Judge Bright has a few questions.

JUDGE BRIGHT: Mr. Cort, is there a relationship between stored energy and graphite through the effect of neutrons? Or the Wigner energy as it's called, think? And thermal conductivity?

THE WITNESS: Do you mean changes in thermal conductivity due to irradiation?

JUDGE BRIGHT: Yes.

THE WITNESS: There is a relationship although I don't know if there's a numerical way of predicting one from the other. They are both caused by the same thing, that is, the fast neutrons, and so I would assume that there should be some direct relationship. I don't know that anybody has ever tried to predict it.

JUDGE BRIGHT: But you're not trying to develop a direct relationship here, are you?

THE WITNESS: No, not between those two phenomena.

JUDGE BRIGHT: So your purpose is strictly to talk about the thermal conductivity in graphite?

THE WITNESS: Yes.

JUDGE LUEBKE: Ask him a question. Have you been doing that in answers that are being objected to?

THE WITNESS: I guess I'd like to hear that again.

JUDGE LUEBKE: Have you restricted yourself to that limitation in the recent answers to questions to which there

is an objection and asked to be stricken?

THE WITNESS: I'm not quite sure how to answer that. My purpose was to shed some light on the effects on the radiation on the changes in thermal conductivity. However, because they are caused by fast neutrons, Wigner energy and change in thermal conductivity, I may have overstepped and said something about Wigner energy. I don't remember now.

JUDGE FRYE: Well, I think if you confine yourself to the thermal conductivity, we won't have a problem. With regard to these questions as I perceive it, and it gets very technical, and I'll have to admit, somewhat beyond my grasp. The questions are purely based on the testimony that you filed here, but then the answers seem to get off into the subject that other witnesses have testified to, and that's creating a problem.

THE WITNESS: I see. I'm sorry. I'll try not to do that.

JUDGE FRYE: Okay. Now we'll review the transcript when we have it with respect to the motion to strike.

MR. HIRSCH: Thank you.

JUDGE FRYE: Mr. Cormier?

BY MR. CORMIER:

Q Dr. Cort, before we broke, I want to make sure -- the only explanation I wanted was in reference to the statement that appears at the bottom of page eight. I think we got it.

vc

1 I just want to make sure. Your explanation of your statement
2 that there is greatly reduced fast neutron flux in the reflec-
3 tor, the graphite reflector in the Argonaut reactor. Again,
4 I'm not asking about Wigner effect, although the phenomena are
5 related.
6 A. Yes, the answer to your question is that it is
7 greatly reduced as compared to the flux within the fuel ele-
8 ments themselves.
9 Q. You mention up above the windscale fire. Caused
10 at the windscale reactor. Again, without reference to Wigner
11 energy, can you distinguish between the two reactors with
12 respect to the fast neutron flux attenuation from the fuel
13 in a graphite reflected -- graphite moderated reactor as
14 opposed to a graphite reflected reactor like UCLA's?
15 A. Yes.
16 MR. HIRSCH: Objection. Mr. Cormier continues to
17 try to get us into windscale fire, Wigner energy and --
18 JUDGE FRYE: It's right here in the testimony.
19 MR. HIRSCH: The mention to it is in relation to
20 the issue of thermal conductivity in a loss of coolant accident.
21 And it seems to me any attempt to have Mr. Cort testify about
22 fire capability of this reactor, or Wigner storage goes far
23 beyond the scope of his testimony which he says himself on
24 the first two pages is to clarify the underlying bases for
25 the document he wrote, which is "Fuel Temperatures in the

1 Argonaut Reactor Core following Hypothetical Design Basis
2 Accident" which is a loss of coolant, the dropping of the
3 water. And I must say that to have -- to attempt to expand
4 testimony on a LOCA into windscale fire and Wigner energy
5 when the only relevance that those has to do with the thermal
6 conductivity values he used for his heat transfer calculations
7 is most objectionable.
8 MR. CORMIER: I asked him no question about wind-
9 scale fire. I think he understands me perfectly that I don't
10 want to hear about the windscale fire. I asked him to make
11 the comparison in the two different types of reactors based
12 on the different effects on the fast neutron flow in graphite,
13 in a graphite moderated reactor compared to a graphite
14 reflected reactor. Now, that is the underlying process that
15 informs one about the thermal conductivity of the graphite.
16 I don't care about -- I'm not asking about Wigner energy. I'm
17 not asking about the windscale fire. I don't know how I
18 could be any clearer.
19 MR. HIRSCH: Again, Mr. Cormier has objected numer-
20 ous times when we've asked questions about other reactors,
21 TRIGA's and so forth. It seems to me that the reference,
22 the attempt to have Mr. --
23 JUDGE FRYE: But he's got the reference in his
24 testimony, as problems that have occurred in other reactors,
25 such as the windscale fire that occurred partly because

vd

1 graphite was used in the proximity or actually made part of
2 the fuel, and it seems to me that the --
3 MR. HIRSCH: But the only rele --
4 JUDGE FRYE: And it seems to me that the question
5 that, as I understand it now, is trying to draw a distinction
6 between the Argonaut where the graphite is not a part of the
7 fuel, and may or may not be in proximity, I suppose, depending
8 on your point of view, and that effect on thermal conductivity.
9 MR. HIRSCH: On thermal conductivity related to a
10 loss of coolant accident as analyzed in Mr. Cort's study.
11 Anything that goes beyond that to try to deal with fire seems
12 to us vastly outside the scope of Mr. Cort's testimony.
13 JUDGE FRYE: I didn't understand it to deal with fire.
14 MR. CORMIER: I don't want to hear --
15 JUDGE FRYE: Can you rephrase it? We've been so
16 far in this now, I'm not sure anybody really -- can you try
17 to rephrase it?
18 MR. CORMIER: I'll rephrase it.
19 BY MR. CORMIER:
20 Q Dr. Cort, you make mention of the windscale fire
21 that occurred with the windscale reactor. Without any discus-
22 sion of the fire, or any possible Wigner energy phenomena at
23 the windscale reactor, could you explain for us the difference
24 between a windscale type reactor, graphite moderated, and the
25 UCLA Argonaut type reactor, water moderated and graphite

1 reflected, with respect to the fast -- the greatly reduced
2 fast neutron flux that occurs in the Argonaut reactor?
3 A. All of the neutrons that are generated in a reactor
4 such as windscale are slowed down in the graphite. Essentially
5 the coolant has no interaction with the neutrons to any sig-
6 nificant extent. In Argonaut, the water interacts strongly
7 with the -- in fact, it interacts strongly with the fast
8 neutrons, and takes the place of the graphite in effect and so
9 the remaining fast neutrons that finally wind up on the graph-
10 ite are much reduced.
11 MR. CORMIER: Thank you. I have no further questions.
12 MR. HIRSCH: No questions.
13 JUDGE FRYE: Any redirect? Oh, excuse me.
14 EXAMINATION
15 BY JUDGE LUEBKE:
16 Q. In the title of your prepared testimony, you have
17 the phrase, "Design Basis". Is that of your origin, that
18 phrase?
19 A. That is -- that may be a mistake. I didn't intend
20 that to be a legalistic design basis accident.
21 Q. So would I be correct then in saying that if it were
22 deleted, it wouldn't change the content or conclusions of
23 your report?
24 A. No.
25 Q. What would be correct? No change? You could take it

out?

A. You could take it out.

Q. It could be blocked out.

JUDGE LUEBKE: That's it.

JUDGE FRYE: Ms. Woodhead?

MS. WOODHEAD: No redirect.

JUDGE FRYE: And questions based on Dr. Luebke's questions? Mr. Cort, thank you very much for being with us. We appreciate your coming.

(The witness was excused.)

JUDGE FRYE: How long do you anticipate for Mr. Bernard?

MR. HIRSCH: Some time.

JUDGE FRYE: Some time. All right, well, let's get started then this afternoon.

MR. HIRSCH: If it were short, we would start tomorrow?

JUDGE FRYE: No, we'd start this afternoon either way.

MS. WOODHEAD: May I have two or three minutes to get my exhibits and testimony together?

JUDGE FRYE: Why don't you make it about fifteen? We'll start again at 3:00.

(Whereupon, a brief recess was taken.)

JUDGE FRYE: Back on the record.

JUDGE FRYE: Mr. Bernard is at the witness stand, and has been previously sworn.

MS. WOODHEAD:

Whereupon,

HAROLD BERNARD

took the witness stand, was previously sworn, and was examined, and testified as follows.

DIRECT EXAMINATION

BY MS. WOODHEAD:

Q. Mr. Bernard, excuse me, let's go back and make sure we have it there on the record. Would you state your name and place of employment for the record?

A. Harold Bernard, Nuclear Regulatory Commission, Division of Licensing.

Q. Mr. Bernard, I'm going to hand you a document entitled "Testimony of Harold Bernard." Thirteen pages. Attached to which is the statement of your professional qualifications. Did you prepare these two documents?

A. Yes, I did.

Q. Are there any additions or corrections that you wish to make to either of these two documents?

A. I have some corrections on the testimony.

Q. Will you tell us what those are?

A. On page two, the next to the last line from the bottom. I just want to change "is" to "are." Since I'm

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speaking about two or three items.

On page four, answer 8, second line, the comma after "plugs" doesn't make any sense so that should come out.

Fourth line from the bottom on that same page, to make it a little clearer, the value is the highest, but the dispersion factor is the lowest, so the sentence should read, "The curve shows that the lowest measured dispersion factors", "S" after factor -- "comma, when extrapolated to --" so the words "when extrapolate to" should be added too after the comma, and should now read, "The curve shows that the lowest measured dispersion factors, when extrapolated to zero meters from point of release is 10^{-2} sec/m^3." Etc. The rest is okay.

Q. Do I understand that you wish to delete "at", the word "at"?

A. Oh, delete the word "at" and change it -- make that "to."

On page five, answer 9, second line, the "but" should be an "and." And the sixth line down which starts with "present reactor room," the comma doesn't make any sense there either. And two lines after that, the comma after "earthquake" should be eliminated.

The typos on page eight, the second full paragraph down which starts, "Assuming uniform distribution" should be "of the gases in the reactor room", not "in the gaseous reactor room".

Q. Would you repeat that as it should be?

A. "Assuming uniform distribution of the gases in the reactor room," the rest of it is okay.

And I thought I had removed all of the boo boo's on the 10 to the exponents, but the one I missed was in part a) the fourth line down that says, "Whole body dose, R = 7.2 x 104^{-5}." It should be "10^{-5}." Somehow that 104 came out on every one of the tens, and that's one I missed.

That's it.

Q. Are there any corrections or additions to the list of professional qualifications?

A. No.

MS. WOODHEAD: At this time the Staff moves that the testimony of Harold Bernard and professional qualifications be incorporated into the record as if read.

JUDGE FRYE: Any objections?

MR. CORMIER: No objection.

MR. HIRSCH: We have some objections. The scope issue, and I'd like to do some voir dire.

JUDGE FRYE: Okay. Well, the scope I think we've covered before.

MR. HIRSCH: I'd just like it explicit as to whether there are passages dealing with the seismic matter should be taken out.

JUDGE FRYE: The seismic matter, right. That should

be governed in the same was as, I believe it was --

MS. WOODHEAD: Dr. Smith.

JUDGE FRYE: Dr. Smith, for UCLA.

MR. HIRSCH: Which we removed those sections, right.

JUDGE FRYE: Well, we didn't -- they won't be considered in this phase. They wouldn't be removed.

MR. HIRSCH: Okay. So it's just understood that the seismic assertions will be removed. Okay. I do have some voir dire.

JUDGE FRYE: Fine, proceed.

VOIR DIRE EXAMINATION

BY MR. HIRSCH:

Q. Mr. Bernard, you have a bachelor's degree in civil engineering, is that correct?

A. Yes.

Q. And no advanced degrees, is that correct?

A. Everything except the thesis.

Q. Meaning that you have a degree or --

A. I have everything up to a thesis. That means I don't have a degree.

Q. And what you had up to a thesis was in sanitary engineering?

A. Yes.

Q. You spent the years '51 to '55 as a sanitary engineer, that's correct?

A. Yes.

Q. And your period from '55 to '60 also dealt with waste disposal matters?

A. I was a process engineer dealing with waste, radioactive waste, and other processes.

Q. And that work on waste disposal continued from '60 to '66 as well? But for a different employer?

A. Yes.

Q. From '66 to '72 you were at EPA but not involved in nuclear matters, correct?

A. Correct.

Q. And from '72 to '80, you were not involved in nuclear matters?

A. Correct.

Q. And you joined the NRC in February of 1980?

A. Correct.

Q. And the application for license renewal from UCLA was submitted in February of 1980?

A. Correct.

Q. And so assignment to the UCLA license application was among your first assignments at the Agency?

A. Yes.

Q. Do you have any -- you do not have any degrees, then, in nuclear physics, nuclear engineering, metallurgy, is that correct?

