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**UNITED STATES ATOMIC ENERGY COMMISSION**



**IN THE MATTER OF:**

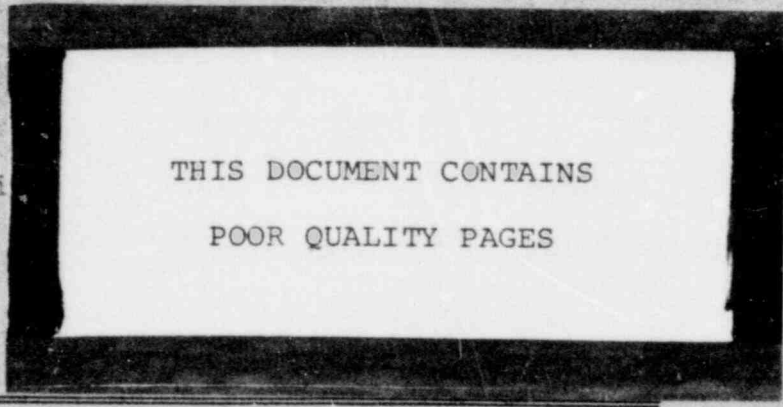
THE TOLEDO EDISON COMPANY

and

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY  
(Davis-Besse Nuclear Power Station)



Place - Cleveland, Ohio  
Date - 8 July 1972



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UNITED STATES OF AMERICA  
ATOMIC ENERGY COMMISSION

In the Matter of:

THE AEGISCO HOLDING COMPANY

and

Docket No. 30-246

THE DELAWARE ELECTRIC  
ILLUMINATING COMPANY  
(Davis-Besse Nuclear Power Station)

Holliday Inn,  
Brookpark Road,  
The Great Hall  
Brookpark, Ohio

Saturday, July 2, 1972

Pursuant to notice, the above-captioned matter  
was covered at 9:30 a.m.

BY:

MR. JEROME GARTNER, Chairman,

MR. JOHN R. SMITH, Member.

MR. EUGENE A. HUBERT, Member.

APPEARANCES:

FRANCIS S. DAVIS, USA and DAVID KAPLAN,  
United States Atomic Energy Commission,  
Washington, D. C.

GERALD SHARNOFF, USA, and GUY E. SHERMAN, USA,  
Shaw, Pittman, Watts, Thompson and  
WILSON W. SMYLER, USA, and DANIEL RICE  
On Behalf of Permittees.

JEROME S. KALIN, ESQ., Justice, Ulrich, Burkhalter &  
Hessers; on behalf of Intervenor, Coalition for  
Safe Nuclear Power and Living in Peace  
Environment.

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I N D E X

	<u>DIRECT</u>	<u>INTERPOSE</u>	<u>CROSS</u>
1 <u>WITNESS:</u>			
2 Dr. Morton Goldman			3100
3 George Knighton	3051	3119	3100
4 Brian Grimes	3051		3057
5 Dr. Norman Frigerio	3051	3104	3091, 3133
6 Harold Glauberman	3051		3130
7 Charles B. Shott	3121		3124
8			
9 <u>Applicant's Exhibits:</u>		<u>Classified</u>	<u>Excluded</u>
10 5			3018
11 <u>Intervenor's Exhibits:</u>			
12 1 (Number changed to			
13 Intervenor's Exhibit			
14 No. 3.		3050	
15 2 (Number Changed to			
16 Intervenor's Exhibit			
17 No. 9.		3051	
18 <u>Regulatory Staff Exhibits:</u>			
19 1			(As 12 Read) 3077
20 2		3078	(As 12 Read) 3062
21 <u>ARGUMENT</u>			
22 Applicant			3150
23 Regulatory Staff			3150
24 Intervenor			3152
25			

.D&gt;sl-1-1

PROCEEDINGS

1 CHAIRMAN: UNFINISHED. May this hearing come in  
2 order.

3 The first order of business this morning is a  
4 correction in the transcript. The copy of the transcript  
5 of the hearing dated 7 July 1972 indicates that the page  
6 begins with 2782 and ends with 2871. In fact, at the last  
7 hearing prior to this present the last page of the record,  
8 as I understand it, was Page 2871. Consequently I would  
9 like the record to note that the court reporter will correct  
10 the blue cover of yesterday's transcript to note that Page  
11 2782 follows Page 2871 of the transcript of this proceeding.

12 The next order of business is Applicant's  
13 Exhibit No. 5 for identification.

14 MR. CHARNOFF: Mr. Chairman, before we proceed  
15 with the evidentiary matter I have a procedural matter I  
16 would like to raise.

17 CHAIRMAN: CHAIRMAN: Go ahead.

18 MR. CHARNOFF: At the telephone conversation we  
19 had on Monday with Mr. Kartalia and Mr. Kalar and yourself,  
20 Mr. Kalar had mentioned that he was going to have four  
21 witnesses, a Dr. Meek, Mr. Sedarick, Dr. Haver and Dr. Garris,  
22 and that those gentlemen would be present at the hearing by  
23 Friday night. In the interest of expediting the proceeding  
24 I wonder if we could ask Mr. Kalar if he has written copies  
25

WJpsl-1-1 1 of these gentlemen's testimony or if perhaps after completion  
2 of the cross-examination of the witnesses and before the  
3 Staff testimony begins on what Mr. Kalur would be asked to  
4 say on his direct so that we on the Staff will then have  
5 seen copies of it, perhaps overnight, and then we would be  
6 able to prepare both our cross and our rebuttal so that we  
7 may all make the effort I think we are interested in, which  
8 is to expedite the proceeding and allow it to be completed  
9 possibly tomorrow.

10 CHAIRMAN GARFINKEL: What are your views on that,  
11 Mr. Kalur?

12 MR. KALUR: No.

13 CHAIRMAN GARFINKEL: You don't want to do what?

14 MR. KALUR: No.

15 CHAIRMAN GARFINKEL: Let me ask you this. Do you  
16 have any prepared testimony of your direct case?

17 MR. KALUR: I do not.

18 CHAIRMAN GARFINKEL: You don't contemplate having  
19 any prepared testimony prior to their taking the stand?

20 MR. KALUR: No.

21 CHAIRMAN GARFINKEL: Who do you propose to call  
22 to the witness stand?

23 MR. KALUR: Dr. Perrin, Dr. Sedawitz, Dr. Nease  
24 and perhaps Dr. Haver. I am not sure of that yet.

25 CHAIRMAN GARFINKEL: With respect to each one can

H0051-1-3

1 we have the general nature of their testimony now?

2 MR. KALUR: I have already given that to counsel.

3 CHAIRMAN WATKINS: Let's get it on the record  
4 so that Mr. --

5 MR. KALUR: I am not going to put this on the  
6 record. I have no burden to get any statement on in this  
7 case until such time as it is up with the jury on a case. If  
8 I decide to put one on.

9 CHAIRMAN WATKINS: I agree with you but in terms  
10 of expedition -- I am not asking for what their actual testi-  
11 mony is but the general nature as to what Mr. Karamita  
12 may have the benefit of that.

13 MR. KALUR: They already have the benefit of it.

14 CHAIRMAN WATKINS: Do they have the benefit of  
15 that?

16 MR. KARAMITA: Mr. Chairman, we got very sketchy  
17 descriptions of what this testimony is going to be. It  
18 amounts to a description such as to and so with terms as  
19 to the effects of a class time according to the manner.

20 MR. CHARNOFF: It was the material you heard on  
21 the phone on Monday. We have gotten nothing from Mr. Kalur  
22 since Monday, Mr. Chairman.

23 CHAIRMAN WATKINS: You indicated in a conference  
24 basically that you would make every effort, as I recall it,  
25 to have prepared testimony if you were going to have testimony

W0051-1-4

1 available. I know you were not under an obligation. I am  
2 not arguing with that.

3 MR. XAVIER: Mr. Chairman, I made a statement that  
4 I would make every effort to have Mr. Petrie's testimony  
5 committed to writing, not as to the other witnesses.  
6 It has proved impossible because of Mr. Petrie's schedule  
7 on 11/1/57.

8 CHAIRMAN CARTWRIGHT: In order to expedite the  
9 hearings I am asking you whether you can indicate more  
10 specifically the general nature of their testimony.

11 MR. XAVIER: I know's about my time of reflection  
12 like that from Petrie. I don't see why the Interveners should  
13 be left in that position.

14 MR. MARSHALL: Mr. Chairman -

15 CHAIRMAN CARTWRIGHT: I am not going to get involved  
16 at this time. Let's forget it and continue with the cross-  
17 examination.

18 MR. CHARNOFF: I think the record should be  
19 clear that the Interveners have had the Staff's testimony  
20 certainly since the last hearing session and they have had  
21 50 percent of our testimony since the last hearing session.

22 CHAIRMAN CARTWRIGHT: I will ask accordingly.

23 MR. CHARNOFF: Thank you.  
24  
25



WSvo2-1

1 CHAIRMAN GARDINER: Now with respect to Exhibit  
2 No. 5 marked for identification, Dr. Walker, do you have any  
3 objection to this document?

4 MR. WALKER: No, no objection.

5 CHAIRMAN GARDINER: Mr. Kartalia, do you have  
6 any objections?

7 MR. KARTALIA: No objection to this one.

8 CHAIRMAN GARDINER: O.K. Applicant's  
9 witness's Exhibit No. 1 marked for identification is received  
10 in evidence.

11 Applicant's Exhibit No. 3, hereafter  
12 marked for identification, is re-  
13 ceived in evidence.

14 MR. GARDNER: Thank you, Dr. Gardner.

15 CHAIRMAN GARDINER: With that out of the way,  
16 Mr. Kartalia, I will start with you for cross-examination on  
17 the Applicant's witnesses.

18 MR. KARTALIA: Thank you.

19 DR. MORISON GOLDMAN

20 resumed the witness stand and testified further as follows:

21 CROSS-EXAMINATION

22 BY MR. KARTALIA:

23 Q Dr. Goldman, have you computed the one-mile  
24 pathway loss for the Davis-Besse plant?

25 A We have completed that some time ago in a document  
26 that was filed with the construction permit application.

Wvo2-2

I have not computed it with the revised source terms that have come out since that time, no.

Q I see. When such a computation is made, do you make any assumption as to the area in which the accused cow is grazing when you are making such a computation?

A It's not necessarily an assumption. It will be determined by what actually exists in the environment of the plant.

In the case of Davis-Besse, the nearest cows are about two and a half miles west or southwest of the plant facility.

CHAIRMAN GARFINKEL: May we be off the record for a second?

(Off the record discussion.)

CHAIRMAN GARFINKEL: O. K. - You may be on the record.

BY MR. KATREYA:

Q You stated that the nearest cows are two and a half miles southwest?

A Approximately, west of Davis-Besse.

Q Is that of the site boundary?

A From the approximate location of the plant itself.

MR. KATREYA: I have no further questions.

CHAIRMAN GARFINKEL: Have you finished with your cross?

WSvo2-3

1 MR. MARSHALL: I am.

2 CHAIRMAN CHRISTIAN: J. KALIN, you may commence  
3 cross-examination.

4 CROSS-EXAMINATION

5 BY MR. KALIN:

6 Q Mr. Kallman, how long have you been with the  
7 WIS Corporation?

8 A Since 1971.

9 Q Who did you work for before that?

10 A U. S. Public Health Service.

11 Q Do the letters WUS have any meaning to you that  
12 an abbreviation for something?

13 A They used to stand for Nuclear Utility Services  
14 which was the original name of the company.

15 Q Can you give us any kind of a condensed statement  
16 as to the general purpose and the goals of the company be-  
17 sides making money?

18 A The company was founded to provide consulting  
19 engineering and scientific services to nuclear utilities or  
20 utilities getting into the nuclear business 10 or 15 years  
21 ago.

22 It has continued in that area to provide con-  
23 sulting engineering and scientific services in a general  
24 energy and environmental area since that time.

25 Work that we do is involved not both nuclear and

WSyo2-4

1 fossil fuel plants and covers a gamut of environmental and  
2 engineering services required to site, design and build and  
3 operate those plants.

4 Q You have a normal title with the WEP Corporation?

5 A Yes, my title is vice-president and general  
6 manager of the Environmental Safeguards Division.

7 Q When did the WEP Corporation first become involved  
8 in the Davis-Besse project, if you know?

9 A To the best of my recollection it was about 1964  
10 or '5.

11 Q Excuse me, 1967.

12 Q What was the initial project work that WEP did at  
13 Davis-Besse?

14 A We had done an evaluation of the original site  
15 proposed for this plant, which was the Darcy Marsh Site.

16 Q Do you remember if your initial reports concluded  
17 that Darcy Marsh was an adequate site?

18 A Yes, we had concluded that a plant could be  
19 located on that site.

20 Q Was your original report founded on a concept of  
21 environmental significance, or was it devoted entirely to  
22 engineering?