A. I have no degrees. I have some course of curriculum in those areas.

Q. And have you been involved in the research regarding power excursions?

A. Have I been involved in research? No.

MR. HIRSCH: I guess at this point we're prepared to make our objections.

JUDGE FRYE: All right. Ms. Woodhead, did you have any questions?

MS. WOODHEAD: Yes, I do.

BY MS. WOODHEAD:

Q. Mr. Bernard, have you had any experience with the operation of a nuclear reactor?

A. Yes, I have. I was at a ten megawatt reactor as a shift supervisor for about ten of my twelve, thirteen months there.

Q. Where was this?

A. I was at the National Reactor Test Station in Idaho Falls. It was the ten megawatt organic moderated reactor experiment.

Q. And what were your duties there?

A. Regular duties of shift supervisor, keep the reactor operating safely, take data, analyze data, make suggestions, recommendations.

Q. And will you describe what courses you may have had

1 which are relevant to your job as a project manager at the
2 Nuclear Regulatory Commission?
3 A. I had a nuclear chemistry course. I had a nuclear
4 fuels, and as a neophyte at the Thomas International, they put
5 us through a nuclear engineering course that I'd say would be
6 equivalent to a two year course at a university.
7 Q. Have you had any other experience relating to
8 nuclear reactors besides the one at Idaho Falls?
9 A. As a project manager at the Atomic Energy Commission,
10 I funded research involving reactors and reactor components,
11 and accidents in reactors, and fission product attenuation
12 capture, treatment. I monitored the geologic survey and their
13 activities on seismic activities in geological nations. And
14 I monitored the Weather Bureau and was responsible for the
15 -- their programs in atmospheric dispersion.
16 Q. Have you had any other education or experience which
17 might be relevant to your job at the Commission?
18 A. Again, as a project manager, I initiated research
19 on sodium fires. Drop tests on shipping casks. And damage
20 to fuels and shipping casks, fires on shipping casks. That's
21 all I can recall off the top of my head.
22 Q. You said as a project manager, do you mean in your
23 present job?
24 A. No, with the Atomic Energy Commission.
25 Q. Oh, in your former employment?

A. Former employment.

Q. Could you briefly describe the duties of a licensing project manager at the Nuclear Regulatory Commission, in other words, your present duties?

A. There are 65 or 66 research reactors under license to the Commission. At present time, there are two project managers monitoring those 66 reactors, so we have approximately 33 each. Of those, when I first came on board, 26 license renewal applications had been received, and many had been processed by the two of us. So we have been reviewing and analyzing research reactors that are Argonauts, TRIGA's, AGN's, critical facilities. Right now, again, as I said, there are only two project managers, so we have each about ten or eleven license renewal applications that we are -- that are in various stages of process.

Q. You say you review and analyze applications. Could you explain a little more in detail what that entails?

A. An application is received from the licensee for renewal. We review it to see if all the information is in there. We don't review it for technical correctness at that particular time, but if certain parts are missing, we just correspond with the licensee and ask them to submit the other parts. When the application comes up for review, we request our contract for Los Alamos Scientific Laboratory to help us evaluate certain portions of the license application. And we

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then review their input to us, put it together with the other sections that we do ourselves, and propose or reject an applicant for license or ask for additional questions and move on that particular license. We also review amendments from the various licensees for safety features, and suggest and recommend amendments to technical specifications. We negotiate with licensees, and the end product being what we hope is a safe operation of a reactor.

Q. In the performance of your duties of reviewing license renewal applications for research or test reactors, do you have occasion to work with other members of the NRC staff outside perhaps of the licensing division or within it?

A. If we have a particular question, we can go to anybody in the agency, and get some expert input. In general, however, because the agency is -- they say, severely understaffed and overworked, and the staff is -- has many, many power reactors to review, that we can not give -- we found we can not give a long term analysis to any of the staff and expect a response that's within a respectable or predetermined time frame. That's the reason we contracted with Los Alamos and they have been helping us since '81, 1981, I think.

MS. WOODHEAD: All right. I have no further questions.

JUDGE FRYE: Mr. Hirsch?

MR. HIRSCH: The testimony offered by Mr. Bernard --

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1 excuse me, let me back up for a moment. As I understand it,
2 the staff is also including as part of the testimony Section
3 14 of the SER. I'd like to include that in my remarks if
4 that's okay. On the very first part of the testimony, it says
5 he adopts Section 14 as well.
6 Section 14 of the SER and the matters addressed in
7 Mr. Bernard's testimony cover essentially the entire scope
8 of the safety problems or safety -- potential safety problems
9 analyzed for this reactor. These are very complicated matters,
10 from reactor kinetics related to power excursion and also to
11 metallurgy in terms of the degree of fracturing under severe
12 impace, the amount of fission product release in case of
13 severe fracture, to atmospheric disperion, meteorology, to
14 structural questions related to response to severe shock, to
15 chemical reactions, water reactions, the entire gamut of what
16 we've dealt with here. With due respect to Mr. Bernard, I
17 think that his remarks are telling in that he indicates that
18 he has 33 research reactors to review. The statement of qual-
19 ifications indicates his educational background as civil
20 engineering and sanitary engineering, and his primary work
21 experience has been in the area of waste disposal.
22 His reactor experience appears to consist primarily
23 of ten months in the late '50's, and an organic moderated
24 reactor as a shift supervisor. To be able to do what we
25 understand Mr. Bernard's testimony is attempting to do, which

1 is to take the generic studies and apply them to this specific
2 case seems to us to require the entire gamut of qualifications
3 that would be necessary to address all of those matters. And
4 it appears to us that Mr. Bernard is primarily a manager with
5 background in waste disposal and sanitary engineering. And
6 we just think that those qualifications are not sufficient to
7 be able to sponsor the entire gamut of safety analyses put
8 forth by Mr. Bernard.
9 JUDGE FRYE: Ms. Woodhead?
10 MS. WOODHEAD: I don't know what your motion is.
11 JUDGE FRYE: The motion is to exclude Mr. Bernard's
12 testimony.
13 MS. WOODHEAD: All together? I hadn't heard the
14 motion before.
15 MR. HIRSCH: I'll make it clear. Yes, we object to
16 the SER section referenced in the testimony, and to his testi-
17 mony on the grounds that he does not possess sufficient
18 qualifications to sponsor --
19 MS. WOODHEAD: This seems rather nonsensical to me.
20 I think the Board can take official notice that all SER's
21 incorporate conclusions performed -- calculations and conclu-
22 sions performed by other persons, and that the project manager
23 primarily compiles data produced by other people, usually
24 within the staff, sometimes by the National Laboratory.
25 At any rate, his testimony does not pretend to

1 develop or expand on any of the conclusions referenced in the
2 -- which he clearly references as being those of the National
3 Laboratory. There is one section in the SER which analyzes
4 an earthquake. And he very clearly states the source of his
5 figures, and shows his calculations and his mathematical
6 deductions and conclusions which is not a very difficult area
7 which would require an expert in extrapolating numbers. This
8 is something within the regimen of engineering classes, and
9 certainly within his area of experience since his formal edu-
10 cation has ceased.
11 His testimony is to a great extent a reflection of
12 the SER itself. He references studies done by the National
13 Laboratories. He has done some calculations on his own which
14 it seems clear to me, he's certainly competent to do. And
15 they're thoroughly explained within the document. I think
16 there's absolutely no basis for this motion whatsoever. I
17 think it should be denied.
18 JUDGE LUEBKE: Ms. Woodhead, you speak of how
19 customs are. Usually the staff puts on a panel that says
20 Mr. Jones, pages such and such, and so on and so Mr. Smith's
21 book, pages this and that, and that might be sometimes as many
22 as six people from the staff bringing in -- supporting the
23 SER. In this instance, I think it is unusual to have one
24 person do it.
25 MS. WOODHEAD: Dr. Luebke, this is the first SER

:20

1 ever issued for a non-power reactor. Because it was not
2 within the schedule of the specialty branches of the staff,
3 the basic underlying scientific analyses were performed by
4 the persons from the three national laboratories who have
5 previously testified. So to that extent, you have a panel,
6 but since it was not done within the staff, and I did offer,
7 if you will recall, to put them on as a panel, what you have
8 is a sequence of contributors to the Commission's Safety
9 Evaluation Report. And the basis, the primary basis, of the
10 SER is the work done by the national laboratories.
11 JUDGE LUEBKE: Then I misunderstood you because I
12 thought I heard you say this SER in this instance was put
13 together by -- was contributed to by numerous people on the
14 staff.
15 MS. WOODHEAD: I did not say that, Dr. Luebke. I
16 said it is a matter of routine at the Commission in the case
17 of power reactors that quite a few individuals on the NRC
18 staff contribute to the contents of the SER. And that the
19 normal procedure is for the project manager to compile the
20 actual analyses done in different branches of the staff. And
21 that this document is of similar kind in that there are con-
22 tributors from the three national laboratories as well as Mr.
23 Bernard. And it's clearly stated as to which information
24 comes from the laboratories and which was compiled by Mr. Ber-
25 nard. It says that it's written by Mr. Bernard, and he

21

1 references every single document or analysis which was done
2 by someone else.
3 JUDGE FRYE: I'm curious about one fact. You indi-
4 cated this was the first SER that has been prepared for a non-
5 power reactor?
6 MS. WOODHEAD: By that I mean an SER that is as
7 extensive in detail as this one is. This one was the first
8 attempt to produce a document which is equivalent to that of
9 a power reactor as we issue them today. In previous years,
10 the safety evaluations had been very brief, and very conclu-
11 sionary. As you will --
12 JUDGE FRYE: That's what -- it's a matter of course
13 that it's produced whenever a license renewal application
14 comes in?
15 MS. WOODHEAD: Oh, yes, but it's the first time
16 it's attempted to cover as many areas in terms of explanations
17 and diagrams and be as detailed and as informative as those
18 that we produce for power reactors. So it's much more exten-
19 sive, and was one of the reasons that the three laboratory
20 analyses were contracted for. Because we wanted documentation
21 to include in the SER.
22 JUDGE FRYE: Yes, and it's Mr. Bernard's overall
23 responsibility to see to it that it's prepared, as I under-
24 stand.
25 MS. WOODHEAD: That's correct, and there's no

1 implication anywhere in the document or in his testimony that
2 he did the majority of the calculations. It's quite clear
3 the majority of the evidence in this case is that which was
4 produced by the national labs.
5 JUDGE FRYE: We'll accept his testimony.
6 Cross examination, Mr. Cormier?
7 MS. WOODHEAD: Excuse me, I haven't finished.
8 JUDGE FRYE: Oh, I'm sorry.
9 BY MS. WOODHEAD:
10 Q. Mr. Bernard, I'm going to hand to you a document
11 entitled, "Safety Evaluation Report related to Renewal of
12 the Operatin License for the Research Reactor of the Univer-
13 sity of California at Los Angeles." It has a date of June
14 1981, and on the second line, it indicates that it was
15 corrected in July of 1981. And would you identify this docu-
16 ment for me by saying if this is the one you prepared?
17 A. Yes, it is.
18 Q. Is the information in here true and correct to the
19 best of your knowledge and belief?
20 A. Yes, it is.
21 MS. WOODHEAD: The staff moves into evidence Staff
22 Exhibit 7, the Safety Evaluation Report for the UCLA Reactor
23 which the staff has previously marked as Staff Exhibit 7.
24 JUDGE FRYE: Any objection?
25 MR. CORMIER: No objection.

MR. HIRSCH: The same objection that we had to his testimony and one other, just for clarification. It's the same situation as the application. There's obviously a great deal in the SER unrelated to this proceeding, and the portion we understand is relevant to Mr. Bernard's testimony is Section 14, and if -- my understanding is that if the full SER is brought in, it would be in the same way as the application, that only Section 14 can be relied upon for this proceeding for material facts that are being presented herein.

(The document referred to was marked for identification as Staff Exhibit No. 7.)

JUDGE FRYE: Ms. Woodhead, is that so, given the scope of the proceeding? I mean, I agree with that in general, but I'm looking at -- accident analysis clearly would be in it, that's Section 14. But just looking through here quickly, I see in the Table of Contents Section 4, Reactor, Summary Description, Radiation Facilities, Biological Shield Dynamic Design, Evaluation, Functional Design, Reactivity Control Systems. Some of that anyway would seem to be -- might well be relevant in Phase 1.