23 A It was based on the ability of engineering to  
24 resolve environmental problems.

25 Q Do you have any biological training?

WSyo2-5

- 1 A Yes.
- 2 Q Where is that?
- 3 A Both in New York University and at Massachusetts
- 4 Institute of Technology.
- 5 Q Do you hold degrees in the biological field?
- 6 A M.I.T. does not give doctorate degrees in any
- 7 field, they are general.
- 8 Q Your answer is no when, in the course of it, you
- 9 have a degree in the field of biology, is my question?
- 10 A No.
- 11 Q How would you describe yourself professionally,
- 12 as an engineer? Could you put yourself in one area or other?
- 13 A I think I would tend to call myself an
- 14 environmentalist.
- 15 Q But your degrees are in engineering?
- 16 A Yes.
- 17
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- 19
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Hqs2-1-1

Q As I correct in stating that in your testimony yesterday you indicated you expected a certain volume of about 200 curies per year from David-Peter?

A That's the number that has been estimated for this area, yes.

Q Have you seen the testimony that the Staff has indicated they will present, that's written testimony?

A No, I have not.

Q If I told you that testimony indicated they expect a thousand curies per year of criticism from David-Peter would you tell me how that fits in with your concepts?

CHAIRMAN GARFINKEL: Before you answer that, is that a fact that the Staff said that, Mr. Valur?

MR. VALUR: That is in their report.

MR. KAWASIA: What is in the table.

CHAIRMAN GARFINKEL: Okay. I want an assumption based on the record.

MR. VALUR: I don't believe it has been admitted in evidence yet.

CHAIRMAN GARFINKEL: But you are saying it is a fact in the report?

MR. VALUR: Right.

CHAIRMAN GARFINKEL: Okay.

MR. VALUR: Would you repeat the question?

(Question read.)



WSnp2-1-3

1 experience from reactors with similar level of roughly  
2 comparable power and appears reasonable to me.

3 Q What plant or how do similar power output did  
4 you compare it.

5 A Sigma.

6 Q Where is that?

7 A That is on Lake Ontario. Rochester Gas Company.

8 Q What is their capacity?

9 A Somewhat in excess of 100 megawatts. I think  
10 400.

11 Q That is a little less than half Davis-Besse's  
12 expected capacity?

13 A About five-eighths.

14 Q What was their output of curies per year of  
15 tritium?

16 A I think it was in the vicinity of two to three  
17 hundred.

18 Q Do you know whether they use Dircaloy rods or  
19 steel rods in that plant?

20 A Dircaloy.

21 Q Dr. Goldman, do you know if it is technologically  
22 feasible to recycle tritium and to hold it within a plant,  
23 within a nuclear plant?

24 A I would say it's biologically undesirable but  
25 technologically possible.



USps22-

1 Q What would be the cost to Davis-Besse to do that?  
2 Can you give me any figures on doing that?

3 A I can't give you a figure for that, no.

4 Q Isn't it true that a pressurized water reactor  
5 gives out significantly more radioactive wastes per year than  
6 does a boiling reactor?

7 A I think that you can't compare the two, because the boiling  
8 reactor is a different reactor than that, yes.

9 Q Do you subscribe to the view that you is a much more  
10 radio-sensitive body, and if we take care of him through  
11 lower organisms will not be affected by radioactivity?

12 A I can't state that, no.

13 Q Are you familiar with the case report which was  
14 report that was submitted yesterday on behalf of the applicant?

15 A No.

16 Q Are you familiar with the text cited therein by  
17 D. P. Cade called From the Basis of Ecology, which appeared  
18 Philadelphia, 1971?

19 CHARLES CAMPBELL: What page is that, Mr. KUBA?

20 MR. KUBA: Page 149 of the references.

21 A Not specifically, no.

22 Q You wouldn't be willing to admit that that is  
23 an accepted text in the environmental ecology field and  
24 environmentalists should know about?

25 A I wouldn't argue with that assumption.

MSps2-2-5

Q Would you argue with the assumption that Dr. Edom makes on Page 437 where he says, "It is our belief that if we take sufficient care in paleontology by look at the air-land, with few exceptions the rest of nature will take care of itself." and he says this is a legitimate overland question.

MR. STUBBS: Mr. Chairman, could you see, at least show this part to the witness so he can look at it?

MR. KALUR: I will be happy to rephrase the question. I don't think I have any obligation to show him the text.

CHAIRMAN CARPENTER: He has the problem of he has an obligation to show -- are you quoting the exact text?

MR. KALUR: Yes.

MR. STUBBS: We don't know what the context is of that.

CHAIRMAN CARPENTER: That's all right. This is cross-examination. He has the right to raise it from the spot.

MR. KALUR: I withdraw my question. I will rephrase it.

CHAIRMAN CARPENTER: Go ahead.



HDvo3-2

1 CHAIRMAN GARFINKEL: That is all right. I am  
2 asking now --

3 MR. KALUR: He is Professor of Zoology at the  
4 University of Georgia.

5 CHAIRMAN GARFINKEL: Fine. I wanted to get that  
6 back on.

7 MR. CHARNOFF: Mr. Chairman, I think the observa-  
8 tion that needs to be made is that Mr. Kalur withdrew a  
9 quotation and then stated in his own words what he under-  
10 stood Mr. Olson or Professor Olson or Dr. Olson to be stating.  
11 We don't know whether that is what Dr. Olson stated.

12 CHAIRMAN GARFINKEL: That is not important.  
13 Mr. Charnoff. This is cross-examination. On the basis of  
14 cross-examination the question comes out we are dealing with  
15 EXP-718.

16 The question of Dr. Goldman -- You can disagree,  
17 there is no question about that.

18 MR. CHARNOFF: Dr. Goldman stated that he was  
19 not familiar with that book and Mr. Kalur is stating that that  
20 book says something without our knowledge as to whether that  
21 book says it.

22 CHAIRMAN GARFINKEL: I know, but this is still  
23 cross-examination and the right of Mr. Kalur to phrase the  
24 question -- if it is wrong you have a right ultimately to  
25 rebuttal to correct it but we are dealing with experts and no



HD 3-5

kind of thing to which I testified yesterday. That is, as  
the life form increases in complexity, the radiosensitivity  
in these organisms increases also.

1043-3-1

1 Q Will you look at the last section on Page 195  
2 where it starts out, "A different pattern is noted?"

3 A Yes.

4 Q Would you say the language contained in that  
5 paragraph is consistent with your concept?

6 A Yes, because in the comments I made yesterday  
7 I referred to a comparison of species, not of different  
8 figures in life to elements. The young of a fish mature in  
9 any species are more rapidly so radiated than the adults,  
10 but as between species the comments I made yesterday on  
11 Dr. Polinorov agrees that as the life span simplifies and  
12 radio resistance increases.

13 Q You yesterday made some comments about the  
14 effect of tritium on human beings. As I correct in stating  
15 that you said that the possible dangerous effects of tritium  
16 are all?

17 A No.

18 Q Would you consider that to be any dangerous  
19 effects from exposure to tritium?

20 A In sufficient quantities or concentrations,  
21 certainly.

22 Q What type of radiation is tritium?  
23 Is it alpha beta or gamma or what?

24 A It is a very low energy beta radiation.

25 Q Beta radiation if taken internally can be harmful,

WDps3-2-2

1 can't it?

2 A Anything taken internally can be harmful.

3 Q Your answer is yes. Isn't it?

4 CHAIRMAN WATKINS: Can you speak louder?

5 THE WITNESS: I cannot give a yes or no answer  
6 to that.

7 BY MR. WILBUR:

8 Q Let's talk about human beings. When you talk  
9 about radiation effects on human beings, what do you mean  
10 when you say effect? You used that a number of times  
11 yesterday. You said there would be no effect. Does that  
12 mean that won't drop over right away or does that mean  
13 there will be harm in one generation or two or what?  
14 Tell me about it.15 A When I say no harm or no effect I mean that there  
16 will be nothing that can be observed and in no individual  
17 exposed or his descendants.18 Q Are you telling me now that exposure to tritium  
19 in the outflow from Davis-Besse by taking drinking water  
20 internally could not cause any chromosome damage to  
21 individuals drinking that water?

22 A That is not what I said.

23 Q I am asking you that now.

24 A No observable chromosome damage, no.

25 Q Yesterday you mentioned that you are familiar



1 with aquatic and animal studies done at Hanford Labs. Is  
2 that correct?

3 A That is correct.

4 Q Are you familiar with the fact that migratory  
5 birds around the Hanford Lab were found to have a zinc 50  
6 concentration several thousand times above that which the  
7 plant discharged?

8 A Above those which were found in the water in  
9 which the birds were nesting, yes.

10 Q And you don't consider that to be any adverse  
11 effects?

12 A There was no real adverse effect observed  
13 in these birds.

14 Q It is your contention that it doesn't matter if  
15 we have levels several thousand times above what is given  
16 off in the water in zinc in human beings or animals or any-  
17 thing else?

18 A They are biologically insignificant.  
19 The facts speak for themselves.

20 Q What about Goffman and Temple's theories about  
21 direct relationship, one to one relationship, in cancer and  
22 leukemia from exposures?

23 CHAIRMAN GARFINKEL: Mr. Salar, do me one favor.  
24 Ask him as a preliminary statement if he has heard of the  
25 works of these people. I am not arguing that, but I think

HDvo3-2-1

(Intervenor's Exhibit No. 2 marked  
for identification.)

BY MR. KALUR:

Q I am handing you now what has been marked for purposes of identification as Intervenor's Exhibit 2. Can you tell me if you are familiar with the regulations on that document?

MR. SILBERG: Mr. Chairman, while the witness is looking --

CHAIRMAN CARPENTER: I am concerned over here. Mr. Charneff has been handling the response to cross-examination. I am willing to allow Mr. Charneff to ask questions.

MR. CHARNEFF: Thank you, Mr. Chairman.

BY MR. KALUR:

Q Can you tell me what this document purports to be?

MR. CHARNEFF: The point to be made, Mr. Kalur, is simply a logistics one. We marked that exhibit yesterday as 1 and apparently this one has Exhibit 2. Mr. Silberg tells me that at the hearings on May 1 through 3 you had marked some other exhibits.

CHAIRMAN CARPENTER: That is right, for identification. I think we went up to Exhibit 7 for identification, all the way up to Intervenor's Exhibit 7.

WSvo3-3-2

MR. KALUR: I think we could number these separately today. We are keeping a separate record.

CHAIRMAN GARDENHILL: No, there's the same record. It is all part of one proceeding.

MR. KALUR: What do you want me to identify this as?

MR. CHUDNOFF: I would suggest that yesterday's Exhibit 1 by the Intervenor be marked as Intervenor's Exhibit 2 and today's be marked as Intervenor's Exhibit 3, because we have a separate numbering system for the Applicant's exhibits.

CHAIRMAN GARDENHILL: That is correct.

MR. KALUR: I will change that.

CHAIRMAN GARDENHILL: Let the record show that in yesterday's transcript we had Intervenor's Exhibit 1 for identification on Page 2020.

Let that refer to Exhibit No. 2 instead of Exhibit No. 1.

Today's exhibit marked for identification as Intervenor's Exhibit No. 2 will be treated as Intervenor's Exhibit No. 3 for identification.

MR. KALUR: Thank you, Mr. Chairman.

BY MR. KALUR:

Q Will you identify this document for me?

A It appears to be a reprint from the Federal Register.

of Tuesday, March 6th, 1962.

Q Are you familiar with the regulations contained in this document?

A I think this is an amendment to the FWS drinking water standards.

Q On the last page under Section 73.206, Radioactivity, under Subsection C, would you read that for me?

A "In the known absence of strontium 90 and alpha emitters, the water supply is acceptable when the gross beta concentrations do not exceed 1,000 micromicrocuries per liter. Gross beta concentrations in excess of 1,000 micromicrocuries per liter shall be grounds for reduction of supply except when more complete analyses indicate that concentrations of radionuclides are not likely to cause exposures greater than the radiation protection guides as approved by the President on recommendation of the Federal Radiation Council."

Q Thank you. Now, tritium is a beta emitter, isn't it?

A Yes, sir.

Q Does it say anywhere in this document that tritium is not to be included in that 1,000 standard?

A In that document, no. In the drinking water standards as published it does, however.

Q Does it say anywhere in this document that you are supposed to use the dry method that you indicated

HDps3-2-4

for the record. Lay the foundation and then follow through.  
If he hasn't heard of that work we have a different problem.

MR. KALUR: If he won't listen I will ask him.

CHAIRMAN GARFINKEL: I am sure he knows about it,  
but just ask on the record.

BY MR. KALUR:

Q Have you heard or read the Goffman and Tamplin  
concepts with respect to the radiation and the curves in  
CTR 202?

A Yes.

Q Do you agree with their concepts and they  
direct one to one relationship of exposure?

A I don't know what you mean by that.

Q Do you agree that there will be a certain amount  
of cancer or leukemia deaths with the rising exposure of  
radiation, a direct correlation?

A No, not at the dose levels and rates at which we  
are operating.

CHAIRMAN GARFINKEL: Let me ask you, do they have  
a contrary position to yours with respect to the dose level  
that we contemplate in the Davis-Besse case?

THE WITNESS: If I may answer the question this  
way, Mr. Chairman, Drs. Goffman and Tamplin assume that there  
is a linear relationship between radiation exposure and  
radiation injury. This is the same assumption which is

H0ps3-1-5

1 made by every standard setting organization. The National  
2 Council on Radiation Protection, the International  
3 Commission on Radiological Protection, our own National  
4 Academy of Sciences.

5           However, this is an assumption of linear dose  
6 effect relationship which is now general one to adopt in  
7 the absence of firm data on that relationship at the times  
8 of doses and dose levels with which we are concerned in  
9 proceedings of this type. There is no indication in the  
10 scientific literature of the existence of such a relationship  
11 and in fact most radiobiologists or people involved in research  
12 in this area do not believe that such an effect exists at  
13 dosages of the order that we are talking about.

14           However, in the absence of firm proof for this  
15 the conservative, prudent health assumption to make in  
16 establishing standards is that such an assumption is valid,  
17 that such an effect does exist. This is to be conservative.  
18 However, in response to a question does such an effect  
19 actually exist, I would have to answer no, even though that is  
20 the assumption on which the standards are based. I reiterate  
21 it is only an assumption used for the purposes of planning  
22 and establishing standards. It is not a biological fact.

23           CHAIRMAN GARFINKEL: Thank you.  
24  
25

HEvo3-3-6

1 yesterday is determining that figure?

2 A No, but that is an amendment to the drinking water  
3 standards, however.

4 Q Tricium can be incorporated in DNA material in  
5 the human body, can't it?

6 A Along with every other element, yes.

7 Q It shows a special affinity for it, doesn't it?

8 A No, sir.

WSvo4-1

9 MR. KILBUR: Just a moment, Mr. Chairman.

10 CHAIRMAN GARDEWEL: Surely.

11 Q MR. KILBUR: Dr. Goldman, do you know who Dr.  
12 Haver is?

13 A I have heard the name, yes.

14 Q Have you read any of his material, Charles W.  
15 Haver?

16 A Only once.

17 Q Do you know what particular material of his you  
18 read?

19 A Yes. It was a statement that was prepared for  
20 presentation at the construction permit hearing of this  
21 proceeding.

22 That was never to my understanding accepted.

23 Q You are not familiar with his comments on the  
24 biological hazards of tritium as presented to the Illinois  
25 Pollution Control Board in 1971?

WSv04-2

1 A. No, sir. I don't consider him worth the reading  
2 on that subject.

3 Q. Mr. Haver holds a Ph.D. from Yale University in  
4 zoology. Why don't you think that is an acceptable criteria  
5 for making determinations about radiation?

6 A. No, I think that --

7 Q. You think engineering is better?

8 A. I think radiobiology is better.

9 Q. Dr. Haver in that report I referred you to makes  
10 the statement that it appears that the energy spectrum of the  
11 beta emission of cesium is such that it can create a large  
12 amount of damage when the radioactive is located within the  
13 structure of the DNA molecule.

14 Do you have any quarrel with that statement?

15 A. It sounds like a statement of a physician, not a  
16 zoologist.

17 Q. Do you have any quarrel with the statement as to  
18 its factual validity?

19 A. Yes, I do. It is totally irrelevant and in-  
20 correct.

21 Q. Dr. Goldman, are you familiar with Volume 2 of  
22 the Environmental Supplement?

23 A. With those sections.

24 CHAIRMAN GARFINKEL: Will you identify it by  
25 exhibit number so that we have it for the record?



WSvo4-2

1 MR. SILBERG: It's Applicant's Exhibit No. 1 in  
2 this proceeding.

3 CHRISTIAN GAUFFINEL: Thank you.

4 BY MR. TADUR:

5 Q I would like you to look at Page 8-18. Let's  
6 start that on 8-37. Take a look at the loss of coolant  
7 accident described there. Do you have those sections?

8 A Yes.

9 Q Did you prepare any part of this?

10 A No.

11 Q Do you see any dose rate expectations connected  
12 with that?

13 A On Page 8-41.

14 Q Are those your figures?

15 A No.

16 Q Do you know whose figures they are?

17 A Yes.

18 Q Who are they?

19 A They were prepared by Bechtel Corporation.

20 Q Do you know who at Bechtel prepared them?

21 A I think they were prepared under the direction  
22 of Mr. Moni.

23 Q Are you familiar with these calculations that  
24 were used to arrive at those dose rate figures?

25 A Generally.

WDvo4-4

Q Do you consider them accurate and correct?

A I think they are reasonably correct, but I can't testify to the precision that attaches to them, no. I did not do the calculations, but they appear to be reasonable.

Q Can you describe for the Committee what a loss of coolant accident is?

A A loss-of-coolant accident under the definition of the analysis for an environmental report considers that one of the larger pipes in the reactor primary system fails and that the emergency systems provided to restore the coolant to the core works to some degree.

The analysis that proceeds to the determination of the amount of radioactivity that is released from the core under these circumstances using realistic assumptions as far as the performance of systems provided in the plant to take care of it.

Q Based upon your knowledge in the field can you give us your opinion as to what would occur if the emergency core coolant system failed to operate in a situation where there had been a loss of coolant?

MR. CHARNOFF: I think there is an objection there, Mr. Chairman, on the fundamental proposition that we are not now doing the radiological safety evaluation, we are looking at radiological accidents in the context of the national environmental policy act review, where the Commission

WSvo4-5

1 allows and requests a review of radiological accidents, but  
2 on assumptions that are reasonable and probable as distinguished  
3 from the conservative and unlikely assumptions that are used  
4 for radiological safety purposes, and with respect to which  
5 there was a public hearing which Mr. Kalur and his client  
6 participated in more than one year and a half ago.

7 CHARNOFF: I note your objection. There  
8 is some merit to your objection, but nevertheless there is a  
9 thin line between health and safety and environment and as  
10 long as Mr. Kalur raises his amendment, how far he is going  
11 to go into this question in the emergency core cooling system  
12 I will allow the witness to answer this question, but I will  
13 not permit a re-hashing of the emergency core cooling system.

14 No. 1, the Commission made it very clear in a  
15 recent opinion that the emergency core cooling system is not  
16 at issue before any licensing board.

17 That will be taken up specifically by either the  
18 rule-making function or in a separate petition for rule-  
19 making, but the emergency core cooling system is not a part  
20 of the responsibility any longer of a Licensing Board.

21 But I will allow this question to go in to  
22 determine the possibility of releases.

23 MR. CHARNOFF: I want to comment on your observa-  
24 tion, if I may.

25 MR. KALUR: May I be permitted to comment? We are

NSv04-6

going around here.

CHAIRMAN GARDINER: I will let Mr. Kalur comment for the record, and I think I don't want any further discussion. I want the stimulation to continue.

MR. CHARNOFF: I am not referring to the --

CHAIRMAN GARDINER: There is no point in continuing.

MR. CHARNOFF: I think it is important.

CHAIRMAN GARDINER: Please, Mr. Charnoff.

MR. CHARNOFF: Mr. Chairman, I think you misstated the rule in that Vermont Yankee case.

CHAIRMAN GARDINER: Maybe I misstated it, but the record speaks for itself.

MR. CHARNOFF: No, Mr. Charnoff, please. I have just ruled on that point. I want you to sit down, Mr. Charnoff.

MR. CHARNOFF: Mr. Chairman, I don't want this record to have error in it.

CHAIRMAN GARDINER: I am not worried about the record having error. I am now concerned about Mr. Kalur's statements.

MR. KALUR: Mr. Chairman, my questions are directed solely to the consequences of a failure of the core coolant system with respect to the environment. I will limit myself to that inquiry.

CHAIRMAN GARDINER: Very well. Do you have any

WSvo4-7

1 further statements you want to make, Mr. Kartalia?

2 MR. KARTALIA: No, but I think I have some of the  
3 same feelings that Mr. Charroff has.

4 CHAIRMAN CHARROFF: I am not worried about my  
5 ratings on the point.

6 MR. KARTALIA: The ESDS question can be ruled  
7 completely out of this proceeding.

8 CHAIRMAN CHARROFF: I want Mr. Kalor to have  
9 this part of the examination done and record.

10 When he says he is limited in terms of the  
11 releases, I think it is a valid request of this case. We do  
12 not have a certain point. If he goes too low, I will cut off the cross  
13 examination, but as a preliminary I want it to go on.

14 Mr. Kalor, please continue.

15 MR. KALOR: Would you read the last question back,  
16 sir?

17 (Question read.)

18 A. I think that would proceed in that highly unlikely  
19 event would be what we referred to as a core meltdown.

20 Q. What is a core meltdown?

21 A. Literally a meltdown of the fuel and cladding  
22 in the core.

NSP4-2-1

1 Q What physical forces are set in motion by such a  
2 meltdown?

3 A Heat.

4 Q Are gases given off?

5 A There will be material in the core which is  
6 volatilized, yes.

7 Q Radioactive gases?

8 A There are radioactive and non-radioactive gases.

9 Q Does some from the core itself, is that correct?

10 A From the core itself and from materials near the  
11 core.

12 Q Now, is there a possibility of some of those gases  
13 being released to the environment in this unlikely situation?

14 A There is a containment provided around the plant.

15 Q All right. Now, if the pressure from those gases  
16 builds up, isn't it a feature of the Davis-Besse plant that  
17 those gases would be vented to the environment?

18 A No. There are systems not connected with the  
19 emergency core cooling system which act to depressurize  
20 the containment.

21 Q And there is no chance in your mind the containment  
22 vessel could ever be breached?

23 A That is a very --

24 MR. CHARGOFF: Mr. Chairman, objection. I must  
25 state that we are in an environmental hearing, that the



NSps4-3-31

probability of such occurrence is so small that their environmental risk is extremely low.

Then they simply say that Class nine accidents are not to be considered.

Now, the reactor vessel failure is beyond the Class eight events. It is a Class nine event. It is not to be considered in the National Environmental Update Act review.

CHAIRMAN BIRNBAUM: How objection is overruled. I will allow Mr. Kaluz to continue. I hope you don't have many more questions along this line.

MR. KALUZ: I have just a few more. They have about three pages of direct data.

CHAIRMAN BIRNBAUM: That's all right. Go ahead.  
BY MR. KALUZ:

Q Now on Pages 837 through 840 there is an assumption there that some of that material, some of the gaseous materials escape through the environment, isn't that true?

A Yes.

Q Will you give me any idea what percentage of the core gases escape in this postulated accident?

A I can't give you precise value except to indicate that Appendix B-A does identify the activity sources that are used in the accident analysis section.

The text on Page 837 does indicate that the release



NSP44-1-4

1 to the containment vessel is assumed to be the total core  
2 gap inventory but what fraction of the total core inventory  
3 that represents I can't give you directly.

4 CHAIRMAN GARPINKEL: Mr. Salur, you to straighten  
5 this out, one of the reasons I have allowed you to continue  
6 is that there is mention in the Applicant's Exhibit 1, the  
7 Emergency Core Cooling System. So, like I won't allow you in  
8 your direct case to go into the emergency core cooling system,  
9 I am allowing you for the purposes of cross-examination,  
10 because what is raised in a direct case you have a right to  
11 cross-examination, which I didn't bring up, but that is one  
12 of the reasons I have allowed you. I only hope that you  
13 limit your cross-examination to you one or two.

14 MR. CHARNOFF: Mr. Chairman, may I comment on that?

15 CHAIRMAN GARPINKEL: You may.

16 MR. CHARNOFF: As I understand the Vermont Yankee  
17 Appeal Board decision he says that in no individual licensing  
18 case will the Licensing Board consider challenges to the  
19 emergency core cooling system acceptance criteria.

20 CHAIRMAN GARPINKEL: I am not arguing --

21 MR. CHARNOFF: I want to be clear as to what this  
22 says for this case, because I think you may have overstated  
23 the restriction on Mr. Salur's case, and I would like to  
24 fight for him.

25 CHAIRMAN GARPINKEL: I don't want you to fight for

WSps4-2-5

1 him.

2 MR. GUARNOFF: Mr. Chairman, it is more that  
3 we don't have this error.

4 CHAIRMAN GARDINER: Please, I am not worried  
5 about it, because he has not been overruled on any of his  
6 questions, so there is no prejudicial error, Mr. Guarhoff,  
7 that I have overruled the question.

8 MR. GUARNOFF: Was you have told him that he may  
9 not be permitted to discuss emergency core cooling system  
10 in his direct case.

11 CHAIRMAN GARDINER: I didn't say -- the question  
12 hasn't come up yet. When it comes up I will permit discussion.

13 MR. GUARNOFF: Very good.

14 BY MR. KALUR:

15 Q Dr. Goldman, in Section Appendix G-5 on Page 1  
16 there is a discussion of the accident meteorology which I  
17 assume applies to the loss-of-coolant accident at 8-27,  
18 is that correct?

19 A Yes.

20 Q Am I correct in saying that from reading the  
21 accident meteorology in 1.1 that this is assumed to be a  
22 normal average day based on weather calculations at Davis-Besse.

23 A I think more correctly it is the most probable  
24 day.

25 Q It is right in the middle, isn't it, between some of

MSps4-2-6

1 the worse and some of the best?