MS. WOODHEAD: That's true. Let me clarify one matter. 10CFR27432 requires the staff to submit a Safety Evaluations Report in all proceedings before the Licensing Board. Now, quite clearly, a reference to the SER of the

1 materials which are not relevant to the particular phase of
2 this proceeding, it would simply be irrelevant material.
3 JUDGE FRYE: To this phase, yes. I'm just trying
4 to get it sorted our ahead of time which particular parts of
5 it are relevant to this particular phase.
6 MS. WOODHEAD: Primarily, I believe, it's Section
7 14. There may be other information in here concerning the
8 design which should be adequately referenced, but I can not
9 believe this is going to be prejudicial. It is a matter of
10 whether it's relevant to this phase of the proceedings, or
11 irrelevant.
12 JUDGE FRYE: Right.
13 MR. HIRSCH: For us it's just notice of which por-
14 tions are being asserted to be relevant. Answer 3 of Mr.
15 Bernard's testimony says that he wrote Section 14 of the SER
16 and adopted -- adopts it as his testimony. So we were on notice
17 to prepare cross examination on Section 14. The other parts
18 seemed to us not relevant, and also we weren't on notice about
19 them. If there are parts that seem to be relevant as we pro-
20 ceed, maybe they can be called to people's attention so we
21 can deal with them then.
22 JUDGE FRYE: Okay. That's probably the best way to
23 handle it.
24 MS. WOODHEAD: All right. So that Exhibit 7 is
25 admitted?

JUDGE FRYE: Yes, we will admit Staff Exhibit 7.

MR. HIRSCH: With the understanding that no material facts can be relied upon outside of Section 14.

JUDGE FRYE: Well, it's the relevance argument again. We're just going to look at the parts of this that are relevant. Section 14 obviously is relevant to this portion of the proceeding, and you indicate that as other matters pop up in the course of this, why, we'll address them as we go along.

MR. HIRSCH: Okay.

(Whereupon, Staff Exhibit 7 was inserted into the record as if read:)

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
THE REGENTS OF THE UNIVERSITY OF CALIFORNIA	)	Docket No. 50-142
	)	
	)	(Proposed Renewal of Facility License)
(UCLA Research Reactor)	)	

TESTIMONY OF HAROLD BERNARD

Q.1 Please state your name, your place of employment, and your position.

A.1 My name is Harold Bernard. I am employed by the Nuclear Regulatory Commission as a licensing project manager in the Standardization and Special Projects Branch of the Office of Nuclear Reactor Regulation.

Q.2 What is the purpose of your testimony?

A.2 The purpose of my testimony is to explain and to clarify the bases and assumptions used in the Safety Evaluation Report (SER) for the UCLA reactor in the Section 14 analysis of the consequences of postulated accidents.

Q.3 Who wrote Section 14 of the SER?

A.3 I wrote Section 14 of the SER and adopt it as my testimony. Mr. Millard Wohl of NRC Staff provided calculations for Table 14-2-1 which I used.

Q.4 What information did you use to develop the analysis of the maximum hypothetical accident in the SER Section 14-2.2.6 entitled "Severe Earthquake Accident"?

A.4 I used information from "Analysis of Credible Accidents for Argonaut Reactors" NUREG/CR-2079; The UCLA Application; 10 CFR Part 20; The National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum ERL APL-84; "Fuel Temperatures in an Argonaut Reactor Core Following a Hypothetical Design Basis Accident," NUREG/CR-2198; and the references noted in the SER § 19.

Q.5 Why did you choose a severe earthquake as the maximum credible accident for the UCLA reactor?

A.5 I chose this postulated accident because California is known to be a seismically active area so that it is possible that a severe earthquake could cause damage to the reactor. In addition, earthquake damage could hypothetically include all the events that together would constitute an extremely conservative "worst" series of hypothetical incidents and concomitant consequences, that illustrates the "inherent safety" of the UCLA reactor and complex. In addition the arbitrary choice of assuming building collapse due to a severe earthquake event eliminated a time consuming and expensive site seismic investigation and all associated probability and structural damage analyses. Though the staff believes that building construction codes, design and technology in the southern California high seismicity area is well founded, and that structural integrity of the building and the reactor would be

maintained during high intensity seismic events, the staff adopted as the maximum credible accident a hypothetical earthquake which caused collapse of the building, onto the reactor causing the top shield plugs to fall onto the core.

Q.6 Why do you believe that damage from earthquake is the most serious accident that could occur at the UCLA reactor?

A.6 Damage from an earthquake could cause the following potentially significant safety considerations:

A. Disruption of the reactor while operating at maximum power with maximum fission product inventory

B. Reactor fuel melting and related consequences

C. Extensive mechanical damage to the fuel and release of maximum fission products

No other postulated accident would produce such a combination of events and maximum fission product inventory for potential releases and mechanisms for release.

Q.7 Why did you use the fission product calculations for a fuel handling accident in the "Analysis of Credible Accidents for Argonaut Reactors," NUREG/CR-2079 (Battelle Study) as the results of earthquake damage?

A.7 The Battelle fuel handling accident assumptions are overly conservative and more appropriate for a core crushing accident. First, it must be noted that the "Battelle Study" is generic in nature and aimed at analysis of the most conservative consequences that can be related to the accident in question. Second, it is not conceivable

that all the cladding could strip from the fuel following the postulated fuel handling accident; nor is it conceivable that the fuel could be ground up to the extent necessary to produce the equivalent amount of exposed surface area following a maximum drop height of about 15 feet. Third, it is not possible for the fission product inventory to be as high as that used in the Battelle Report (NUREG/CR-2079) for the fuel handling accident at UCLA because the time necessary to remove the reactor shield plug by crane would result in some fission product decay, but more importantly, due to Technical Specification 3.6.3.4 UCLA cannot unload fuel unless the reactor has been shut down for at least 21 days.

Q.8 Why did you use a less conservative dispersion factor than the Battelle study?

A.8 The SER analysis of a seismic event postulated collapse of the reactor building onto the core and collapse of the top plugs, onto the core to compress it along its three axes. The postulated destruction results in at least a partial outdoor scene with perhaps parts of walls standing, but certainly destruction of some of the reactor room enclosure. Accordingly, the staff used micro-meteorological sampling data obtained from NOAA (reference 12 in the SER) since dispersion would be immediate to the atmosphere surrounding the rubble. The curve shows that the highest measured dispersion factor at zero meters from point of release is 10^{-2} sec/m^3 and at 20 meters the dilution factor has a range of 5×10^{-3} to 5×10^{-7} sec/m^3. Use of the factor 7×10^{-3} sec/m^3 is conservative.

Q.9 How can you reconcile the difference between your lower dose calculation "within the reactor room" and the Battelle study's higher dose estimate at the exterior of the reactor building?

A.9 The term "within the reactor room" merely describes the area surrounding the reactor for spatial definition but was not meant to imply that the walls formed an enclosure. Collapse of both the classroom and reactor buildings would result in releases to the atmosphere immediately, rather than into an enclosure of the present reactor room, and later release through the stack to the atmosphere as would be the case in a fuel-handling accident. Since the damaged reactor after the postulated severe earthquake, would be out-of-doors, a greater dilution would occur. In addition, the NOAA dispersion figures are based on extensive meteorological sampling data around buildings, and being empirical data, is reliable.

Q.10 If you correct your analysis to reflect the actual operating characteristics of the UCLA reactor, what fission product activity and dose equivalents would result? Please explain your calculations.

A.10 The Technical Specifications (3.8.3.C) require that the average weekly operation and maximum one week operation do not exceed 8.5 hrs and 20 hours, respectively. Therefore, the fission product inventory would be much less than for the longer term operation used in the accident analysis in the SER § 14, as shown in the following table:

$A(T) = Ao\ (1-e^{-LT})$

A(T) = Fission Product Activity at Time T

Ao = Equilibrium Activity (See Table on following page)

T = 8.5 hours/20 hrs

L = Effective removal (i.e. decay for a reactor that has ceased operating)

GASEOUS FISSION PRODUCTS (F.P.)
IN ARGONAUT FUEL ELEMENT

Nuclide	T-1/2	*Curies at Equilbrium	F.P. @ 8.5. hrs.	Curies Released	F.P. @ 20 hrs.	**Curies Released
^{85m}Kr	4.4 h	78.5	8.5	.2	77	2.1
^{85}Kr	10.8 y	1.1	1	-	1	-
^{87}Kr	1.3 h	140	140	3.8	140	3.8
^{88}Kr	2.8 h	215	203	5.5	215	5.8
^{133m}Xe	2.3 d	11.2	2	-	3.4	-
^{133}Xe	5.3 d	400	28	.7	60	1.6
^{135m}Xe	0.3 h	62	62	1.7	62	1.6
^{135}Xe	9.1 h	397	242	6.5	353	9.5
Kr-Xe Subtotal		1304.8	686	18.5	911	24.4
^{131}I	8.1 d	164	5	.1	12.3	.3
^{132}I	2.3 h	244	240	6.5	240	6.4
^{133}I	20.3 h	399	136	3.7	251	6.6
^{134}I	0.9 h	424	424	11.4	424	11.4
^{135}I	6.7 h	327	235	6.3	311	8.4
Iodine subtotal		1558	1040	28.0	1238	33.1

*From NUREG/CR 2079 Table 3, p. 46

**This is based on 2.7% release. Conversion to dose results in less than .1 rem whole body dose from noble gases and 11 rem to the thyroid from radioiodine from releases after 20 hours operation.

Q.11 In case of serious accident at the reactor, could fission products released from the UCLA reactor into the reactor room escape into adjoining rooms so that nearby occupants would receive exposures?

A.11 There could be some leakage if the ventilation fan were not operative, after pressure equalization. For consideration of an actual fuel handling accident scenario it must be reiterated that the revised Technical Specifications indicate fuel cannot be removed from the core until three weeks after shutdown. Three weeks after shutdown the fission product inventory would have decayed to approximately 2 curies, composed almost exclusively of Xe-133 and K-85. Iodine would be present, but it would have decayed to about 0.1 curies of I-131 (T/2=8.1d).

With the ventilation fan operating, leakage would be <u>into</u> the reactor room from adjacent areas. With the ventilation fan inoperative and the damper closed it is likely that there would eventually be an exchange of reactor room air with adjacent rooms. However, this exchange would be slow, permitting both operators and public to be evacuated with little exposure. If it were assumed that 2.7% of the 2 curies of fission products escaped from the fuel, the release would be 5.4×10^{-2} curies of noble gases and about .003 curies of iodine. The integrated dose to a person in the reactor room or in the public [unrestricted] areas is as follows:

(a) For a person inside the reactor room with the ventilation fan stopped and the damper closed, i.e. no exchange of air: 2.3×10^{-6} rem whole body dose for 20 minute exposure, and 0.64 rem I-131 to the thyroid.

(b) For a person inside the reactor room with the ventilation fans running and damper open, at air change of 8000 CFM the reactor

room air (99,250 cubic feet) would be diluted by incoming air by 50% every 12 minutes with resultant decrease in fission product concentration noted in previous discussion. Thus the dose would be a fraction of that in (a). No public exposure.

(c) For a person in a nearby unrestricted area with the reactor room ventilation fan inoperative, a small fraction of doses on p. 6 would be received due to dilution by initial infiltration of outside air during equalization of the negative pressure in reactor room. The dose would be about 0.64 rem in 20 minutes.

Exposure calculations for the above conditions were determined as follows:

Assuming uniform distribution in the gaseous reactor room (whose dimensions are 75' x 49' x 27') the following fission product concentration would occur, assuming instantaneous releases:

$$\frac{5.4 \times 10^{-2}\ \text{Ci}}{75 \times 49 \times 27 \times 2.86 \times 10^{4}} = \frac{5.4 \times 10^{-2}}{2.84 \times 10^{9}} = 1.83 \times 10^{-11}\ \frac{\text{Ci}}{\text{cc}} = 1.83 \times 10^{-5}\ \frac{\mu\text{Ci}}{\text{cc}}$$

a) Reactor Room - no exchange of room air; whole body dose for exposure to noble gases for various times of exposure assuming a constant concentration during that exposure period:

Whole body dose, $R = 7.2 \times 104^{-5}$ (Ei)Ai [NUREG/CR-2079]

$Ai = 5.4 \times 10^{-2}$Ci, Ei = .971 Mev

$R_5 = 5.74 \times 10^{-7}$ rem: 5 minutes

$R_{10} = 1.14 \times 10^{-6}$ rem: 10 minutes

$R_{20} = 2.28 \times 10^{-6}$ rem: 20 minutes

$R_{60} = 6.84 \times 10^{-6}$ rem: 1 hour

My calculation of instantaneous maximum iodine concentration in the reactor room assuming no air dilution [from NUREG-CR-2079] is:

$$\frac{3 \times 10^{-3} Ci}{2.84 \times 10^{9}\ cc} = 1.1 \times 10^{-12} \frac{Ci}{cc} = 1.1 \times 10^{-6} \frac{\mu Ci}{cc}$$

The thyroid dose in the reactor room from exposure to I-131 for one hour following the fuel handling accident would be

$H_t = C \cdot V \cdot t \cdot f \cdot D$ where

H_t = the dose in rem following exposure for t hours in the reactor room with no exchange of room air.

Ci = Activity in $\frac{Ci}{m^3}$; $1.1 \times 10^{-6} \frac{\mu Ci}{cc} = 1.1 \times 10^{-6} \frac{Ci}{m^3}$ for I-131

V = Breathing rate = 1.2 m^3/hr

f = fraction of inhaled activity that reaches thyroid (ICRP 60) = 0.23

t = time of exposure in reactor room in hours, [5 min, 10 min, 20 min, 60 min]

D = for I-131 = 6.3 rads per μc of uptake and rad to rem conversion = 1

$H_t = 1.1 \times 10^{-6} (1.2)(t)(0.23)(6.3 \times 10^{6}) = 1.9t$

For 5 min exposure t = 1/12 =

$$H_5 = 1/12 \times 1.9 = 0.16 \text{ rem}$$

H_5 = 0.16 rem

H_{10} = 0.32 rem

H_{20} = 0.64 rem

H_{60} = 1.9 rem

The ICRP-2 states that the maximum permissible thirteen week and annual iodine dose is 8 rem and 30 rem, respectively.

In summary, exposures due to noble gas and iodine fission product releases are a small fraction of 10 CFR Part 20 under all circumstances.

Q.12 Explain the function of the reactor stack in the event of a fuel handling accident in the reactor room.

A.12 If the exhaust fan is operating or if the damper valve is open, reactor room air would be exhausted up the stack resulting in immediate dilution of fission product concentration.

Q.13 Why did NRC contract with Pacific Northwest Laboratories (Battelle), Los Alamos National Laboratories (LANL) and Brookhaven National Laboratory (BNL) to analyze postulated accidents in Argonaut-UTR's?

A.13 NRC contracted with the above three National Laboratories to establish sufficient background information to enable staff to confidently process four Argonaut-UTR renewal applications and nine TRIGA renewal applications.

Q.14 Explain how these contracts were managed and by whom.

A.14 The NRC managers of the various contracts with the National Laboratories were as follows:

Battelle (PNL) - Millard Wohl - Accident Evaluation Branch (AEB)

Brookhaven National Laboratory - Jocelyn Mitchell - Accident Evaluation Branch (AEB)

Los Alamos National Laboratory - Millard Wohl (AEB), Harold Bernard - Standardization & Special Projects Branch (SSPB)

Q.15 How were the laboratory analyses reviewed and approved by NRC prior to their publication?

A.15 The UCLA Project manager and AEB staff frequently contacted the laboratory personnel by telephone; progress and problems were reviewed. NRC Staff in AEB and SSPB then reviewed preliminary drafts and commented to the particular NRC contract manager who relayed comments to the laboratory. Draft final reports were also reviewed by staff prior to approval of the work and release for publication.

Q.16 What is your opinion of the risk to the public from a serious accident at the UCLA Argonaut-UTR?

A.16 I am confident, based on the results of all the accident analyses described in the SER Section 14, that no credible accident at the UCLA reactor would create a significant risk to public health and safety.

Q.17 Please explain the reasons for your opinion.

A.17 From our review of hypothetical accidents such as those postulated in the SER, and the very conservative assumptions used as the bases for the analyses, I think that there is no significant risk to the public from any conceivable accident or series of accidents, at the UCLA reactor. The basis of my opinion is as follows.

1. It is unlikely that a seismic event greater than 7.5 (Richter scale) would occur in the Westwood area.
2. It is highly unlikely that Boelter Hall would collapse even if a severe earthquake occurred.

3. It is incredible that sufficient force would develop to collapse the massive concrete reactor shield structure onto the core to crush it.

4. There is no scientific basis to support an assumption that no air convection would exist in a crushed core, as the LANL report assumes.

5. The high degree of fuel exposure postulated by the Battelle Study as clean guillotine-type breaks is overly conservative. Though some breaks would undoubtedly occur, most of the damage would be in the form of ruptures or cracks. In this case, little surface area would be exposed, and a smaller value of fission products release would undoubtedly result.

6. For the seismic accident no "credit" was taken for reduction of iodine inventory in the immediate vicinity of the damaged core from solution or sorbtion reactions with water, vapor, and dust particulates, or chemical reactions with other reactive fission products being released.

7. For the fuel handling accident, no credit was taken for the decay resulting from 21 days of reactor shutdown. Waiting three weeks, as the "Tech Specs" require, would reduce iodine inventory for average operation, to less than .03 curies or less than 1/1000 of the inventory in Table 14-2.1 of the SER. It is self-evident that 36 MWD as assumed, is impossible and overly-conservative, since UCLA operates the reactor an average 8.5 hours per week, and is limited to a maximum 20 full power hours in one week (T.S.3.8.3.C).

8. No credit was taken for evacuation of personnel or students from areas following an accident which would reduce exposures to much smaller amounts than those postulated.

9. The analyses by Battelle and Brookhaven demonstrate that incidents involving large insertions of excess reactivity would result in relatively small fuel temperature increases so that neither rupture or melting could occur.

10. Even with the above multiple scenarios of conservatism, the calculated doses to persons in restricted and unrestricted areas are a small fraction of the limits in 10 CFR Part 20.

HAROLD BERNARD

PROFESSIONAL QUALIFICATIONS

My name is Harold Bernard. I am a Project Manager in the Standardization & Special Projects Branch in the Division of Licensing, in the Nuclear Regulatory Commission, assigned to review those functions of non-power nuclear research and testing plants that are associated with the review and issuance of construction and operating licenses and amendments to assure the safe operation of this category of nuclear reactors. I have been employed by the Nuclear Regulatory Commission since February 1980.

As project manager, I was responsible for planning the evaluation of the UCLA license renewal application; for providing a technical evaluation of this application; for reviewing the evaluations of other technical personnel; for producing the Safety Evaluation Report (SER), the Technical Specifications, and the environmental appraisal.

I received a Bachelor of Civil Engineering Degree from the Polytechnic Institute of Brooklyn [now New York Polytechnic Institute] in 1949 and in 1951 completed all technical requirements for a Master of Science in Sanitary Engineering at the University of Illinois. I have completed many short courses and additional graduate courses in various aspects of nuclear engineering and in sanitary/environmental engineering at UCLA, George Washington University, the National Institute of Health and the University of Michigan. I am a registered Professional Engineer in the State of Maryland.

From 1951 to 1955 I was employed as a Sanitary Engineer by a consulting firm in Los Angeles, California.

I was employed by Atomics International from 1955 to 1960 as a Process Engineer concerned with the design of liquid, gaseous, and solid waste management systems. One year was spent as a shift supervisor at the 10 MW Organic Moderated Research Experimental Reactor located at the National Reactor Test Site in Idaho.

From 1960 to 1966 I was a Senior Sanitary Engineer with the Atomic Energy Commission with the responsibility for the development of operational radioactive waste management concepts for liquid, gaseous, aerosol, and solid, low, intermediate and high level wastes.

From 1966 to 1972 I was employed by the Environmental Protection Agency in the Office of Research and Development, as a Branch Chief with the responsibility for the development and implementation of waste management concepts in the areas of pollution control from agribusiness activities and acute discharges of oil and hazardous materials into terrestrial, river, atmosphere and marine systems. From 1972 to 1980 I was Vice-President and President, respectively, in two consulting engineering companies.

26

BY MS. WOODHEAD:

Q. Mr. Bernard, I'd like to hand you a second document entitled "Supplemental Safety Evaluation Report related to Renewal of the Operating License for the Research Reactor at the University of California at Los Angeles." The date is October 1982. Did you prepare this document?

A. I put it together and did just about everything but the emergency plans. That was done by another gentleman in the agency.

Q. All right. Is this document true and correct to the best of your knowledge and belief?

A. Yes, it is.

MS. WOODHEAD: Staff moves into evidence Staff Exhibit 8, which has previously been marked. It's the Supplement to the SER for UCLA.

MR. HIRSCH: We have the same qualification objection, and also note that we understand the portion to be relevant to be Section 14 of this document. The other portions --

JUDGE FRYE: Fuel handling accident.

MR. HIRSCH: Yes, pages 14-1 and 14-2. The emergency plan and other materials seem to us irrelevant, and again we were on notice about Section 14, and not the other portions.

MS. WOODHEAD: I would like to remind the Board of one fact, and that is that I listed every exhibit the Staff

27

1 planned to enter --

2 JUDGE FRYE: We're just talking about relevance now.

3 We're just talking about relevance, that's all. What's rele-

4 vant to this phase.

5 MS. WOODHEAD: I understand that. His objection as

6 to notice. He was on notice that the staff planned to submit

7 both the SER and the Supplement at this proceeding.

8 JUDGE FRYE: Okay. Well, we will admit the Supple-

9 ment to the SER.

10 MR. HIRSCH: Again with the same understanding about

11 relevance?

12 JUDGE FRYE: Yes.

13 (The document referred to was

14 marked for identification as

15 Staff Exhibit No. 8, and was

16 received in evidence.)

17 MS. WOODHEAD: Mr. Bernard is available for cross

18 examination.

19 MR. CORMIER: No questions at this time.

20 MR. HIRSCH: May I make one inquiry of Staff counsel

21 before I proceed which will help, I think, eliminate duplica-

22 tion of cross examination?

23 JUDGE FRYE: Go ahead.

24 MR. HIRSCH: I understand Mr. Wohl will also be into

25 some part of the SER. I would just like to make sure that-

I'm not duplicating questions that should be addressed to Mr. Wohl. Could you spell out which portions of the SER should be addressed to Mr. Bernard and which to Mr. Wohl?

MS. WOODHEAD: I think I'm going to have to ask Mr. Bernard about that. Can you specifically identify what Mr. Wohl contributed to the SER?

THE WITNESS: We looked at the meteorological data together on the atmospheric dispersion proceedings, and I'm as familiar with that portion as Mr. Wohl is.

I'm familiar with that portion, the atmospheric dispersion units that we used, as well as Mr. Wohl.

MS. WOODHEAD: Are you speaking about the SER now, not your testimony, but the SER?

THE WITNESS: The SER Mr. Wohl gave me the dose -- same thing. The SER -- the point -- the 7×10^{-2} dispersion factor we did together.

MS. WOODHEAD: Uh --

THE WITNESS: We looked up together.

MS. WOODHEAD: Could you clarify what you were about to say concerning dose? Did Mr. Wohl do some calculations on doses?

THE WITNESS: He supplied that table. Let me get it specifically. Table 14, there's 2.1.

MS. WOODHEAD: Would you tell us the page number?

THE WITNESS: 14-7. That was the corrected table

1 from the Battelle report. And those values were reduced by
2 30% or 70% of these values were utilized, and Mr. Wohl pro-
3 vided that particular factor.
4 MS. WOODHEAD: Where does that appear in the SER?
5 THE WITNESS: In the fuel handling accident, on
6 page 14-9. The bottom paragraph, micrometerological dilution
7 factor of 7×10^{-3}, Reference 12. And that dilution factor
8 is one I was mentioning before that we discussed jointly
9 with the meteorological staff of the NRC.
10 MS. WOODHEAD: So do I understand you that Mr. Wohl
11 provided nothing independently of your --
12 THE WITNESS: Correct.
13 MS. WOODHEAD: Joint effort with him?
14 THE WITNESS: Correct.
15 MS. WOODHEAD: All right. Thank you.
16 MR. HIRSCH: So my query is, Mr. Wohl hasn't pre-
17 filed his testimony yet, it's to occur in October. And if
18 he provided nothing independent, am I to cross examine him
19 on all this or --
20 JUDGE FRYE: That is -- I guess we'll have to wait
21 and see his testimony first before --
22 MS. WOODHEAD: Oh, no, what -- are you --
23 MR. HIRSCH: In other words, what will be the scope
24 of Mr. Wohl's testimony so I don't have to duplicate with Mr.
25 Bernard matters which Mr. Wohl had testified to.

MR. CORMIER: Sounds like we're getting into matter of litigation strategy about this --

JUDGE FRYE: No, I don't think so.

MS. WOODHEAD: Mr. Wohl will testify only to the scientific validity of the three laboratory reports. That is the only link in the chain we haven't gotten to yet. We have -- it's obvious that we have accepted the laboratory reports. We don't have any seal of approval from the NRC staff who ran the contracts. That was the only intention I had for presenting Mr. Wohl. Since he is in the accident evaluation branch.

JUDGE FRYE: So he is the individual then who received the reports from the national labs, and said, yes, we will accept these.

MS. WOODHEAD: Absolutely.

JUDGE LUEBKE: That sounds like an administrative feature. Is that what it is?

MS. WOODHEAD: What is?

JUDGE LUEBKE: Mr. Wohl's function that you just described. I mean, he received in the mail some reports from Argon, from Los Alamos.