2 A That is correct.

3 Q Could weather conditions substantially worse  
4 than anticipated cause a higher body dose or whole body  
5 dose than are predicted on page 2-4?

6 A Yes. This is stated in the preliminary safety  
7 analysis report using those kinds of conditions.

8 Q Do you know where this meteorology material was  
9 gathered? Was it on site.

10 A I think on Page 1 of Appendix 2-3 it indicates  
11 that on-site data for the period June, 1968, to November,  
12 1970, were used in this determination.

13 Q All right.

14 A And it refers to Appendix 2-4 of the environmental  
15 report supplement for the data itself.

16 Q Can we assume a straight-line relationship,  
17 in other words, if we postulate that the accident occurred  
18 at a day with double the wind, that double-the-wind conditions  
19 expected that we would be double-the-dose rate?

20 A No. If you double the wind conditions you would  
21 have half the dose rate.

22 Q But if we cut it in half would we double it?

23 A That's correct. That is approximately correct  
24 anyway.

25 Q Are you familiar with the emergency core coolant

WSps4-2-7

1 system for the Davis-Besse plant?

2 A. No, not specifically.

3 Q. Have you ever worked on emergency core coolant  
4 system design?

5 A. No.

6 Q. Are you familiar at all with the MIT Research  
7 Nuclear Reactor that says that a emergency core coolant  
8 system did not work in certain tests?

9 A. R. CHARNOFF: Objection. This relates to the  
10 criteria, Mr. Chairman.

11 CHAIRMAN GASPINEL: Mr. Charnoff, I am not going  
12 to allow this hearing to go into --

13 A. R. CHARNOFF: Was that addressed to Mr. Kalur?

14 CHAIRMAN GASPINEL: It is sorry, Mr. Kalur,  
15 did she correct.

16 A. Question had off the record.

17 CHAIRMAN GASPINEL: Back on the record.

18 A. R. KALUR: I withdraw the question, Mr. Chairman.

19 CHAIRMAN GASPINEL: All right.

20 BY MR. KALUR:

21 Q. I notice on Page 3-49, the middle of the page,  
22 the last sentence there before we go onto the next section of  
23 environmental consequences, it says, "The loss-of-coolant  
24 accident is not expected to occur."

25 Tell me what actual in-test plants you based that

NDps5-33

1 MR. KANTALIA: What position do you hold at  
2 Atomic Energy Commission?

3 MR. CLAUSERMAN: I am a materials and process  
4 engineer with the Division of Waste Management Transportation,  
5 currently on temporary detail with the Radiological  
6 Assessments Branch in the Directorate of Research,  
7 concerning health physics type functions.

8 MR. KANTALIA: Where did you receive your formal  
9 education and what degrees, if any, did you receive?

10 MR. CLAUSERMAN: I received a Bachelor of  
11 Chemical Engineering from the Polytechnic Institute of  
12 Brooklyn in 1952.

13 MR. KANTALIA: Could you describe for the record  
14 and the Board your employment history, your professional  
15 experience?

16 MR. CLAUSERMAN: In 1952 I joined the Atomic  
17 Energy Commission's Health and Safety Laboratory in New  
18 York City and my employment at HASL covered a variety of  
19 assignments covering field projects and laboratory studies  
20 pertinent to health physics and industrial hygiene.

21 Some of these studies included exposures to  
22 radon and radon daughter products and uranium mines, airborne  
23 dust hazards in the vicinity of uranium mill tailing sites  
24 and the significance of surface contamination at uranium  
25 and plutonium facilities.

WSv06-3

DR. FRIGERIO: Bachelor of Science in Qualitative  
Biology and Chemistry, Massachusetts Institute of Technology,  
1957.

Ph.D. in Bio-physical Chemistry, Yale University,  
1957.

MR. KAMAHARA: Would you define quantitative  
biology for the record?

DR. FRIGERIO: It is the application of physical  
and chemical quantitative methods to biological problems as  
opposed to the older, more classical and descriptive  
biology.

MR. KAMAHARA: Could you state for the record  
what bio-physical chemistry is in the discipline?

DR. FRIGERIO: Again it is the discipline of  
chemistry, physics and biology for the solution of biological  
problems.

MR. KAMAHARA: How do these two disciplines relate  
to the discipline of radiobiology, if it does?

DR. FRIGERIO: Radiation biology is a sub-set  
of the above and considers specifically the effects of that  
physical quantity known as radiation.

MR. KAMAHARA: Do you have any formal  
education in the discipline of radiobiology?

DR. FRIGERIO: Yes, as above, radiation biology  
as a sub-set of the above and is included in courses of the

above.

MR. KATZMAN: Have you any practical experience in the field of radiobiology?

DR. FRIEDMAN: About 10 years of research in teaching and directing the research of others.

MR. KATZMAN: Have you published anything in the radiobiology field?

DR. FRIEDMAN: About 100 papers and six or seven books.

MR. KATZMAN: Could you describe at least in general terms your professional experience?

DR. FRIEDMAN: Yes. The professional experience pertinent to radiation biology and nuclear medicine began in 1956 at Argon National Laboratory when I joined a gamma neutron radiobiology group there.

From that time I have been essentially involved in the elusive nuclear reactor as radiation source for determining biological effects and for curative uses. Much is determining the biological effects of nuclear reactors and their products.

The two are not exactly synonymous in fact.

I have been involved with a number of research and production reactors at the laboratory and at the same site with respect to their efficiency, their radiation and their biological effects thereof.

W5ps6-2-3

radioactive material from the Davis-Besse nuclear plant?

DR. PRIGERIO: Yes, I have, and it includes each of the nuclides listed on Page 19 and a number of others as well.

MR. KARPALIA: And what capacity did you take this assessment?

DR. PRIGERIO: As consultant to the environmental statement project and as developer of their specific package for these assessments.

MR. KARPALIA: Was that a sole consultant?

DR. PRIGERIO: Yes, in this area.

MR. KARPALIA: Will you state what if any role was played by the Oak Ridge National Laboratory?

DR. PRIGERIO: The Oak Ridge made an independent assessment based on very similar methods and models and my own values and those of Oak Ridge were in very close agreement.

MR. KARPALIA: Have you reviewed the Tables I and II?

DR. PRIGERIO: Yes, I have.

MR. KARPALIA: And could you address yourself to the values given in those tables in light of your own experience?

DR. PRIGERIO: In the light of my own experience the values given in those tables are approximately of the same those which I forwarded and very probably are simply the values normalized to a value of 5 curies for total fish and



NSps6-2-5

1 be rejected. I am not saying it will be.

2 I think you should make the offer of the document  
3 into evidence if you are going to talk about comparisons  
4 of the figures between what he gave and what is in the  
5 document.

6 MR. KARZALIA: Well, could I just say this.  
7 I was planning to reserve my offer of the document into  
8 evidence until I accounted for everything that I want to  
9 go into evidence.

10 As the matter now stands these tables have been  
11 marked for identification since they are part --

12 CHAIRMAN GARFINKEL: But you can't talk about the  
13 tables, the actual tables themselves.

14 You can indicate how the tables were prepared  
15 if you want to. You may talk about what role he played in  
16 the preparation as background. But you cannot talk about the  
17 tables themselves until the document is received.

18 MR. KARZALIA: I am prepared to abide by that.

19 CHAIRMAN GARFINKEL: All right.

20 MR. KARZALIA: At this point, Mr. Chairman, in  
21 order to complete work with respect to this document I would  
22 like to turn to the non-radiological portions of the document  
23 for which I understand no foundation need be laid.

24 CHAIRMAN GARFINKEL: That's right, but he can't  
25 testify as to the contents of the document.

WSpa6-2-5

1 MR. KARSALIA: I am not about to ask questions  
2 of Dr. Frigerio --

3 CHAIRMAN MARTINKEE: All right, fine.

4 MR. KARSALIA: At this time that I am simply  
5 going to offer Staff Exhibit 1 for identification into  
6 evidence and make the following exceptions: Table 1 and  
7 Table 2, because I will deal with this problem separately  
8 with Dr. Frigerio.

9 Paragraph 4 on Page 25, the accident assessment  
10 which I will deal with separately with Mr. Grimas.

11 I am not offering Tables 1 & 2 of the paragraph  
12 entitled "Accident Assessment" on Page 25.

13 CHAIRMAN MARTINKEE: Is any time during this  
14 proceeding? What I am saying in effect, are you going to do  
15 it by oral testimony without reference, because if you are going  
16 to put it in subsequently, I would rather have it in now.

17 MR. KARSALIA: Paragraph 4 I am not putting into  
18 evidence. In lieu of that I am going to offer into evidence  
19 the table which I distributed before the break.

20

21

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25

WSps4-2-3

1 conclusion on?

2 A I indicated I did not prepare this section, but  
3 I would agree with that conclusion.

4 Q All right, that's fine. Did you do any work  
5 on the environmental consequences --

6 CHAIRMAN GARFINKEL: I have a question. I know  
7 I am interrupting. I have a question on this point.

8 You said you agree with that statement. I would  
9 like to know, this Board would like to know what the basis  
10 is for your agreeing to that statement.

11 THE WITNESS: It has been my experience, or let's  
12 say as a result of my experience and familiarity with the  
13 case which is often in the design, the fabrication and the  
14 assembly of these facilities, the tests, the continuing  
15 surveillance and tests that are done on facilities after  
16 their construction, and the extremely close scrutiny that  
17 the Atomic Energy Commission gives to these facilities, both  
18 during the time, fabrication and operation, that the likelihood  
19 of an accident of this kind, considering materials, design  
20 and surveillance, is extremely unlikely. It's a judgement.

21 CHAIRMAN GARFINKEL: Very well. When a Board  
22 member asks a question keep in mind any party is allowed to  
23 cross-examine even Mr. Kaluz, on that basis.

24 MR. KALUZ: Got of turn?

25 CHAIRMAN GARFINKEL: No, not out of turn. I am

WSps1-2-9

1 talking about at the time, on the grounds that it is not  
2 his witness.

3 I won't treat him as the witness of Mr. Charnoff  
4 when the Board asks a question.

5 MR. CHARNOFF: You mean I am permitted to cross-  
6 examine him?

7 CHAIRMAN WOFFENBACH: By leading questions.

8 MR. CHARNOFF: That is an opportunity that has  
9 rarely been extended to me.

10 MR. FAIRB: You can depend your own witness.

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HDvo6-1

CHAIRMAN GARPINKEL: Mr. Kalur.

BY MR. KALUR:

Q Are you telling me that you have had no part in the designing of the system and you can't tell me in detail about the Davis-Besse system but you are fully capable of telling us that system is very workable and usable?

A I am saying that based on a very broad and long experience with large numbers of facilities that I would expect this to be equally true of Davis-Besse as it is of the others.

Q Tell me about any facility equivalent to Davis-Besse in which there has been a loss-of-coolant accident in which the emergency core cooling system hadn't functioned?

MR. CHARNOFF: Objection. The question before that which was a premise was will a loss-of-coolant accident occur, not will the emergency core cooling system work.

CHAIRMAN GARPINKEL: I think the objection is correct. Will you rephrase your question, Mr. Kalur?

BY MR. KALUR:

Q Do you know if an emergency cooling core system has worked in operation in the plant equivalent in megawatt capacity to Davis-Besse?

A Yes.

Q What plant is that?

EDvc5-2

1 Q Braden II.

2 Q When did that occur?

3 A I think last summer, if I recall.

4 Q And your testimony to me is that the emergency  
5 core cooling system worked properly in the Braden II  
6 accident?

7 A To best the core covered.

8 Q Thank you. The environmental consequences there,  
9 you didn't prepare the figures -- Bethel did -- but I assume  
10 it is your testimony that you stand behind everything in this  
11 Applicant's Exhibit 1, is that correct?

12 A I certainly stand behind the parts that I  
13 prepared, yes.

14 Q Whenever they are. You don't include anything  
15 here under environmental consequences to migratory birds or  
16 marsh animals, did you?

17 A No, sir.

18 MR. KALIN: No further questions.

19 CHAIRMAN GARFINKEL: Let's be off the record.

20 (Discussion off the record.)

21 CHAIRMAN GARFINKEL: Mr. Kalin, I understand now  
22 that you are finished with the cross-examination of the  
23 direct case of Mr. Charnoff for the applicant.

24 Am I correct?

25 MR. KALIN: Yes.

HDV05-3

1 MR. CHARNOFF: And Mr. Kartalia similarly?

2 CHAIRMAN GARDNER: That is correct.

3 MR. KARTALIA: I am finished.

4 CHAIRMAN GARDNER: Now, Mr. Charnoff, you bring  
5 in rebuttal evidence if you want to do that or redirect.

6 MR. CHARNOFF: At this point the opportunity is  
7 redirect. We have an opportunity later for rebuttal after  
8 witnesses by the others.

9 CHAIRMAN GARDNER: You are right. It is  
10 redirect.

11 MR. CHARNOFF: We have no redirect.

12 CHAIRMAN GARDNER: All right, the applicant's  
13 case is finished.

14 I want the regulatory staff to be second in  
15 bringing their direct case.

16 I will give a ten-minute recess to prepare their  
17 direct case and they will commence immediately with the  
18 direct case.