MS. WOODHEAD: The staff has to review it scientifically before it's accepted and issued -- and published as a NUREG document --

JUDGE LUEBKE: But Mr. Bernard is just saying he's

1 taken credit for everything. Mr. Wohl seems to have nothing
2 left in October, I think, is how it comes out, as I listen.
3 MS. WOODHEAD: I don't think it's very substantial
4 myself.
5 JUDGE LUEBKE: Oh, that's what we're getting to.
6 MS. WOODHEAD: I never indicated it was. That idea
7 came from Mr. Hirsch.
8 JUDGE LUEBKE: That's why I suggested his presence
9 at the hearing and his function was going to be sort of admin-
10 istrative.
11 MS. WOODHEAD: To a certain extent, yes.
12 Does that answer your question, Mr. Hirsch?
13 MR. HIRSCH: I'm afraid it confuses me a little
14 more.
15 JUDGE FRYE: This is one of those situations, the
16 more you explain it, the more I don't understand it?
17 MR. HIRSCH: Right. The deeper one gets into a hole.
18 Let me be explicit. The 7×10^{-3}, chi over Q, is Mr. Wohl
19 going to testify to that?
20 JUDGE FRYE: No. I take it Mr. Bernard has indicated
21 that he would.
22 MS. WOODHEAD: No, Mr. Wohl will testify only as a
23 reviewer in the accident evaluation branch who has reviewed
24 all the documents in this proceeding as a scientist and states
25 his testimony on it.

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1 MR. HIRSCH: And the portions of the SER that talk
2 about each of those lab studies and adopts the conclusions,
3 those questions should be addressed to Mr. Wohl or to Mr.
4 Bernard?
5 MS. WOODHEAD: Mr. Bernard. Mr. Wohl has nothing to
6 do with the SER other than that one calculation, which he and
7 Mr. Bernard jointly worked on. That's it. That's his only
8 contribution.
9 THE WITNESS: May I take an opportunity to explain?
10 Mr. Wohl was contract manager for several of the
11 reactors. He contracted -- I mean, several of the laboratories.
12 He contracted with Battelle for what we call the Battelle
13 study. The evaluations came to Mr. Wohl. He distributed them
14 to several of us in the agency. We made our comments, we
15 discussed them with him, and he went back to Battelle with
16 the comments, and Battelle reevaluated or took into considera-
17 tion our comments, reevaluated, came out with, in essence, the
18 final report. It was a contract between Battelle and the
19 AEB, the accident evaluation branch. We utilized that report
20 to help us evaluate the UCLA license application renewal.
21 Does that help?
22 MR. HIRSCH: Let me explain my problem. When staff
23 submitted Mr. Wohl's name, and what he was to testify about,
24 it indicated he was going to testify about Section 14 of the
25 SER. Staff then said if they couldn't provide that testimony,

because it would take several person weeks to be able to come up with the basis for that portion of the SER. And now I'm hearing that -- it's essentially that he represents the seal of approval for the agency, and that he -- his sole contribution to the SER was this one number which I'm told I'm supposed to ask Mr. Bernard about. And I'm particularly confused as to whether I should address my questions about why the staff has accepted the conclusions of the three laboratories which is the bulk of what this testimony is about. Should I address those to Mr. Bernard or to Mr. Wohl?

JUDGE FRYE: From what I have heard so far, I would think you would be well advised to address them to Mr. Bernard and if he can't answer them, then you would go to Mr. Wohl.

MR. HIRSCH: Am I -- my question is, am I going to have to do this a second time?

JUDGE FRYE: Only to the extent that he can't answer it, I would think, but of course, that's up to you.

MR. HIRSCH: No, I'm asking from Staff. Mr. Wohl's testimony won't come back on the same matters?

MS. WOODHEAD: Won't what?

MR. HIRSCH: Will not -- Mr. Wohl's testimony will not come back to us on the same matters that we're addressing now with Mr. Bernard?

MS. WOODHEAD: I don't know what you're going to ask Mr. Bernard. How could I answer your question? Mr. Wohl

1 will review the laboratory documents and discuss them as to
2 their validity and their application to this reactor. He
3 was the one who was responsible for accepting them and approving
4 them, so he should be the one who testifies about their basic
5 validity. All Mr. Bernard did was reference them, and use
6 their numbers.
7 JUDGE LUEBKE: And is it correct that those documents
8 are already in the record of this proceeding?
9 MS. WOODHEAD: Quite correct.
10 JUDGE LUEBKE: I guess I'm beginning to understand
11 this case.
12 MR. HIRSCH: I just want to express again my confu-
13 sion. I do not know whether the staff conclusions of the
14 scientific validity of these three studies Mr. Bernard is
15 testifying to, or Mr. Wohl, or both. And I think I've just
16 heard that it was Mr. Wohl who's testifying to that.
17 MS. WOODHEAD: That's correct. Mr. Bernard was not
18 the reviewer. He did not manage the contract. He may have
19 information about it, but the decision was Mr. Wohl's as to
20 whether to approve the final document.
21 JUDGE LUEBKE: Does that mean that Mr. Wohl, when
22 he comes in October or whenever, November, he'll have a sub-
23 stantial prefile testimony for these people to work with?
24 MS. WOODHEAD: I doubt that it will be substantial.
25 What I've described doesn't take many pages.

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1 JUDGE LUEBKE: I had the suspicion of that, and I
2 just wanted to be sure Mr. Hirsch understood that. That Mr.
3 Wohl is not the heavyweight in this thing.
4 MR. HIRSCH: Mr. Bernard?
5 JUDGE FRYE: Mr. Bernard, are you the heavyweight
6 in this?
7 THE WITNESS: Let me -- I'm overweight.
8 JUDGE FRYE: Let me see if I understand it. You
9 know, I'd -- Mr. Bernard indicated that because of resource
10 limitations, the agency was contracting with national labora-
11 tories for work with regard to non-power reactors. In this
12 case, that work obviously is the Battelle study, the work
13 done by Mr. Cort, the one done by Dr. Neogy, which has all
14 come in to the proceeding. Now, someone within the agency
15 has to oversee the preparation of those studies as they're
16 going along. And to comment on them, and say, no, we don't
17 like the way you treated this, go back and do that again, or
18 what have you. And from what I've gathered, Mr. Wohl had that
19 responsibility. In connection with or after consultation with
20 Mr. Bernard, is that correct?
21 THE WITNESS: And several other people.
22 JUDGE FRYE: Several other people.
23 THE WITNESS: Several other engineers, right.
24 JUDGE FRYE: Now, so it sounds to me like Mr. Wohl
25 is basically as Dr. Luebke says performing an administrative

1 function.

2 THE WITNESS: And Jocelyn Mitchell performed a

3 similar function for the Brookhaven National Laboratory report.

4 She's the one who --

5 JUDGE FRYE: Let me see -- but it's basically an

6 administrative function.

7 THE WITNESS: Well, it's a technical -- it's a tech-

8 nical function, but it's -- let me call it a technical func-

9 tion rather than an administrative function. Because it's

10 really the technical aspects that they were reviewing. The

11 fact that they developed the paperwork to get them the funds

12 and developed the scope of work, so they provided the correct

13 kind of information and analyses is administrative, but the

14 review aspect is strictly technical.

15 JUDGE LUEBKE: But does that mean that come October

16 that these people are going to write prefile testimony that's

17 extensive technical nature?

18 MS. WOODHEAD: I don't envision that at all.

19 JUDGE LUEBKE: I didn't think so. But to listen to

20 Mr. Bernard, it sounded that way again. I mean, he didn't

21 want to limit them to be administrators. He said they're

22 technical.

23 JUDGE FRYE: Wait. If you received a draft, say,

24 from Brookhaven, it came to you through Mr. Wohl and you looked

25 at it and you said, this is no good, it's got to go back.

you went up to Mr. Wohl and said, I can't use this. Have it redone. And he says, no, I think it's fine. Would you then be stuck with it or would he have to follow your wishes in the matter?

THE WITNESS: We would have a heated argument. And I would not accept the report, and I would write to several people telling why because I would not want that report to be received by the Commission and distributed as a NUREG report even though it's got a slash with a contractor on it. We would resolve those technical problems.

JUDGE FRYE: But he would have a technical input into it?

THE WITNESS: Yes.

JUDGE FRYE: I see.

THE WITNESS: In that particular -- you picked the wrong example, because I don't know very -- I'm not a physicist so that particular retran one with Brookhaven, Jocelyn Mitchell ran pretty much herself.

JUDGE FRYE: I see.

THE WITNESS: But the Battelle report we did have extensive dialogues, technical dialogues.

JUDGE FRYE: Well, my anticipation had been that Mr. Wohl's testimony and Ms. Mitchell's had she remained with the agency would be very brief. And basically administrative in nature. I think we ought to get started with it, and see

1 how it goes. I don't know how else to approach it at this
2 point.
3 MR. HIRSCH: Just for the record, the delay -- the
4 request to delay filing of those two people's testimony was
5 based on an assertion that it would take four staff weeks to
6 produce that testimony. That makes me somewhat nervous to
7 cross examine Mr. Bernard on matters which a witness may come
8 back on two months later and testify about also. It seems to
9 me like two bites out of the apple, seems prejudicial in terms
10 of the two months to review questions on the same matter. And
11 I must say I still do not know clearly to whom the questions
12 should be addressed. And I do find it prejudicial to have
13 to perhaps ask them twice over a period of two months.
14 JUDGE LUEBKE: I have listened long enough to hear
15 Ms. Woodhead would exclude Mr. Wohl from doing that to you.
16 MR. HIRSCH: Is that correct?
17 MS. WOODHEAD: Mr. Hirsch, the object of this pro-
18 ceeding is to find the truth, and not to play dirty tricks.
19 I don't think the Staff has done one thing that hasn't been
20 well in advance and clearly noticed to you. I don't know
21 where your question's coming from, and I think it's inappro-
22 priate.
23 MR. HIRSCH: I'd appreciate an answer, though to
24 Dr. Luebke's point. The material we'll go over with Mr. Bernard
25 will then not be -- will be excluded then from Mr. Wohl's

:39

1 testimony?

2 MS. WOODHEAD: Mr. Hirsch, I think you are now

3 playing a dirty trick on me, or attempting to. We haven't

4 even written Mr. Wohl's testimony yet. I can't tell you what

5 he might want to say. He is the witness. We have clearly

6 identified who wrote what, who did which analysis. You've

7 had ample opportunity to cross examine the authors of the

8 three laboratory analyses. They're merely referenced in the

9 SER. Mr. Bernard's contribution to the SER is clearly

10 identified in that where he did not make the contribution, he

11 clearly states that. I do not know what else it is you want

12 to know.

13 JUDGE FRYE: Also we know that there's nothing --

14 there's nothing in the SER that Mr. Wohl did independently.

15 MR. HIRSCH: Which would appear to me that he could

16 testify about all of it.

17 JUDGE FRYE: No,I wouldn't read it that way.

18 JUDGE LUEBKE: Well, Ms. Woodhead has just back-

19 watered, and in the sense that she has said that there can be

20 duplication in October and November, and that we can go over

21 this ground once more with Mr. Wohl. She has now -- she is

22 not excluding Mr. Wohl from the ground we're covering this

23 week.

24 MR. HIRSCH: I thought --

25 MS. WOODHEAD: Dr. Luebke, how can I do that when

1 I have no idea what questions Mr. Hirsch is going to ask?
2 JUDGE LUEBKE: Well, then we have one possibility of
3 that, is put Mr. Bernard and Mr. Wohl on in October together
4 as a suggestion from the Board.
5 MS. WOODHEAD: I have no objection to that.
6 JUDGE FRYE: Do you have any objection to that?
7 MR. HIRSCH: I should think about it for a minute.
8 JUDGE FRYE: Well, you think about if for a minute.
9 Do you have any objection to that, Mr. Cormier?
10 MR. CORMIER: I'd like to think about it, but I'd
11 like to point out that I thought that we had rearranged this
12 schedule so that CBG's witnesses would be after all Staff wit-
13 nesses in October because the parties contemplated that Mr.
14 Wohl and I guess, Ms. Mitchell, were going to be coming in
15 with testimony late that couldn't be filed earlier because of
16 their own work schedules. So I thought it was clearly in
17 the contemplation of all the parties that this testimony was
18 going to be coming in late.
19 JUDGE FRYE: Well, I think it was. The original
20 contemplation was that it wouldn't be late, and then it
21 subsequently developed that it would be.
22 MR. CORMIER: It -- my point -- my further point is
23 if we thought it was just administrative -- I'm not sure I
24 know what that means -- there'd be no reason to even delay
25 the testimony. It must have been contemplated that there was

1 going to be some substance to the testimony of Mr. Wohl and
2 Ms. Mitchell because that's why we rearranged this schedule,
3 split it up, and at CBG's insistence, had them going last in
4 the proceeding which is different from the way Intervenor's
5 normally appear in NRC proceedings. I thought we did all this
6 to accomodate CBG.
7 JUDGE LEUBKE: And two staff witnesses who were
8 only going to write a few pages, but they couldn't do it very
9 fast.
10 MR. CORMILR: I don't know where the two pages
11 came up. I contemplated that there was going to be -- there
12 was some substance to that testimony. If there wasn't some
13 substance, I would have objected vehemently to delaying this
14 thing until October just to get an administrative stamp of
15 approval. It must have been contemplated by the parties that
16 there was going to be some substance to that testimony.
17 That's my point.
18 JUDGE FRYE: Why don't you all confer? You wanted
19 to think about it a little bit. You wanted to think about it
20 a little bit. And we'll give you a few minutes to do that.
21 MR. HIRSCH: I have one query to help with that
22 contemplation. I understood that Staff was going to file
23 that testimony on September 1, and I just wanted to make sure
24 that's correct.
25 JUDGE FRYE: I'd forgotten the -- is it September 1?

MS. WOODHEAD: I don't recall that date. We just talked about September 7th, but I think September 1 would be -- oh, I remember now. I said that the staff could file its testimony by September 1, and could appear mid-September or --

JUDGE FRYE: Mid-Septerber.

MS. WOODHEAD: Or early October according to the schedule set up. So it was a proposal on my part which was never established as a date, but we can stick to that.

JUDGE FRYE: Well, I was assuming that it was to be filed by September 1. The date that you had given that it could be filed by, that was my assumption.

Why don't you all contemplate this for a few minutes, and we will go off the record?

(Whereupon, a brief recess was taken.)

JUDGE FRYE: Back on the record.

Any rays of sunshine in the dilemma?

MR. HIRSCH: Yes, we have a ray of sunshine for you. I think it resolves the problem. We have no questions for Mr. Bernard.

JUDGE FRYE: That would certainly solve the problem.

MR. HIRSCH: Let me -- just to explain for a moment. The SER simply says we accept the conclusions of the three studies. We've cross examined on those studies, so there's no need to do it again with Mr. Bernard as to why he accepted them. The two or three minor additional matters are ones

which seem to us minor, and one in particular, Mr. Wohl provided the calculation for, so perhaps we can ask Mr. Wohl about it. So -- fine. Maybe that solves the problem. I hope so.

JUDGE LUEBKE: It sure does.

JUDGE FRYE: It surely simplifies it in the short term.

MS. WOODHEAD: I certainly like that answer.

JUDGE FRYE: Well, fine. Do you have any questions?

JUDGE LUEBKE: No. While we're here, we might still work out then the detail of where -- we're still thinking in terms of October 4th, is that it?

JUDGE FRYE: Well, let's let Mr. Bernard get off the stand.

JUDGE LUEBKE: Oh, all right.

JUDGE FRYE: Do you have anything?

JUDGE LUEBKE: No, I don't have any questions.

MR. CORMIER: No questions.

JUDGE FRYE: Mr. Bernard, I thank you very much.

(The witness was excused.)

JUDGE FRYE: Now, do we need to -- I don't think we really need to talk about future scheduling on the record, so why don't we go off the record at this point? Unless you would like to -- would you like to keep it on the record?

MR. HIRSCH: We could repeat it back into the

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record once we made a decision. I just want to indicate that we do have some procedural matters which we'd like to raise on the record before we close this --

JUDGE FRYE: Okay. Let's stay on the record then. First, would it be best to take up schedules first, do you think? Or do you want to take up procedural matters?

MR. HIRSCH: Schedule would be good.

JUDGE FRYE: Okay. Your witnesses, Mr. Hirsch, are available the first two weeks of October, if I understand correctly.

MR. HIRSCH: That's best.

JUDGE FRYE: That's best for them. But do you, Mr. Cormier and Mr. Woodhead, have any idea about how long you think it will take to get through these CBG panels?

MR. CORMIER: It will take me --

JUDGE FRYE: I asked you before, I think.

MR. CORMIER: Yeah. Some time given the form of the testimony to go through voir dire.

JUDGE FRYE: All right. I wanted to make a suggestion in that regard. It would seem to me that if you're going to have extensive questions on that -- that you previously outlined with regard to who is responsible for what statement, that it would be best to take that up in the course of cross examination, and then make your motions after you finished with your cross examination. On the thought that that would

1 go much faster.

2 MR. CORMIER: I would prefer not to be constrained

3 to do that. For other reasons. I guess I haven't thought

4 about that. I understand what you're suggesting, but the

5 nature and scope of voir dire examination is different than

6 the scope of cross examination, and there are reasons for

7 engaging in one and not in the other, or engaging in them in

8 different ways. And I would want to think that out first.

9 JUDGE FRYE: Okay. Assuming that you were to do

10 it in the traditional way, how much time is some time? Do

11 you have any rough idea?

12 MR. CORMIER: Again, as I understand it, CBG is

13 proposing to enpanel its first panel, and go through panel

14 by panel?

15 JUDGE FRYE: It's my understanding --

16 MR. HIRSCH: Yes, we hope it can be done in that

17 order because it's intellectually more coherent. It depends

18 on the availability of witnesses in terms of when we start,

19 however.

20 JUDGE FRYE: But they would in any event -- you

21 would present one panel followed by a second panel followed

22 by a third panel, maybe not necessarily in the order --

23 MR. HIRSCH: Yes, we hope it will be in the order

24 in which it's presented when we filed it, but certainly it

25 will be one panel, then they'll get off, and then another

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1 panel will come up in the next issue.

2 JUDGE FRYE: Fine.

3 MR. CORMIER: There is considerable overlap as I

4 note it for the witnesses for the various panels. Indeed, I

5 think we have something like ten or eleven that are spread

6 in various configurations with four panels. So a lot of that

7 would be -- a lot of the voir dire would be duplicative.

8 Taking the first panel on power excursions, -- I mean, a long

9 time in voir dire for me is a day for the entire panel. That's

10 -- I would consider that long. I wouldn't ordinarily think

11 that I would go beyond that for voir diring the whole panel.

12 And then because of the overlap on the people on the panel,

13 the voir dire of any other panel would be greatly reduced

14 from that because they're the same people in most cases.

15 JUDGE FRYE: I see.

16 MR. CORMIER: I don't know how I can better --

17 JUDGE FRYE: So you think probably around -- in the

18 neighborhood of one day for voir dire would take care of all

19 four panels?

20 MR. CORMIER: No, not in -- I can't commit to that,

21 because the subject matter is different. My trouble is --

22 JUDGE FRYE: Well, I realize the subject matter is

23 different. I said, in the neighborhood of. I wasn't trying

24 to make you definite. I was trying to get some sort of an

25 idea.

MR. CORMIER: Yeah. That's about as good as I can do right now.

JUDGE FRYE: All right. Then how much time for cross after that?

MR. CORMIER: I don't know. That is going to depend on our motion to strike certain portions of the testimony outside the scope and certain exhibits. And assessing what's left -- in addition, I certainly want to review these proceedings, and see what cross I --

JUDGE FRYE: Well, assuming that it all stayed in, you think about a week?

MR. CORMIER: I would think a week is more than sufficient for my cross.

JUDGE FRYE: Less than a week then?

MR. CORMIER: Yeah.

JUDGE FRYE: So you'd probably go through the whole procedure within a week, voir dire and cross?

MR. CORMIER: Voir dire and cross, as far as my commitment, yes, less than a week.

JUDGE FRYE: Okay. Ms. Woodhead, any ballpark on that?

MS. WOODHEAD: I doubt very much that I'd have an hour or two total in a whole week additional cross. I don't know what he's going to ask, but obviously he will ask the majority of the questions.

JUDGE FRYE: I see. So then probably for both of you in the neighborhood of a week. We'd be able to get through it.

MS. WOODHEAD: That's correct.

JUDGE FRYE: Okay.

MR. HIRSCH: May I inquire? If I remember your comment two weeks ago, you have a problem with the second and third week in October?

JUDGE FRYE: Well, if you can't get your witnesses here, I'll be here.

MR. HIRSCH: No, no, I may be able to help you.

JUDGE FRYE: But getting the first and second weeks helps me considerably.

MR. HIRSCH: It's the third week in particular --

JUDGE FRYE: The third week in particular.

MR. HIRSCH: Do you have problems also with the second week?

JUDGE FRYE: No -- well, I can work around those. That's no problem.

MR. HIRSCH: Because what I hear is we're talking about a week.

JUDGE FRYE: That's what I hear, too, and conceivably, we might -- if they're available the first week, we might be able to get through them in the first week.

MR. HIRSCH: If we start Tuesday, that's difficult.

1 But if we think about a Saturday day proceeding, so have
2 six days or so, we may be able to pull itoff.
3 JUDGE FRYE: You mean Monday through Saturday?
4 MR. HIRSCH: Something like that. I'm just asking.
5 Columbus Day in there it's a problem. You'd have to stay
6 over three days.
7 JUDGE FRYE: We've also got Mr. Wohl to --
8 JUDGE LUEBKE: Excuse me, does it -- what three
9 day weekend is Columbus Day, the 10th?
10 JUDGE FRYE: It's the 10th.
11 JUDGE LUEBKE: The 10th is the official holiday.
12 MR. CORMIER: For whom?
13 MR. HIRSCH: I don't know for whom. I asked that a
14 while ago. I think we have an answer.
15 JUDGE FRYE: It's the official holiday for Chris-
16 topher Columbus.
17 MR. HIRSCH: He's been enjoying it for some years
18 actually.
19 JUDGE LUEBKE: So are we getting down to would
20 CBG go first, and these two -- one or two staff witnesses last?
21 JUDGE FRYE: No --
22 MR. HIRSCH: No, my understanding was we could do
23 Mr. Wohl very quickly. It sounds like that's only a few pages
24 and then begin --
25 JUDGE LUEBKE: All right.

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JUDGE FRYE: And then go into the CBG -- we'd take Mr. Wohl first, I think.

JUDGE LUEBKE: So then we're down to one weekend in Los Angeles from Washington.

JUDGE FRYE: No, I'm wondering from what Mr. Hirsch suggests -- we could travel on a Sunday and --

JUDGE LUEBKE: Could work Saturday.

JUDGE FRYE: We could travel on a Sunday and work through the following Saturday and be done with it all.

JUDGE LUEBKE: That would be two weekends.

JUDGE FRYE: And that would be two weekends at that point, yes.

JUDGE LUEBKE: Yes, two of my weekends.

JUDGE FRYE: Well, is there a problem scheduling Mr. Wohl? Is his schedule fairly flexible, or do you know at this point?

MS. WOODHEAD: It's even worse since Jocelyn Mitchell left. But he has planned for some time to come the first week, be the first witness in the first week of October.

JUDGE FRYE: I see.

MS. WOODHEAD: And I assumed that would be October 3rd or 4th.

JUDGE LUEBKE: I would prefer traveling on Monday, the 3rd, starting on Tuesday, the 4th and being in California one weekend instead of two weekends.

1 JUDGE FRYE: And then going over to the following
2 week?
3 JUDGE LUEBKE: If we have to.
4 JUDGE FRYE: If we have to.
5 JUDGE LUEBKE: Extending into the next week. And
6 work on Saturday if we're here.
7 JUDGE FRYE: Work on Saturday, and do you have any
8 objections to working on Columbus Day?
9 MR. HIRSCH: I noticed that Judge Bright seemed to.
10 JUDGE BRIGHT: Oh, I've given up any number of
11 holidays.
12 MR. HIRSCH: Frankly, if we can --
13 JUDGE FRYE: The courthouse would be closed, but
14 we'd have to find some other --
15 MR. HIRSCH: If we had -- as they say, that bounce
16 room that we were discussing earlier I think that would be
17 useful, because if we're estimating five to six days, it
18 would be nice if there were flexibility in case we ran into
19 trouble. So starting the 4th, trying to finish by the end of
20 that week, and if we can't, going into the next week. If that
21 works with your schedule, it would seem to work with ours.
22 MR. CORMIER: You think you can get a panel on after
23 Mr. Wohl, like the 5th or 6th?
24 MR. HIRSCH: Yes. There's one witness who we may
25 end up losing because of that, who will be out of the country,

1 but I don't, at the moment, see that as essential.

2 MR. CORMIER: That would be fine, and if we could

3 have Columbus Day to work on, if there's some option that we

4 have -- maybe there isn't, then that would seem to probably

5 be sufficient.

6 MS. WOODHEAD: Is it possible to start on October

7 3rd on Monday with the outside hope we could finish on Friday

8 or at the very latest on Saturday?

9 JUDGE FRYE: I'll let you negotiate with Dr. Luebke

10 on that.

11 MS. WOODHEAD: My thought is that it seems to me

12 quite likely that Mr. Wohl's cross examination would be rather

13 quick, and that CBG could go on on Monday the 3rd, perhaps

14 in the afternoon, and be finished by closed of business Friday.

15 That's Pacific time.

16 JUDGE FRYE: All right. Let's plan to do that, plan

17 to start Monday the 3rd.

18 MR. HIRSCH: I just want to say I think it's okay.

19 I didn't ask them if we could start as early as the 3rd,

20 because I knew about the travel day. I'll assume it's okay,

21 and if not, it has to start on the 4th. I'll let you know

22 within days, and I'll get back to you. But I believe it's

23 okay. But I had always told them that if the hearing started,

24 it would be the 4th. So I just want to make sure that's

25 okay.