19 MR. KARTALIA: Very well.

20 Could I move right now that we intend to offer  
21 into evidence in supplementation of our written testimony what  
22 is now identified as staff Exhibit 1, this table which sets  
23 forth the results of an accident analysis.

24 You may recall that during the telephone conver-  
25 sation in which I participated I mentioned the possibility that

HDvc5-4

1 Mr. Grimes, our accident witness, might supplement his  
2 testimony. This is the result, and this is the result of a review  
3 of the Davis-Besse plant.

4 The testimony in Staff Exhibit A for identification  
5 is based on reviews of other plants. At the time that was  
6 written we had not completed this work.

7 CHAIRMAN GASPINKEL: I would bring this in.  
8 It is obviously a one-page document. I would mark this as  
9 an exhibit.

10 MR. CHARNOFF: We only received the one page.

11 MR. KARPALIA: I am sorry.

12 CHAIRMAN GASPINKEL: I would staple it and I  
13 think this would be Regulatory Staff's Exhibit A.

14 MR. CHARNOFF: Mr. Karpalia, I take it. Is not  
15 introducing it now but will introduce it?

16 MR. KARPALIA: I just wanted to make it available  
17 now so that it can be inspected.

18 CHAIRMAN GASPINKEL: I would like it stapled  
19 if we had a stapler. If we don't --

20 MR. CHARNOFF: When he introduces it why don't  
21 we put it into the record as though read?

22 CHAIRMAN GASPINKEL: No, this particular one  
23 I would like as an exhibit.

24 MR. CHARNOFF: Aren't you introducing the rest  
25 of your material to be included in the record?



1 MR. KARTALIA: I don't have enough copies of this  
2 table.

3 MR. CHERNOFF: The reporter can simply repro-  
4 duce it.

5 CHAIRMAN GARTNER: I would like it as an  
6 exhibit.

7 MR. CHERNOFF: Then we would like it supplied, too,  
8 Mr. Kartalia.

9 (Records taken.)

10 CHAIRMAN GARTNER: Will the hearing come to  
11 order? Mr. Kartalia, will you advise your case in chief?

12 MR. KARTALIA: I shall. I would like to call to  
13 the stand at this time Mr. George Knighton, Mr. Brian Grimes,  
14 Dr. Norman Priggen and Mr. Harold Claiborn. I would  
15 like the Chairman at this time to swear these witnesses  
16 either collectively or individually.

17 CHAIRMAN GARTNER: Collectively.

- 18 GEORGE KNIGHTON
- 19 BRIAN GRIMES
- 20 DR. NORMAN PRIGGEN
- 21 HAROLD CLAIBORN

22 being first duly sworn, was examined and testified as  
23 follows:

24 DIRECT EXAMINATION

25 MR. KARTALIA: Mr. Knighton, would you state  
26 your full name for the record, please?

27 MR. KNIGHTON: My name is George W. Knighton.

HDvo5-6

1 MR. KARTALIA: By whom are you employed?

2 MR. KNIGHTON: U. S. Atomic Energy Commission,  
3 1717 H Street, N.W., Washington, D. C. 20545.

4 MR. KARTALIA: What is your position with the  
5 Atomic Energy Commission?

6 MR. KNIGHTON: My present position is Chief of  
7 the Environmental Projects, Branch EC-1.

8 MR. KARTALIA: Mr. Knighton, could you explain  
9 what the responsibilities are in that position?

10 MR. KNIGHTON: My responsibility in that position  
11 is one of developing, supervising, and directing and co-  
12 ordinating the review of the environmental reports sub-  
13 mitted by applicants on proposed nuclear power facilities.

14 This review requires the coordination of technical  
15 groups in the Directorate of Regulatory Standards, the  
16 Directorate of Licensing, the AEC National Laboratories,  
17 consultants, governmental agencies, federal, state and  
18 local.

19 It is my responsibility to see that approximately  
20 eight professional project managers organize and coordinate  
21 these reviews, present a final statement for the AEC which  
22 is technically complete and includes proper recommendations  
23 and evaluations and conclusions for the AEC to make on any  
24 given facility.

25 MR. KARTALIA: I would like to interject at this



HDvo5-8

Alco Products, Incorporated, Schenectady, New York, Nuclear Division, as an equipment engineer, design engineer in plant layout, pressure vessel design, heat exchanger design, thermo-mechanical and mechanical design in general for nuclear power plants.

Subsequent to this I was Chief, Mechanical Engineering Branch, U. S. Army Engineer Reactor Group, Fort Belvoir, Virginia.

In this position I was responsible for all mechanical engineering support plus chemical, radiochemical and metallurgical support for six nuclear power plants located at various points in the world.

In addition we provided support to seven Army test reactors located in various parts of the United States.

Other responsibilities with the Engineer Reactor Group included Chief of their Operations Plans, which required management support as well as engineering support for these fuel plants.

Later I was Deputy Director of the Engineer Reactor Group, Engineering Division. In this position I was responsible for all engineering aspects and management support of these fuel plants and new designs.

I then served as Chairman of the Department of the Army, Reactor Safety and Health Committee. In this position I was responsible for a Committee which reviewed all

HDVc5-9

Department of the Army reactors for health and safety, new designs, operational and decommissioning.

I then joined the Research and Technology Division of the Engineer Reactor Group as Director.

I then joined the AEC as a Senior Project Engineer in the original Division of Reactor Licensing. In that position I coordinated detailed reviews of proposed nuclear power facilities with respect to their safety.

I then was transferred to the Division of Radiological and Environmental Protection which has recently been reorganized and is now under the Directorate of Licensing.

HDps5-3-1

1 MR. BARBERIA: Are you a member of any professional  
2 society, Mr. Knighton?

3 MR. KNIGHTON: I'm a member of the American Society  
4 of Mechanical Engineers and the American Society for Testing  
5 Materials.

6 MR. BARBERIA: Have you participated in the  
7 activities of these professional societies?

8 MR. KNIGHTON: I was a Vice Chairman of Special  
9 Nuclear Cycle Committee for WASH and Secretary of the  
10 E-10 Div 2 Radiation-Induced Changes in Metallic Materials  
11 Section of the E-10 Committee.

12 MR. BARBERIA: Mr. Knighton, have you authored any  
13 publications in your field?

14 MR. KNIGHTON: I have co-authored three publications  
15 on radiolysis damage to nuclear vessels and one publication,  
16 Probabilistic Evaluation of a Nuclear Plant Protection System,  
17 which was printed in the ASME Transactions, October 1 through  
18 4, 1969.

19 MR. BARBERIA: Mr. Knighton, I am going to hand  
20 you a copy of what has been identified in this proceeding as  
21 Staff Exhibit 1 for identification entitled Preliminary  
22 Report on Environmental Considerations related to the suspension  
23 of construction activities under construction permit No.  
24 OPR-83 for Davis-Besse nuclear plant dated May 2, 1972,  
25 and ask whether you can identify that document?

HDPa5-3-2

MR. KIRCHICK: Yes.

MR. KIRCHICK: That was a document that you prepared?

MR. KIRCHICK: Yes, sir, based on information supplied from various technical groups.

MR. KIRCHICK: Thank you.

MR. KIRCHICK: I would like to direct your attention in particular to paragraph 2-5 of Page 16 of that document headed "Biological Environmental Monitoring." You also prepared this section?

MR. KIRCHICK: Yes, sir.

MR. KIRCHICK: Is it true and correct to the best of your knowledge?

MR. KIRCHICK: Yes, sir.

MR. KIRCHICK: And you adopt it as part of your testimony in this proceeding?

MR. KIRCHICK: Yes, sir.

MR. KIRCHICK: Mr. Claiborn, will you state your full name for the record?

MR. CLAIBORN: My name is Harold Claiborn.

MR. KIRCHICK: By whom are you employed?

MR. CLAIBORN: U. S. Atomic Energy Commission at Headquarters.

CHAIRMAN GARPINKER: Can you keep your voice up, Mr. Claiborn, so they can hear you?

HDas5-3-4

All of these studies embraced in special ABC reports or published articles in professional journals.

In addition I also conducted experimental procedures at ABC construction facilities to determine and test materials.

In 1984 I was transferred from the Health and Safety Laboratory to the newly organized Occupational Safety Branch of the NIOSH and in 1987 I was appointed Chief of the Occupational Safety Section.

In that position I was responsible for providing administrative and technical guidance in the coordination of the New York Health and Safety Program as it related to OSH and construction activities.

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MR. KARTALIA: Mr. Glauberstein, I am going to hand you a copy of what has been identified as Staff Exhibit 1 for identification, and I am going to draw your attention in reference to several sections of that document.

First, if you would turn to Page 14, Pages 14 and 15, did you participate in the preparation of this portion of Staff Exhibit 1 for identification?

MR. GLAUBERSTEIN: Yes.

MR. KARTALIA: Are the statements made therein true and correct to the best of your knowledge?

MR. GLAUBERSTEIN: Yes.

MR. KARTALIA: Do you adopt them as part of your testimony in this proceeding?

MR. GLAUBERSTEIN: Yes.

MR. KARTALIA: Now I would direct your attention to Paragraphs B-3, B-3 and B-4 on Pages 14 and through 15 and ask whether you participated also in the preparation of those portions of Staff Exhibit 1 for identification?

MR. GLAUBERSTEIN: B, B and B.

MR. KARTALIA: Yes.

MR. GLAUBERSTEIN: Yes.

MR. KARTALIA: And are the statements made therein true and correct to the best of your knowledge?

MR. GLAUBERSTEIN: Yes.

MR. KARTALIA: And do you adopt them as a part of

WSvc6-2

your testimony in this proceeding?

MR. SANDERSON: Yes.

MR. SANDERSON: Now, Mr. Claiborne, I direct your attention to Exhibits 3, 4, 5 and 6 on pages 21, 22, 23 and 24. Did you participate in the preparation of these exhibits?

MR. CLAIBORNE: Yes.

MR. SANDERSON: Is the information contained in these exhibits true and correct to the best of your knowledge?

MR. CLAIBORNE: Yes.

MR. SANDERSON: Do you adopt what is said in your testimony in this proceeding?

MR. CLAIBORNE: Yes.

MR. SANDERSON: Mr. Friester, would you please give your full name for the record?

MR. FRIESTER: Norman A. Friester.

MR. SANDERSON: By what date were you employed?

MR. FRIESTER: Arden National Laboratory.

MR. SANDERSON: What is your current position with Arden National Laboratory?

MR. FRIESTER: Senior consultant to the Environmental Statement Project on loan from the Division of Ecology and Medicine.

MR. SANDERSON: Would you describe your formal education for the record?

IS-706-5

In most cases these involved animal experiments with organisms ranging from micro-organisms up to and in the case of certain therapies, man.

MR. MARSHALL: Dr. Felig, I am going to hand you a copy of what has been identified as Staff Exhibit 1 for identification.

I direct your attention to Paragraph 3-3 on Pages 25 and 26.

MR. CHARNOFF: I'm sorry. What page was that?

MR. MARSHALL: Paragraph 3 of Page 25 and 26 headed "Advocate systems."

Did you participate in the preparation of this section of Staff Exhibit 1?

DR. FELIG: Yes, I did, in the sense that I forwarded each of the information on which it appears to have been based.

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MR. WHELAN: And you have reviewed this paragraph

- 2 -

DR. WHELAN: Yes.

MR. WHELAN: Did you see anything else in

the report?

DR. WHELAN: No.

MR. WHELAN: Is it possible to have the last

part of your knowledge?

DR. WHELAN: Yes.

MR. WHELAN: Did you see anything else in

the report?

DR. WHELAN: Yes.

MR. WHELAN: Did you see anything else in

the report?

DR. WHELAN: Yes.

MR. WHELAN: I am sure that you have seen the

paragraph on page 28 which is the one that

you are talking about. And you are sure that it is

in the preparation of this paragraph?

DR. WHELAN: Yes, I am.

MR. WHELAN: Is that all you have to say?

DR. WHELAN: Yes, that is all.

MR. WHELAN: Is there anything else you would like to

say, Dr. Whelan?

MR. WHELAN: And the other part of the report.

correct to the best of your knowledge?

DR. FRIZZELL: Yes, with the qualification that the numbers given are generally taken from the records which I furnished.

CHAIRMAN: Will you explain what these figures are referring to please?

DR. FRIZZELL: These are referred to Page 11.

CHAIRMAN: Page 11 of the report. Will you please furnish your answer on that point?

DR. FRIZZELL: These are values of annual catch records in fish and invertebrates were given as 19 million dollars respectively, and of the order of 1 million dollars.

CHAIRMAN: I see.

DR. FRIZZELL: These losses are based are based on the releases set forth in Table 1, and that correct?

DR. FRIZZELL: That is correct.

DR. FRIZZELL: Which I am about to set up.

DR. FRIZZELL: Which is on Page 11.

DR. FRIZZELL: Except for one qualification, is that correct, this is your testimony?

DR. FRIZZELL: Yes, I do.