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JUDGE FRYE: Okay. With that understanding, and you'll -- well, you'll know what, by the end of --

MR. HIRSCH: End of the week.

JUDGE FRYE: End o the week.

MR. BERNARD: If what Mr. Hirsch has said comes to fruition, and he can't get his witnesses to come until Tuesday, we could still fly out of Washington on Monday and start here at one o'clock. Because we land at eleven --

JUDGE FRYE: Well, let's see what --

MR. BERNARD: That's another option.

MR. HIRSCH: One thing that helps -- I understand that -- I remember that last week you requested that scope objections be submitted in writing --

JUDGE FRYE: That's right.

MR. HIRSCH: I don't know if you intended to rule beforehand and wish for us to respond in writing, or if you intended that the objections be in hand in writing so that we would have more of a concrete grasp of it when it's discussed.

JUDGE FRYE: It's really the latter is what I had in mind.

MR. HIRSCH: Then we should just schedule a little bit of time during that first day or so to try to resolve that scope issue.

JUDGE FRYE: In light of the fact that we seem to be getting on a fairly tight schedule, I'm wondering if it

1 would be possible to get them in advance. Maybe I could rule
2 in advance before we get out here, and we won't have to take
3 time at the hearing arguing them. I'd forgotten the date
4 that --
5 MR. CORMIER: September 7th.
6 JUDGE FRYE: The 7th?
7 MR. CORMIER: You asked the Staff and University,
8 I believe, last week to have scope objections by September
9 7th.
10 JUDGE FRYE: So if we were to do it in advance, it
11 -- if we were to dispose of those in advance, we would have
12 to get them earlier. In order for Mr. Hirsch to get an
13 opportunity to respond. And for us to have an opportunity to
14 consider it all.
15 MR. CORMIER: Before you ask the question you're
16 going to ask, could we review the number of matters that are
17 pending, dates of submittals of various pleadings?
18 JUDGE FRYE: Sure. I think that would be helpful.
19 MR. CORMIER: I understood several items were put
20 off until October -- or I'm sorry, August 31st. But I'm con-
21 fused as to what items those were. One was clearly the
22 response to the exceptions to Judge Laurenson's order on the
23 class of license. And then I believe Ms. Woodhead has a
24 motion for reconsideration with respect to the class of license
25 contention that is pending. That was also put off to August

31st.

JUDGE FRYE: No, that's been filed, has it not? And we've held --

MS. WOODHEAD: The responses have not been filed.

JUDGE FRYE: The responses have not been filed --

MS. WOODHEAD: The original due date was in the middle of the hearing, and that is indeed, I believe, what was discussed. August 31s would be the due date for responses to my motion.

MR. CORMIER: I realized that afterwards, I guess. I was confused with the motion for reconsideration on Contention 20.

JUDGE FRYE: That's the 15th.

MR. CORMIER: Which -- August 15th.

MS. WOODHEAD: Correct.

MR. CORMIER: And that has not changed?

JUDGE FRYE: No, it has not at this point. That would mean that the responses to the motion for reconsideration would then be due the 31st, if I'm not mistaken. Or no, I guess it would go into September, wouldn't it.

MS. WOODHEAD: I believe in your order it's all set out there. Motions for reconsideration to your order are due August 15th, and responses to motions are due -- I believe, August 25th -- I believe it's in the order.

MR. HIRSCH: I think I have it here.

1 MR. CORMIER: The 25th is obviously not enough time.
2 From the 15th.
3 Page 26 of your May 11th order, Judge Frye, you
4 directed us by August 15th, "any party may seek reconsideration
5 of certain sections. And then responses in support of motions
6 to reconsider must be filed by August 25th."
7 MR. HIRSCH: In support?
8 MR. CORMIER: In support. Or -- so all you want is
9 a motion in support of somebody else's motion to reconsider.
10 JUDGE FRYE: Well, it was Ms. Woodhead's motion
11 originally. And you didn't file a formal response to it.
12 MR. CORMIER: No.
13 JUDGE FRYE: My thought being that is she's going to
14 move to reconsider it being her motion, you may want to file
15 something in support of it, and that was the support of her
16 motion to reconsider.
17 MR. CORMIER: Okay.
18 JUDGE FRYE: And that would come in, and then any
19 responses in opposition from CBG or Santa Monica would follow
20 that.
21 MR. HIRSCH: And what's the date for that?
22 MR. CORMIER: Can we set a date?
23 JUDGE FRYE: What's the date? Is there a date there
24 for that?
25 MR. CORMIER: Oh, I see. Yeah. Responses in oppo-

sition, September 12th.

JUDGE FRYE: September 12.

MR. CORMIER: I'm sorry, the page was cut short. So that scheduling stands --

JUDGE FRYE: Well, that's not to say we can't vary it if it suits the convenience of everyone.

Does that run down all of the various dates that we've got?

MR. HIRSCH: We've got a couple of others. The Staff audit of the specialty materials, you provided an opportunity for response when that audit was finally completed. We got a cover letter from the Staff a couple of days ago indicating that the audit report was available, but we haven't actually received the report. So one, we're going to have to get the report. And two, then the date for us to respond to it.

JUDGE FRYE: All right. That's contention 20.

MR. HIRSCH: The physical inventory.

MS. WOODHEAD: I don't recall an order stating that responses could be made to the inventory by I & E. What would be the nature of that response?

JUDGE FRYE: It didn't provide a date, but it said on the plea, the inventory would put the matter to rest, and it didn't. So we have to see where we went from there. I think what he's saying is that it doesn't put the matter to

rest so far as CBG is concerned.

MR. HIRSCH: Well, I haven't seen it yet, but --

JUDGE FRYE: It may put the matter to rest, but you don't know.

MR. HIRSCH: Right. And we'd like the opportunity, obviously, to respond to it.

JUDGE FRYE: The official report, you should have it, I guess, by now, because it was back in --

MR. HIRSCH: We got the cover letter of transmittal but not report.

JUDGE FRYE: But you didn't get the report?

MS. WOODHEAD: I thought I mailed you the report when I was in the office last week.

JUDGE FRYE: We got it.

MR. HIRSCH: I got the cover letter.

MS. WOODHEAD: No, no. I have mailed you the report, the inspection report, and it's just a slow mail service from Washington out here.

MR. HIRSCH: Well, I got the cover letter.

JUDGE FRYE: Well, apparently it's the slow -- you got the cover letter, but not --

MS. WOODHEAD: I sent two documents to you. One is the cover letter. One is the inspection report.

MR. HIRSCH: So maybe that will arrive soon. At any rate, whenever we get that, we'd like some time to review

1 it, and respond to it. Perhaps we can just establish what
2 -- fifteen days from receipt of the document to respond?
3 JUDGE FRYE: I'm just wondering whether we shouldn't
4 coordinate it with the motion for reconsideration.
5 MR. HIRSCH: Well, why don't -- let's see. How can
6 we do that?
7 JUDGE FRYE: Well, why don't -- let's -- it probably
8 just makes it needlessly complicated to do that. You should
9 have it within the next day or so. If you don't, you want
10 fifteen days to take a look at it, and that certainly seems
11 reasonable.
12 MR. HIRSCH: So actually what your order seems to
13 indicate on page 26 that --
14 JUDGE FRYE: Yeah, I don't have that with me, so --
15 MR. HIRSCH: The Staff is to make a report. The
16 parties may comment on the report within fifteen days of
17 service of the report.
18 JUDGE FRYE: Well, why don't we just leave it --
19 like that?
20 MR. HIRSCH: Fifteen days within service of the
21 report, we'll respond.
22 JUDGE FRYE: Yes.
23 MR. HIRSCH: Okay. If -- on a related matter which
24 may affect scheduling, the Board heard arguments when we were
25 here last week regarding the motion that we may had made on

1 security of the facility. And scheduling of security pro-
2 ceedings, two separate motions. I was wondering if there
3 were any scheduling matters that relate to that that we need
4 to take up here?
5 JUDGE FRYE: No, I looked at that when we were back.
6 I am inclined insofar as scheduling anyway is concerned, to
7 take that whole matter up with the ruling on the motion for
8 reconsideration. If you want an immediate ruling on the por-
9 tion regarding requiring UCLA to immediately institute more
10 stringent procedures, I can do that as soon as I get back.
11 MR. HIRSCH: I think it would just be useful for
12 the record if there is a ruling.
13 JUDGE FRYE: Okay.
14 MR. HIRSCH: On that matter, I just want to remind
15 the Board once again that in this -- in that security issue
16 there are those other matters relating to --
17 JUDGE FRYE: Section 13.
18 MR. HIRSCH: 13, and that portion of the -- 19, I
19 believe, on the hazards scenarios that dealt with sabotage.
20 JUDGE FRYE: I thought we already ruled on that.
21 MR. HIRSCH: We ruled that we would not consider
22 sabotage in this setting, but we should consider it in the
23 security sense.
24 JUDGE FRYE: But we would in the security setting,
25 and then the Contention 20 thing we said sabotage was a

1 scenario that had to be taken into account.

2 MR. HIRSCH: Right. All I'm saying -- is that

3 portion of Contention 19 that was deferred from this proceeding

4 would that be part of that --

5 JUDGE FRYE: Part of that proceeding, yeah.

6 Is that all of the scheduling? Does that run down

7 what we've got at this point?

8 MR. HIRSCH: There's an additional one that I'm

9 aware of. You had given us, I believe, until August 26th to

10 inform you regarding Dr. Perlman's testimony.

11 JUDGE FRYE: Okay.

12 MR. HIRSCH: We'll do that. And as I understand

13 that, that's regarding the objection we had to it, and how to

14 respond to whether he needs to be called back.

15 JUDGE FRYE: Now that brings us back to the proposed

16 motions to strike. We filed those by say, the 26th of August,

17 would that create a burden? By express mail and it's going

18 across the country, and we'll get the responses again by

19 express mail on say, the 9th of September? Which is two

20 weeks.

21 MR. HIRSCH: The date again for the responses.

22 JUDGE FRYE: Well, I was suggesting the 9th of

23 September.

24 MR. HIRSCH: We have no problem with that.

25 JUDGE FRYE: Okay.

1 MR. CORMIER: Let me make sure I understand. Con-
2 cerned about that filing date on August 25th. On Contention
3 20?
4 JUDGE FRYE: Wait a minute. We were talking about
5 motions to strike at this point, CBG's testimony.
6 MR. CORMIER: Yeah, I'm trying to make sure I under-
7 stand what my burden is around that time.
8 JUDGE FRYE: Oh, okay.
9 MR. CORMIER: Staff has indicated it's going to move
10 for reconsideration of Contention 20 by August 15th, is that
11 right?
12 MS. WOODHEAD: Correct.
13 MR. CORMIER: You're not expecting a motion for
14 reconsideration from us. You're expecting a response to the
15 motion for reconsideration by staff --
16 JUDGE FRYE: Should you choose to file one.
17 MR. CORMIER: August 25th?
18 JUDGE FRYE: Okay.
19 MR. CORMIER: I would think that response is not
20 very burdensome for us to make, so I don't see any problem
21 with also filing something on the 26th.
22 JUDGE FRYE: Okay. So it would seem then going
23 down this chronologically if I can, August 15, your motion
24 for reconsideration on the ruling on Contention 20, August
25 25th would be the deadline for responses in support of the

motions for reconsideration on Contention 20. August 26th would be the deadline for motions to strike portions of the CBG prepared testimony on scope grounds. And also the day for CBG to advise about the necessity of recalling Dr. Perlman.

MR. HIRSCH: And to formalize our motion to stike, it was that one last sentence of Dr. Perlman's that's in --

JUDGE FRYE: Dr. Perlman's testimony.

September -- oh, excuse me, no, August 31st is the deadline for filing exceptions to the ultimate Board member's report on Contention 2. And September 12 is the deadline for responses in opposition to motions to reconsider the ruling on Contention 20.

I left one out. Sorry. September 9 would be the deadline to respond to motions to strike portions of the CBG testimony, refiled testimony.

Can everyone live with that?

MR. CORMIER: Would it be possible to move the August 26th date for motions to strike CBG testimony to Monday, the 29th?

JUDGE FRYE: And then make it a similar move to Monday, the 12th? For responses.

MR. CORMIER: I am just going to be away the previous week, and I know how things go. I just don't know if I'd be able to make the 26th.

JUDGE FRYE: Is that all right with everyone?

1 MS. WOODHEAD: Yes, that sounds fine.

2 JUDGE FRYE: Mr. Hirsch, is that okay?

3 MR. HIRSCH: Yes, that's fine.

4 JUDGE FRYE: Okay. And you still want to file --

5 are all three of you planning to file exceptions to the

6 ultimate Board member's report?