DR. FRIZZELL: In now, Dr. T. also, I would like your attention to Tables 1 and 2 on Pages 11 and 12 and ask whether you have made an estimate of the annual catch of

WS-66-2-4

1 products.

2 In the case of criticism the value given, 1999,  
3 is almost exactly four times I calculated.

4 MR. MARTALIA: Could you describe how you went about  
5 preparing an estimate --

6 MR. KAMR: Mr. Chairman, I am going to have to  
7 object. We are getting evidence here, first it is introduced  
8 and now he is launching his own witness.

9 CHAIRMAN GARFINKEL: I don't want to argue about  
10 the impeachment, but your first part of the objection is well  
11 taken. You are getting into the document itself and it is  
12 not in evidence.

13 Consequently he shouldn't be testifying with the  
14 contents of that document unless you have the document  
15 received in evidence.

16 You already have the fact that he participated in  
17 the preparation of that document. It is indicated  
18 to what areas he participated. He has adopted the document  
19 as his own in the areas where you pointed out.

20 MR. MARTALIA: That's right.

21 CHAIRMAN GARFINKEL: Except for one qualification.

22 MR. MARTALIA: That's right.

23 CHAIRMAN GARFINKEL: Therefore, before he can  
24 comment on the contents of that document I think the document  
25 should be either offered and received in evidence or it could

WSvo6-2-1

1 CHAIRMAN GARTINKEL: Fine. Now, what about the  
2 other? You had another I think revision of this time. I  
3 thought you mentioned something besides that. I thought  
4 Table 1 and 2.

5 MR. KARSTEN: With respect to the tables, Dr.  
6 Frigerio will testify orally as to the results of his own  
7 estimate of the radioactive releases from Davis-Besse.

8 CHAIRMAN GARTINKEL: So you are not offering  
9 that at all at any time during this proceeding?

10 MR. KARSTEN: I am not.

11 CHAIRMAN GARTINKEL: O. K. This is his document,  
12 Mr. Charnoff.

13 MR. CHARNOFF: I just want to understand what  
14 is being offered.

15 It is the document without Tables 1 and 2 on  
16 18 and 19, and without Section E on Page 27, is that correct?

17 MR. KARSTEN: Yes, sir.

18 MR. CHARNOFF: May I ask, is Mr. Karsten offering  
19 on Page 26, Paragraph 7 with the doses set forth in the  
20 printed text, or the doses as modified by Dr. Frigerio to  
21 the fish and the invertebrates.

22 As I recall it, Dr. Frigerio indicated that his  
23 calculations would show that those doses would be in the  
24 nature of 1 MR as compared with the printed statements here  
25 of 100 and 210 MR.

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1 MR. KARZALIA: Dr. Frigerio, can you clear this  
2 up?

3 DR. FRIGERIO: Perhaps I can.

4 The values on Page 26 are, I am quite certain,  
5 based on Tables 1 and 2.

6 Since Tables 1 and 2 do not agree with my own  
7 calculations, then neither do the values on Page 26.

8 However, perhaps in order to maintain the homo-  
9 geneity of the document they should all be entered as evidence  
10 and then my own printed separately. Am I doing a naughty?

11 CHAIRMAN GARFINKEL: I think you are doing it  
12 splendidly.

13 MR. CHAMBERLAIN: With all due respect to Dr.  
14 Frigerio, I would have difficulties with accepting him  
15 evidence Tables 1 and 2 and the doses on Page 26 in the  
16 absence of any sponsoring witness for such tables and data  
17 and, therefore, what I would suggest, if I may take the liberty  
18 for doing that, and that is that what perhaps Mr. Karzalia  
19 might do is accept Tables 1 and 2 and the specific dose  
20 numbers on Page 26, or even that paragraph, and then when  
21 Dr. Frigerio presents his calculations in lieu of Tables 1  
22 and 2 he might also submit a new paragraph 7 which reflects  
23 his views.

24 CHAIRMAN GARFINKEL: I can't buy that unless  
25 there is a sponsoring witness for the contents of the statement



WSvo6-3-3

in that record.

MR. CHARNOFF: That is my view, that there is no sponsoring witness.

CHAIRMAN GARTENKEL: There isn't anyone that is sponsoring that particular section.

MR. CHARNOFF: Yes, Dr. Triguero is sponsoring it.

CHAIRMAN GARTENKEL: No, he is challenging that section.

MR. CHARNOFF: He is sponsoring it subject to changing those two numbers.

CHAIRMAN GARTENKEL: But he has modified that.

MR. KARTALIA: He has previously modified it.

CHAIRMAN GARTENKEL: I am saying he doesn't want to rely on Tables 1 and 2.

MR. CHARNOFF: That's right.

CHAIRMAN GARTENKEL: Which is in the document.

MR. KARTALIA: Mr. Chairman, Dr. Triguero is prepared to vouch for the conservation of these tables.

CHAIRMAN GARTENKEL: Then let's let the whole thing in.

MR. KARTALIA: That was my original plan.

CHAIRMAN GARTENKEL: No, you had an exception that you weren't going to allow Tables 1 and 2 in.

MR. KARTALIA: I sensed the Board was about to object, and that is why I made that offer

WV60-1-1

My preference is to have those tables go in, and I will simply ask Dr. Prigorio what is based on your independent review of the --

DR. CARPENTIER: I have no objection to that approach.

MR. KATZ: Will the Chairman call him out there and go with his signature as we can get going?

CHAIRMAN CARPENTIER: You have offered the whole document into evidence, now, Dr. Karstner.

MR. KARSTNER: With the exception of Paragraph 3 on Page 27, which I do not offer in evidence, since I am going to have an exhibit of that.

CHAIRMAN CARPENTIER: And that is settled you are offering the entire document in?

MR. KARSTNER: Yes, I am. Could I complete this question as Dr. Prigorio?

CHAIRMAN CARPENTIER: Surely.

MR. KARSTNER: I beg your pardon?

CHAIRMAN CARPENTIER: Yes.

MR. KARSTNER: Dr. Prigorio, based on your independent estimate of the radioactive releases from the Davis-Besse plant, are you prepared to vote in this proceeding for the conservation of the signals listed in Tables 1 and 2 of Staff Exhibit 1 for identification?

DR. PRIGORIO: Yes, I am.

WS706-3-5

1 MR. KARTALIA: And the figures set forth?

2 MR. KALUS: I have to object to the use of the  
3 term "vouch," it disturbs me.

4 CHAIRMAN GARFINKEL: I am going to object to that,  
5 too.

6 The question of vouch goes into the merits of  
7 the document.

8 I think you have the choice of allowing the  
9 document to stand -- it is a question of whether Mr. Kalus  
10 is going to object to it or not -- to allow the document in  
11 completely and let Dr. Feig do explain it away. I think we  
12 are far better off, except for the Section specifically of D.

13 MR. KARTALIA: That's my offer. When everything  
14 except Paragraph E.

15 MR. CHAMNOFF: What is the offer?

16 MR. KARTALIA: The entire document with the  
17 exception of Paragraph E on Page 27.

18 CHAIRMAN GARFINKEL: Mr. Kalus, I will give you  
19 the right to have voir-dire regarding the background,  
20 educational background and the qualifications of the witnesses  
21 as well as voir-dire on the document as well as any objections.

22 MR. KALUS: Have you got all your witnesses in  
23 now?

24 CHAIRMAN GARFINKEL: Let's get this document in  
25 first, unless you have no objections to the document going in

with the condition. I am allowing you now to examine the witnesses.

MR. BROWN: It is not being submitted, is that correct?

It has gone back and forth several times.

CHAIRMAN CARPENTERS: He is offering the entire document except Paragraph 1 on Section 1 on Page 27.

MR. BROWN: I have no objection.

CHAIRMAN CARPENTERS: O. K. Any objection?

MR. CARPENTERS: No. I think the record is very clear. We have no objection to that either at this point subject to --

MR. BROWN: You think the record is clear? Would you explain it to me as you please?

CHAIRMAN CARPENTERS: O. K. It is received in evidence except for Section 1.

(Regulator Exhibit 1 as follows)

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PRELIMINARY REPORT ON ENVIRONMENTAL CONSIDERATIONS  
RELATED TO SUSPENSION OF  
CONSTRUCTION ACTIVITIES  
UNDER CONSTRUCTION PERMIT NO. CPPR-80  
FOR DAVIS-BESSE NUCLEAR PLANT

DOCKET NO. 50-346

by the

U. S. Atomic Energy Commission  
Division of Radiological and Environmental  
Protection

MAY 2, 1972

I. SUMMARY

The following is a summary of the results of the staffs' brief review of the applicant's Environmental Report with supplements relative to the environmental effects and benefits from the operation of the Davis-Besse Nuclear Plant:

1. The mechanical effects on the aquatic biota are small due to the reduced quantity of Lake Erie water used. The possibility of reducing the present 1.5 foot per second intake velocity to minimize entrainment of fish will be investigated in the detail review. An engineering modification can make the effect negligible.
2. The thermal effects of the cooling tower discharge on Lake Erie are negligible. The plume developed by the applicant shows an 1°F isotherm covering 2.14 acres and the longest dimension 658 feet. This work shows a considerable margin of safety with respect to encroachment on the nearest walleye spawning area, Locust Point Reef. Thus it is not likely that a serious thermal impact on the aquatic biota will be discovered as a result of the detailed NEPA review.
3. The fogging or icing is not expected to be serious problem in the detailed NEPA review even though more conservative meteorological and drift values will probably be used.

4. The proposed concentration of 0.2 ppm residual chlorine in the cooling water blowdown may cause an adverse impact upon aquatic Biota in the outfall. Engineering solutions are available to minimize this concentration. The licensee is not planning the use of biocides such as chromates or polyphosphates. The added total solids resulting from sulphuric acid and sodium hydroxide addition are not considered detrimental at this time.
5. The expected total man-rem dose received from all effluent pathways for the estimated 1980 population in a 50 mile radius is calculated by the staff to be about 6 man-rem. This compares to 267,000 man-rem from natural background. The detailed NEPA review may find some changes should be made to further improve the processing systems.
6. The exposure of aquatic organisms which may be in undiluted discharge effluent including bioaccumulation factors would produce an annual dose for fish and invertebrates of about 200 mrad/yr.
7. Effects such as noise, aesthetics, historical places, aviation do not appear to be significant.
8. The benefits expected through the operation of the plant are approximately  $6 \times 10^9$  Kw-hrs/yr of needed electrical power, approximately 600 acres of wildlife refuge, and a significant increase in the Ottawa County income through the increased tax base.

II. Site and Plant Description

A. Site: The site is located on the south shore of Lake Erie in a rural farm area more than 20 miles from the population centers of Toledo and Sandusky. The nearest municipality of Oak Harbor (1960 population of 2903) is approximately six miles distant from the site. Camp Perry - Erie Industrial Park approximately 2.8 miles from the site is the nearest intake of Lake Erie water used for drinking water. The 954 acres of the site, including about 600 acres of marshland, has approximately 7,250 feet of frontage on Lake Erie. The marshland is part of a larger amount bordering the lake and owned or operated by private as well as Federal and State agencies as wildlife preserves.

Repair of old dikes, addition of new dikes, and installation of pumps for controlling water level in the marshland will provide the 600 acres under the U.S. Bureau of Sports Fisheries and Wildlife control and the conversion of a private game marsh to a preserve area. The principal portion of the site (Navarre Marsh) was acquired from the U.S. Bureau of Sport Fisheries and Wildlife in exchange for Darby Marsh which had been an established private game marsh area.

The north and east of the site is bounded by the lake, while to the west and south it is bounded by farmland and the Toussaint River, respectively.



The Toussaint River is a spawning area for bass and catfish while the Locust Point Reef is the closest off-shore walleye spawning area in the lake.

B. Plant Description

The Davis-Besse Nuclear Power Station will utilize a nuclear reactor of the pressurized water type which will have a net power rating of 2633 megawatts thermal (MWT) and 872 megawatts electrical (MWe). The maximum power capacity is 2772 MWT and 906 MWe. The pressurized water nuclear reactor steam system is to be furnished by the Babcock & Wilcox Company, the architect-engineer and construction manager is the Bechtel Company, and the turbine generator will be supplied by General Electric.

The plant cooling system includes a large natural draft cooling tower to extract the heat from the condenser cooling water. This hyperbolic shaped tower will be 493 feet tall and have a diameter of 414 feet at the bottom and 275 feet at the top. This system will release approximately 98% of the waste heat directly to the atmosphere. The remaining 2% will be released in discharge water to the lake.

The cooling tower, as well as the 220 foot high shield building, will be easily visible from off-site locations due to the relatively

flat terrain. However, by utilizing the cooling tower system instead of direct once-through lake water cooling, the amount of heat released to the lake is substantially reduced. In addition, the cooling tower obviates the need for an open intake channel to the lake for the large quantity of water necessary for direct cooling. The intake pipe in the present design will be located below the lake bottom and extend to an underwater intake crib located 3000 feet off shore. This will allow the beach to be returned to its original condition.