7 MR. HIRSCH: We will.

8 MS. WOODHEAD: The Staff is. The Staff plans to file.

9 MR. CORMIER: I have not read that document yet.

10 MR. HIRSCH: And we will be responding to the motion

11 for reconsideration that we're supposed to respond to at the

12 same time as the Staff.

13 JUDGE FRYE: Well, that's right. I had left that

14 out, too. So the 31st, the motions that you will respond to

15 the Staff's motion to reconsider the ruling on Contention 20.

16 MR. HIRSCH: At the same time we deal with the

17 Judge Laurenson's recommended order.

18 JUDGE FRYE: Okay. Well, good, do we need to take

19 up anything else?

20 MR. CORMIER: We asked on the last point, on the

21 31st, the University will also be -- probably responding to

22 the NRC motion for reconsideration on Contention 2. Is that

23 understood, or was something else --

24 JUDGE FRYE: No, that's what he -- that's what Mr.

25 Hirsch was just saying he was going to do. He was going to

1 respond to it on that date. You may, too.

2 MR. HIRSCH: I have one concern about that in terms

3 of new arguments raised by the Applicant on that issue, which

4 we would then not be able to respond to, if we both replied

5 the same day.

6 JUDGE FRYE: All right. You're going to support

7 the Staff's motion for reconsideration, I take it? On conten-

8 tion 2?

9 MR. CORMIER: Well, I frankly -- I can't recall

10 precisely what the arguments were. The Board should recall

11 that we had our own arguments with respect to Contention 2.

12 JUDGE FRYE: Yeah. And we referred those to the

13 special -- to the ultimate Board member.

14 MR. CORMIER: And they were essentially mooted

15 because we -- they really had to go with what the scope of

16 that proceeding was going to be. And underlying that was a

17 basic argument with respect to what the proper inquiry is on

18 Contention 2, and what the standards are.

19 MR. HIRSCH: So you didn't withdraw that motion?

20 MR. CORMIER: The motion's withdrawn, yeah, I'm just --

21 JUDGE FRYE: So you don't know whether you're going

22 to submit --

23 MR. CORMIER: I don't think my -- I don't think my

24 arguments -- I will -- I'm sure I will probably support the

25 motion, but I have different arguments, I believe, than

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1 Staff the last time I recall.

2 JUDGE FRYE: That's the problem that he's worrying

3 about. If you bring up new arguments in support of the motion

4 for reconsideration, in fairness, we need to give CBG an

5 opportunity to address those in their response, and there's

6 nothing wrong with that, but I think we just have to make an

7 adjustment in the schedule.

8 So, when would be a good time for that, Mr. Hirsch?

9 MR. HIRSCH: I think the time provided in the Rules.

10 JUDGE FRYE: The time provided by the Rules. Fine.

11 Now, just so we understand, as I recall, --

12 MR. HIRSCH: I think it's ten plus five.

13 JUDGE FRYE: I think it probably is, but what I'm

14 recalling is that there's a provision, a specific provision

15 on that in the rule on motions for summary disposition. It

16 doesn't necessarily apply, but that might be used, so you know

17 what it is.

18 MR. CORMIER: Are you thinking about motions for

19 reconsideration?

20 JUDGE FRYE: No -- well, I'm thinking about motions

21 for reconsideration, that's true, but in the rule on motions

22 for summary disposition, they have a provision that covers

23 this situation where a motion is filed, and then a response

24 in support of the motion is filed. Well, I don't see it

25 quickly. Let's say it's ten days. I don't think it is ten

1 days in that rule, but ten days plus the mailing time.

2 MR. HIRSCH: Okay. Ten days.

3 MR. CORMIER: Judge Frye, I think I know the pro-

4 vision. Well --

5 MR. HIRSCH: Does it matter?

6 MS. WOODHEAD: It doesn't matter.

7 JUDGE FRYE: You're right, it doesn't matter. I

8 just wanted to be sure we were all working on the same wave-

9 length. Anything else?

10 MR. HIRSCH: A couple of items. One is that -- we

11 brought this up before, and I'm sure there has been just some

12 procedural problem. But we're having some service difficulty

13 still with correspondence. For example, the most recent

14 response to the most recent citation for violations at UCLA,

15 the response from UCLA back to NRC we were not served. And in

16 addition, we're having problems with service of closures.

17 Often either Staff or Applicant will only serve one enclosure

18 rather than on the full service list. That's particularly

19 difficult and causes delays in situations like this one on

20 the audit because Mr. Bayh and Ms. Thompson, for example, will

21 be involved in responding to that, and if only one copy

22 comes to me, either up north, or in Los Angeles, there's a

23 time delay in getting it. So we just would appreciate it if

24 that enclosures were indeed served on the full list, and

25 remind the parties again about the service of Staff and Appli-

1 cant correspondence.

2 We have one other item which you may remember your ruling

3 or -- half a year ago regarding discovery costs. And the

4 production of documents, and that the University should only

5 be charging that which it costs them. We, thereafter, wrote

6 to the University trying to remedy that financial problem

7 of us having been overcharged, and we have had no response.

8 We'd like to have that rectified, if we may.

9 JUDGE FRYE: Mr. Cormier?

10 MR. CORMIER: Yeah, I happen to have the Staff

11 Applicant response that I brought here. I just didn't have

12 a chance to put in the cover letter on the inspection report.

13 And I also believe -- I've got to check, there may be also

14 the annual report, would be another item, that I think we

15 just transmitted. I've got to verify whether we transmitted

16 that or not. Those are the only two that I know about,

17 the response to the inspection report, and the annual report,

18 and I have just not had a chance to get the cover letter off

19 to you. I've been carrying it around in my case here.

20 With respect to the other, I don't recall the letter

21 on the costs. Can you refresh my --

22 MR. HIRSCH: We tabulated how much we had been over-

23 charged and requested reimbursement for the real costs.

24 MR. CORMIER: I guess I don't recall --

25 MR. HIRSCH: We'd be pleased to provide you another

:69

1 copy and if that can't get remedied quickly --

2 JUDGE FRYE: We received a copy of the letter, it

3 was quite some time ago.

4 MR. CORMIER: Yeah, I don't know. I normally don't

5 have trouble receiving correspondence. It's logged in in

6 several places. I just don't have that in my correspondence

7 file.

8 MR. HIRSCH: I'll send you another copy then, and

9 see if we can resolve that.

10 One other matter. You had ruled on a discovery

11 request late last year regarding the audit that had been

12 performed -- the internal audit. It was a discovery request.

13 The University said it wasn't completed yet, and that when it

14 was completed, we should raise that issue again. We note in

15 some minutes from the University that the audits have been

16 completed and we wish now for those indeed to be provided.

17 MR. CORMIER: You -- the audits are completed, but

18 you did suspend discovery on the emergency response plan --

19 JUDGE FRYE: This is the emergency response plan?

20 MR. CORMIER: Yes.

21 MR. HIRSCH: But with that particular ruling that

22 the audit should be provided to us when they are completed

23 in the order, if you like.

24 MR. CORMIER: That is incorrect. What you asked --

25 you asked the University to advise you when the audits were

1 completed and whether we would have an objection to producing
2 those. And then subsequent to that, you suspended discovery
3 on the emergency response plan. You never told us to make
4 them available. We indicated at the time that we still had
5 the same objection to producing the document. Two grounds.
6 One, it's a document that's normally kept confidential at
7 the University. It just undermines the internal audit process
8 if those become public documents. And two, there is no
9 relevant material with respect to the emergency response plan
10 that document is a -- when we get down to discovery on
11 that contention -
12 JUDGE FRYE: Has all of this been briefed earlier?
13 MR. CORMIER: No, we never -- this was, I believe,
14 a phone conversation followed up by one of your orders, a
15 phone conference.
16 JUDGE FRYE: This would have been done back when?
17 MR. CORMIER: October and November.
18 JUDGE FRYE: October, November.
19 MR. CORMIER: Yes.
20 JUDGE FRYE: All right, well, let me -- you're
21 looking it up?
22 MR. HIRSCH: I'm trying to look it up. My recollec-
23 tion is that you directed the University to inform us when
24 it was available, and if they had any objections, to raise
25 those objections. We didn't learn of it from the University.

1 We learned of it through other means that it was finished.

2 In terms of the first objection, this is a document

3 that previous years has been provided to us through discovery,

4 so it's clearly an issue that's discoverable.

5 And in terms of relevance, if they have objections,

6 perhaps they should make those objections in writing, and we

7 could respond. That's what I understood your order to be,

8 that once it was available, it should be provided or objections

9 made by the University.

10 I'll try to find the actual order.

11 MR. CORMIER: The order said, advise you when it

12 was available, and let you know if we had any objections. It

13 did not say, make it available to CBG. In addition, you

14 suspended discovery on the emergency response plan, subsequent

15 to this.

16 JUDGE FRYE: I know. I remember that took place.

17 MR. HIRSCH: On that, you suspended the interroga-

18 tories. The documents were to be produced, and were produced,

19 it was just this audit that remained. You'll be able to find

20 it.

21 JUDGE FRYE: I will look that up when I get back.

22 MR. HIRSCH: And I have two other small items. We

23 had asked that Mr. Ostrander provide the inner part of the

24 "Rabbit", the one that they said was representative. You may

25 remember when they said that they would bring that.

JUDGE FRYE: There is an inner part in the "Rabbit."

MR. HIRSCH: Yes, but he said the one that was there was not representative of the size of the one actually used.

JUDGE FRYE: Oh, the one in the cadmium --

MR. HIRSCH: Yeah, right.

JUDGE FRYE: He said that that was not -- pretty much filled up the interior.

MR. HIRSCH: But then the actual size was smaller than the interior, the one that was provided as an example here.

MR. OSTRANDER: I don't remember the discussion --

MR. CORMIER: This is Mr. Ostrander.

MR. OSTRANDER: For the purpose of that cadmium rabbit, the polyethylene sleeve was machined to tightly fit the inside diameter and fill the entire thing. There was not a second container in that case at all.

MR. HIRSCH: I just ask that I be able to see it, that it be brought, so that we could see what the dimensions were.

MR. CORMIER: Do you know if you have it?

MR. OSTRANDER: I don't have it with me, but sure, we can show the cadmium rabbit or something like that, if that's what you mean.

MR. HIRSCH: I think it's all combined --

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1 JUDGE FRYE: Have we got to the point where we can
2 go off the record? Are we through with --
3 MR. HIRSCH: I believe that's it.
4 MR. CORMIER: I have one matter. In the cross
5 examination this week, we discussed a report on the SPERT 1A
6 reactor by Schroeder et al. That document was supposed to be
7 provided --
8 JUDGE FRYE: In full.
9 MR. CORMIER: In full. We'd like to have that in
10 the record in full.
11 MR. HIRSCH: Yeah, we didn't get back to our office
12 last night to copy it, and obviously didn't anticipate we
13 were ending today. So --
14 JUDGE FRYE: Why don't you -- afterwards, you can
15 distribute it in full to the parties, and three copies to
16 docketing and service. And you had some photographs, too,
17 as I recall? That I don't believe I got back, that were
18 identified but not admitted.
19 MR. CORMIER: You should have. I distributed them
20 to the parties in set, the two photographs, there were two
21 different ones where I had taken the originals back from you.
22 Along with the Rudman thesis. I had placed it on your desk.
23 JUDGE FRYE: Here?
24 MR. CORMIER: Here. Two days ago I said I was going
25 to distribute them during the break. I've got other ones.

JUDGE FRYE: We'll have to see -- oh, yes, here's the Rudman thesis, and here are the photographs.

MR. CORMIER: Okay.

JUDGE FRYE: So we're all set.

MR. HIRSCH: Judge Frye, there was a similar matter. Judge Luebke asked that some of the original requests for license amendments and the hazards analyses -- or hazards evaluations prepared by AEC related to the excess reactivity be provided. I understood the Staff was going to -- I thought I understood the Staff was going to check back east. I have them available and copies available if they haven't.

MR. BERNARD: It was in storage and it's being transported. It will probably be there when I get back. I made the request already to get them.

MR. HIRSCH: So we can wait on that until the next session.

JUDGE FRYE: Sure. Anything else? Well, we will then adjourn until, tentatively anyway, depending upon advice from Mr. Hirsch, we'll plan to reconvene on Monday, October 3rd.

(Whereupon, the hearing in the above-entitled matter was adjourned, to reconvene, Monday, October 3, 1983.)

1 CERTIFICATE OF PROCEEDINGS

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3 This is to certify that the attached proceedings before the

4 NRC COMMISSION

5 In the matter of: UCLA RESEARCH REACTOR
Docket No. 50-142 OL

6 Date of Proceeding: August 2, 198

7 Place of Proceeding: Los Angeles, California

8 were held as herein appears, and that this is the original

9 transcript for the file of the Commission.

10

11 Martin I. Kersels
Official Reporter - Typed

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Official Reporter - Signature

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