The plant buildings occupy a graded and fenced area of 56 acres at approximately the center of the 954 acre site. The distance from the plant to the nearest point on the lake shore is 3000 feet. The cooling tower is located at the northwest corner of the 56 acres and is about 1500 feet from the nearest boundary of the site.

### III. Environmental Considerations

#### A. Mechanical Effects

The revision of the Davis-Besse waste heat removal from the once-through condenser cooling system using 685,000 gpm of Lake Erie with direct open discharge 18°F above lake ambient temperature to the wet-cooling tower system resulting in a maximum intake of 42,000 gpm and 13,800 gpm discharge at 20°F above lake ambient temperature results in at least a 94% reduction in possible entrainment of aquatic biota (i.e., eggs, larvae, juvenile fish, other weak swimming organisms, and plankton) because of the smaller amount of lake water involved.

A corollary to the reduced entrainment is a reduced impingement of the juvenile fish because of the proportionately smaller absolute number of juvenile fish involved due to reduced water usage. The horizontal intake structure described by the applicant during the winter will have as high as 42,000 gpm flow and a corresponding 1.5 ft. per second entrance velocity. During this cold period fish tend to become entrained at lower velocities than in warmer periods because of their slower reaction time in reduced temperatures. It is possible that the more detailed NEPA evaluation will find that entrainment and impingement of the juvenile fish sufficient to require modification of the intake structure to result in a lower entrance velocity. The lower velocity can be achieved by an engineering modification.

B. Thermal Effects

1. The condenser-cooling tower system circulates 480,000 gpm with 20,000 gpm makeup, evaporates 7500 to 10,400 gpm of water and has a maximum blowdown including dilution water of 13,800 gpm at 20°F. maximum above take water ambient temperature. The total heat rejected to the lake will be  $138 \times 10^6$  Btu/hr discharged 1300 feet beyond the shoreline at the six foot depth through a slot type orifice which promotes rapid mixing by jet action. The resulting thermal plume has been predicted by the applicant as 2.14 acres for the 1°F. isotherm perimeter with the longest dimension of 658 feet. The prediction indicates a considerable margin of safety with respect to encroachment on the nearest walleye spawning area Locust Point Reef some three miles offshore. The only other spawning area reported near the plant is the catfish and bass spawning area in the Toussaint River. Our preliminary conclusion is that these discharges will have no significant impact on the spawning areas.
2. The 493 foot high natural draft cooling tower dissipates  $6.2 \times 10^9$  Btu/hr waste heat through evaporation. The evaporative process under certain weather conditions may produce fog and in some cases ice. The licensee estimates

that the average length of the visible plume will be 1.5 miles and that the vapor cloud will not be visible over population centers of Port Clinton or Toledo, nor present an aircraft hazard.

The licensee has calculated the probability of increased occurrence of fog conditions because of the cooling tower evaporation to be 0.42%. Increased icing is predicted to be negligible.

A preliminary review of the licensee's evaluation of the impact of the tower plume indicates that they appear reasonable. The detailed NEPA review may change the average meteorological data and possibly the moisture loss due to drift from 0.01% to 0.03%, but these changes would not be expected to produce significant changes in the impact of fogging or icing due to the tower.

C. Chemical Effects

All the water required for the Station will be withdrawn from Lake Erie. Except for those times of the year when the temperature rise in the condensers is greater than 20°F. approximately 20,000 gpm will be withdrawn from and 10,000 gpm returned to the lake. Aside from small volumes of water taken for Station potable use, sanitary and primary or secondary systems make-up (demineralizers), the total flow is used for cooling station service systems (turbine cooling, etc.) and make-up supply for the closed-cycle condenser cooling system.

The effluent from the plant will contain chemical wastes from the sanitary sewage facilities, dissolved sodium and sulphate ions from the regeneration of supply water demineralizers, and blowdown from the closed-cycle circulating cooling water system. These wastes are discharged through a common mixing basin and the volume of wastes discharged from the first two sources is minor in comparison to the third. At the present time, the only chemicals which will be used during the operation of the plant and discharged into Lake Erie are sulphuric acid, sodium hydroxide, gaseous chlorine, and sodium hypochlorite.

A concentration factor of 2 was chosen for dissolved solids in the design of the cooling tower which results in a blowdown of approximately equal to the evaporative and drift loss. This results in a concentration of dissolved solids approximately double (450 ppm) that of the make-up water from the lake (225 ppm). This factor was chosen by the licensee for two reasons, to reduce the problems of scale formation on condenser tubes and to keep total dissolved solids as low as possible. The licensee intends to operate its cooling systems without the addition of anticorrosion or scaling agents like zinc chromate or polyphosphates.

As the pH of the raw lake water is high (approximately 8.3), sulphuric acid will be added to lower the pH to essentially neutral (7.3). The sulphuric acid reacts with the calcium bicarbonate to produce calcium sulphate, which helps to reduce scaling. The concentration of sulphuric acid added (or residual sulphate), will be 60 ppm which represents an increase in total dissolved solids of less than 10 percent in the feed water.

Sulphuric acid and sodium hydroxide are used in the regeneration of the Station make-up demineralizers. These wastes are collected in a holdup tank, neutralized and discharged to the collection basin to mix with other station effluents. The holdup tank discharge

would be greater than 6000 ppm (on an intermittent basis) dissolved solids at 200 gpm, this represents only 2% of the major effluent from the cooling tower and would produce only 25% increase in dissolved solids over the normal lake water loading. Normal blowdown is discharged with a dissolved solids content of 1/20 of the normal lake water content.

The only other major chemical used in the plant will be chlorine (as gas or sodium hypochlorite). The intake water will be chlorinated to 0.5 ppm free chlorine immediately ahead of the service water pumps. This chlorination will be intermittent, occurring for four periods of 30 minutes each day, to prevent algae growth and buildup in the Station systems. The applicant intends to inhibit all biological growths in the main cooling system. In order to achieve this, the applicant will also chlorinate after the makeup water intake and ahead of the condenser in the closed loop system continuously to maintain a free chlorine level of 0.5 ppm at the outlet of the condenser. While most of this added chlorine will be lost to the atmosphere with evaporation of water in the cooling tower, there will be a residual concentration of chlorine (probably as chloramines) in the cooling tower blowdown. The concentration in the tower blowdown water is estimated to be less than 0.2 ppm. As this blowdown will be discharged to the lake, under normal



conditions undiluted to any large extent, the concentration of available chlorine at the mouth of the discharge pipe will be approximately the same. Chlorine gas and sodium hypochlorite are also used in the treatment of potable water and sanitary wastes. The concentration of residual chlorine in the sanitary waste is 0.5 ppm but as the flow in relation to the cooling tower blowdown is so small, this concentration has no effect on the final residual chlorine at the outfall.

The discharge of chemicals to the lake, other than chlorine, will have no detrimental effect on the environment as the discharge contains virtually no chemicals other than these taken from the lake concentrated by a factor of two. No other known toxic chemicals are added in the plant.

The concentrations of chlorine likely to be discharged, on the other hand, could cause environmental harm in the immediate vicinity of the discharge pipe. This area will be developed in the full NEPA review and if it is determined unacceptable harm is indicated, engineered modifications and operating procedures will be required to minimize the impact.

In the start-up and maintenance procedures other chemicals will be used to clean all parts of the system. The chemicals involved will include alkali phosphates and various chelating agents. The liquid wastes will not be discharged through the normal systems but taken away from the plant in trucks for disposal elsewhere by a contractor.

D. Radiological Effects

During routine operation of the station at full power, small quantities of radioactive materials will be released to the environment. Preliminary estimates of the probable release rates of radionuclides have been made, based upon experience with comparable operating reactors and an evaluation of the procedures, equipment, and mode of operation at the Davis-Besse station.

The potential radiation doses to residents, within a 50-mile radius of the station, have been calculated using the preliminary releases listed in Tables 1 and 2, and using conservative assumptions relative to dilution, biological accumulation in food chains and use factors for people. The results of the radiation dose estimates are presented in Table 3 as annual doses at equilibrium conditions to individuals at various locations.

1. Radioactive Materials Released in Liquid Effluents

The liquid effluent from the station is discharged into Lake Erie at a rate of approximately 20,000 gpm. The expected annual average concentration based on Table 1 will be about  $1.25 \times 10^{-7}$   $\mu\text{Ci/cc}$  for fission and activation nuclides, and  $2.5 \times 10^{-5}$   $\mu\text{Ci/cc}$  for tritium. The primary source of potable water in the area is Lake Erie. The closest potable water

intakes serve Camp Perry, the Erie Industrial Park, and surrounding residences and are located approximately 3 miles from the Station. The Port Clinton potable water intake is 8 miles east and the Toledo and Oregon intake are 13 miles

west. It was assumed that the water intakes at the above distances contained radionuclides diluted by factors of about 200 and 1000 from the discharge effluent, and that consumption of the water by residents occurred 24 hours after the water leaves the effluent pipe. Under those assumptions the total body dose to an individual drinking 1.2 liter/day would be  $1.4 \times 10^{-2}$  mrem/yr,  $4.7 \times 10^{-3}$  mrem/yr, and  $2.8 \times 10^{-3}$  mrem/yr for the respective distances. The dose to the thyroid of an individual at Camp Perry would be about 0.13 mrem/yr.

If an individual were to consume 20 gm of fish per day, 24 hours after it was caught from Lake Erie around Camp Perry, where the average dilution is approximately 1:200, the total body dose would be 0.04 mrem/yr. Doses to the thyroid and GI tract are indicated in Table 3.

The external total body dose to an individual swimming and boating for 100 hr/yr at each activity in waters containing reactor effluents at a 1:200 dilution was calculated to be  $0.05 \times 10^{-2}$  mrem/yr.

2. Radioactive Materials Released to the Atmosphere

The applicant estimates a  $\chi/Q$  at the site boundary of  $1.5 \times 10^{-6}$  sec/m<sup>3</sup>. Using this value and the preliminary estimate of noble gas releases listed in Table 2 the total body dose was calculated to be about 0.3 mrem/yr. This value would be lower if occupancy and shielding factors from being part-time indoors were considered.

The dose from iodine to the thyroid of a child assuming an intake of 1 liter of milk per day produced by a cow grazing at the site boundary for five months per year was calculated to be about 40 mrem/yr. There is no information in the Applicant's Environmental Report concerning location of cows near the site boundary; however, the surrounding area is largely agricultural. Based on this preliminary evaluation, the licensee may need to consider additional steps which will reduce or limit iodine releases and, or institute off site measurements and controls to insure that thyroid doses via the milk route are as low as practicable.

3. Population Doses From All Sources

The annual integrated population dose for the approximately 680,000 persons who may get all of their drinking water from Lake Erie is estimated to be about 2 man-rem. Table 4 lists the water supply data used in making this estimate.

The applicant estimates that 1,280,000 pounds/yr of edible fish are obtained from District 1, Lake Erie. We have assumed the population within 50 miles of the plant consumes the entire fish harvest and that all fish were obtained from waters diluted by a factor of 1:200 of that in the discharge effluent, after 24 hour decay. The integrated total-body population dose was calculated to be 3.3 man-rem/yr.

The integrated total-body dose to the population living within 50 miles of the Davis-Besse Station from submersion in radioactive gaseous effluents was estimated to be less than 1 man-rem/yr. The cumulative dose and average dose versus distance from the plant are summarized in Table 5.

4. Evaluation of Radiological Impact

The total man-rem dose received from all effluent pathways by the approximately 2,670,000 people (1980) who may live within the 50-mile radius of the plant, as shown in Table 6, was calculated to be about 6 man-rem based on routine operation of the Davis-Besse Station. For comparison, a dose of about 0.1 rem/yr/person from naturally occurring radioactive materials results in an annual total population dose of about 267,000 man-rem.

Thus, routine operation of the station is expected to contribute an extremely small incremental dose to that which area residents already receive as a result of natural background.

5. Radiological Environmental Monitoring

The Applicant's Environmental Report indicates that a comprehensive environmental monitoring program will be started prior to operation to determine the magnitude of the natural radioactivity in the environment surrounding the station and will include environmental sampling of lake and well water, soil, air particulate matter, farm products, lake biota, and bottom sediments. This program will continue after station operation commences to detect and evaluate any change in radioactivity of the environment due to operation of the station. The results of these programs will be submitted to both federal and state agencies as required and will be available to any interested groups or individuals.

The applicant's radiological monitoring program will be further defined in the Final Safety Analysis Report and the Technical Specifications.

TABLE 1

ESTIMATED ANNUAL RELEASE OF RADIOACTIVE MATERIAL IN LIQUID  
EFFLUENT FROM DAVIS-BESSE NUCLEAR POWER STATION

<u>Nuclides</u>	<u>Ci/yr</u>	<u>Nuclides</u>	<u>Ci/yr</u>	<u>Nuclides</u>	<u>Ci/yr</u>
Rb-86	.000038	Rh-106	.000005	Ba-140	.00021
Rb-88	.11	Sb-125	.000001	La-140	.00009
Sr-89	.00018	Sb-127	.000001	Ce-141	.00003
Sr-90	.000006	Te-125m	.00016	Ce-143	.00001
Sr-91	.00001	Te-127m	.00013	Ce-144	.00001
Y-90	.000034	Te-127	.0003	Pr-143	.00002
Y-91m	.0013	Te-129m	.0014	Pr-147	.00001
Y-91	.013	Te-129	.001	Nd-147	.00001
Y-93	.00033	Te-131m	.001	Pm-147	.00000
Zr-95	.000028	Te-131	.00019	Np-239	.00025
Zr-97	.000013	Te-132	.012	Cr-51	.00033
Nb-95	.000028	I-130	.0048	Mn-54	.00012
Nb-97m	.000013	I-131	1.22	Fe-55	.00033
Nb-97	.000014	I-132	.22	Fe-59	.0001
Mo-99	.15	I-133	1.38	Co-58	.085
Tc-99m	.11	I-135	.52	Co-60	.008
Ru-103	.000021	Cs-134	.49		
Ru-106	.000005	Cs-136	.20	Total ~ 5.0	
Rh-103m	.000021	Cs-137	.34	Tritium 1000	
Rh-105	.000011	Ba-137m	.001		



TABLE 2

ESTIMATED ANNUAL RELEASE OF RADIOACTIVE MATERIAL IN GASEOUS EFFLUENTS FROM DAVIS-BESSE NUCLEAR POWER STATION (2772 MWt)

CURIES/YEAR

Nuclide	Waste Gas Processing System (60 days Holdup)*	Condenser Air Ejector	Auxiliary Bldg.	Containment Purge	Turbine Bldg.	Total
Kr-83m	-	2	2	-	-	4
Kr-85m	-	8	8	-	-	16
Kr-85	695	6	6	11	-	718
Kr-87	-	5	5	-	-	10
Kr-88	-	14	14	.1	-	28
Kr-89	-	.5	.5	-	-	1
Xe-131m	15	7	7	2.4	-	32
Xe-133	23	15	15	1	-	54
Xe-135m	-	1150	1150	190	-	2490
Xe-135	-	1	1	-	-	2
Xe-137	-	24	24	.3	-	48
Xe-138	-	1	1	-	-	2
<b>Total</b>	<b>733</b>	<b>1237</b>	<b>1237</b>	<b>205</b>	<b>-</b>	<b>3410</b>
I-131	-	0.2	0.01	0.05	0.3	0.
I-133	-	0.1	0.01	0.01	0.1	0.

\*The PSAR did not give the capacity of the storage tanks; however, the applicant in the Supplement to the Environmental Report committed himself to at least a 60 day holdup time.

TABLE 3

ANNUAL DOSES AT EQUILIBRIUM CONDITIONS  
TO INDIVIDUALS AT VARIOUS LOCATIONS

<u>LOCATION</u>	<u>PATHWAY</u>	<u>TOTAL BODY DOSE</u> Mrem/yr	<u>THYROID/DOSE</u> Mrem/yr	<u>GI TRACT DOS</u> Mrem/yr
Site Boundary	Cloud	0.3		
Site Boundary	Ingestion of Milk		~40*	
Camp Perry- Erie Industrial Park	Ingestion of Water	$1.4 \times 10^{-2}$	0.13	$0.09 \times 10^{-2}$
	Ingestion of Fish	$4.0 \times 10^{-2}$	$0.20 \times 10^{-2}$	$0.90 \times 10^{-2}$
Port Clinton	Ingestion of Water	$4.7 \times 10^{-3}$	0.04	$0.03 \times 10^{-2}$
	Ingestion of Fish	$1.0 \times 10^{-2}$	$0.08 \times 10^{-2}$	$0.30 \times 10^{-2}$
Toledo- Oregon	Ingestion of Water	$2.8 \times 10^{-3}$	0.03	$0.02 \times 10^{-2}$
	Ingestion of Fish	$8.4 \times 10^{-3}$	$0.05 \times 10^{-2}$	$0.20 \times 10^{-2}$

\* Dose to child from a daily intake of 1 liter of milk derived from cows grazing at this site for 5 months per year.

TABLE 4

MUNICIPAL DRINKING WATER SUPPLY INTAKE DATA  
(WITHIN 30 MILE RADIUS OF DAVIS-BESSE STATION)

<u>MUNICIPALITY</u>	<u>INTAKE DISTANCE (Miles)</u>	<u>POPULATION (1980)</u>	<u>ESTIMATED* DILUTION FACT</u>
Camp Perry- Erie Industrial Park	3	2380 (0-5 mi)	1:200
Port Clinton	8	11100 (5-10 mi)**	1:600
Toledo-Oregon	13	663000 (5-30 mi)**	1:1000

\* Haung, Joseph C-K, "Estimation for Concentration Distributions for Conservative Material Released from a Continuous Point Source on the West Basin of Lake Erie."

Okubo, A. and S. S. Farlow, "Analysis of Some Great Lakes Drogue Studies," Proceedings of the 10th Conference on Great Lakes Research 1967.

\*\* Population does not include all sectors in annuli.

TABLE 5

CUMULATIVE POPULATION, ANNUAL MAN-REM DOSE AND AVERAGE ANNUAL DOSE FROM GASEOUS EFFLUENT IN SELECTED CIRCULAR AREAS AROUND THE DAVIS-BESSE STATION

<u>Cumulative Radius (Miles)</u>	<u>Cumulative Population (1980)</u>	<u>Cumulative Dose (Man-Rem)</u>	<u>Average Dose (Mrem)</u>
1	229	0.018	0.079
2	731	0.025	0.034
3	1,260	0.027	0.021
4	1,670	0.029	0.017
5	2,400	0.031	0.013
10	16,000	0.047	0.003
20	121,000	0.096	0.008
30	828,000	0.26	0.0003
40	1,400,000	0.41	0.0003
50	2,670,000	0.75	0.0003

TABLE 6

ESTIMATED ANNUAL MAN-REM DOSES  
FROM DAVIS-BESSE STATION

<u>PATHWAY</u>	<u>ESTIMATED DOSE - MAN-REM/YR</u>
Cloud*	0.8
Ingestion of Water**	2.0
Ingestion of Fish*	3.3
Transportation of Nuclear Fuel and Solid Wastes	~ <u>0.5</u>
	~ 7.0

\* Within 50-mile radius of station.  
\*\* Within 30-mile radius of station.

6. Radwaste Systems

Radwaste treatment systems planned for Davis-Besse utilize state-of-the-art developments to the feasible limits of present proven technology and are clearly equal to, or better than, systems at comparable sites (e.g., Palisades). Specifically, the overall decontamination factors available in the clean and miscellaneous radwaste systems,  $10^7$  to  $10^8$ , would be difficult to improve upon. With the present system tritium release, for which no effective removal methods are available at the present, is retained in-plant by recycling so that much of it will decay and releases will be minimized.

Gas radwaste systems similarly provides maximum holdup of 60 days, so the gas-borne releases are currently dominated by krypton-85. With an 11 year half-life, and noble gas chemistry, krypton-85 cannot be significantly depleted by any currently feasible system of further holdup or chemical treatment.

Possible improvements are: (1) decreasing primary coolant leakage into containment, into the secondary loop and into the miscellaneous radwaste system, and (2) routing the gas

phase of the secondary air ejector and the miscellaneous radwaste evaporator through the present 16,000 cfm filter-charcoal system before venting.

7. Radiation Dose to Species Other Than Man

In the absence of guidelines, it is generally agreed that the limits established for man are very conservative when applied to plants and the lower animals. Terrestrial organisms in the environs of the station would receive approximately the same radiation doses as those calculated for man. Of the lower organisms which inhabit the environment of the Davis-Besse Station, those which will receive the most significant doses are the aquatic organisms which are likely to live in the undiluted discharge effluent. The calculated dose to these organisms is based on the releases listed in Table 1 and the bioaccumulation factors<sup>(1)</sup> for those isotopes. The average annual dose rates to fish and invertebrates would be about 180 and 210 mrad, respectively. The dose rates to aquatic organisms living at other locations would be much lower due to reduced concentration.

(1) Chapman, W. H., H. L. Fisher and M. W. Pratt, "Concentration Factors of Chemical Elements in Edible Aquatic Organisms," UCRL-50564, December 30, 1968.

E. Accident Assessment

An examination of accident assessments in environmental statements for plants similar to Davis-Besse indicates that realistically estimated radiological consequences of the postulated accidents in classes 1-8 of the proposed amendment to 10 CFR Part 50, Appendix D published on December 1, 1971 will probably result in exposure of an assumed individual at the site boundary to concentrations within or near the limits of Table 11 of 10 CFR Part 20. The estimated integrated exposure of the population within 50 miles of the plant from each accident would be orders of magnitude smaller than that from naturally occurring radioactivity.

F. Other Effects

1. Historical Places

The applicant has indicated that the site does not include areas of historic significance recorded with the National Register of Historic Places, Ohio Department of Natural Resources, or the Ohio Historical Society. As such, there is no impact upon Historical properties. The applicant does not appear to have considered possible impact of transmission lines on Historic Sites. The detail NEPA review will consider this possibility.



2. Aesthetics

While the use of the natural draft cooling tower significantly reduces adverse impacts on the site ecosystem, but it does present an adverse impact from an aesthetic point of view. The 493 foot concrete cooling tower will present a massive and extremely prominent landmark visible for miles in the flat terrain.

3. Aviation

The height of the tower and fogging by the tower required consideration of possible hazard to aviation. The Federal Aviation Agency has determined proper lighting required for the tower to meet the standard of Subpart C, Part 77, Federal Aviation Regulations and as such does not pose a hazard to air navigation.

4. Noise

The design and operation of the nuclear power plant using a natural draft cooling tower should not offer a significant noise level with adverse effects on the surrounding area human or wildlife population. The only area that might desire further study in the detail NEPA review is the noise level with the emergency diesels running. It might be that the noise level may be such as to require testing on a schedule with the least effect on the wildlife in the marsh.

5. Transportation

Consideration of transportation accidents of cold fuel, irradiated fuel and solid waste has been reviewed in light of the evaluation made in preparing the impact for the Enrico Fermi Plant.

Radiation exposure during normal accident free transport of irradiated fuel assuming 270,000 people, 900 mile route, 8 shipments, 10 persons handling shipment would be 0.2 man-rem for population and 0.1 man-rem for 10 persons handling shipment. The exposure represents a negligible amount compared to the annual dose of 27,000 man-rem received by the people due to naturally occurring radioactive materials.

IV. Benefit Considerations

The principal benefits of the Davis-Besse plant will be to provide over 6 billion kilowatt-hours of electricity per year for residential, commercial, and industrial customers in northern Ohio and to contribute 872 megawatts of capacity to enhance the reliability of power supply. Secondary benefits are providing employment during construction and operation, payment of local property taxes, and the addition to the National Wildlife Refuge System of over 600 acres of prime waterfowl habitat.

WSvo6-3-7

1 MR. KARTALIA: Mr. Grimes, would you state your  
2 full name for the record?

3 MR. GRIMES: Grant K. Grimes.

4 MR. KARTALIA: And by whom are you employed?

5 MR. GRIMES: The U. S. Atomic Energy Commission,  
6 Washington, D. C.

7 MR. KARTALIA: And what is your position with the  
8 AEC?

9 MR. GRIMES: Employed as Chief of the Accident  
10 Analysis Branch and the Directorate of Licensing.

11 MR. KARTALIA: What is the function of that branch  
12 and your responsibilities as branch chief?

13 MR. GRIMES: Function of the branch, functions of  
14 the branch are to develop models, procedures and methods to  
15 allow evaluation on both the conservatism standpoint and a  
16 realist standpoint of the consequences of a spectrum of  
17 postulated accidents for each nuclear power plant that is  
18 reviewed by the Commission.

19 MR. KARTALIA: About how many plants have been  
20 reviewed in your branch under your supervision?

21 MR. GRIMES: I will break it into two parts. We  
22 do a conservative assessment to evaluate site acceptability  
23 and the design basis of engineering safety features. I  
24 have had that function. --

25 CHAIRMAN GARFINKEL: Can you speak a little

WSvo6-3-8

1 louder, please?

2 MR. GRIMES: I have had that function under this  
3 branch title and previous branch title for approximately one  
4 year in terms of providing calculation for models, and that  
5 has involved approximately 20 or 30 evaluations.

6 With respect to evaluation of the realistic  
7 assessment of the consequences of accidents from an environ-  
8 mental standpoint we have participated in all the draft and  
9 final environmental statements issued by the Commission to  
10 date and I believe that is approximately 15 evaluations.

11 MR. KANTALIA: Mr. Grimes, what is your profession,  
12 or how do you describe yourself professionally?

13 MR. GRIMES: I am a nuclear engineer.

14 MR. KANTALIA: Where did you receive your formal  
15 education?

16 MR. GRIMES: I received a Bachelor's degree in  
17 chemical engineering from the University of Washington, and  
18 a Master's degree from the same university in nuclear  
19 engineering.

20 MR. KANTALIA: I would like to have this document  
21 marked as Staff Exhibit 2 for identification.

22 (Staff Exhibit 2 was marked for  
23 identification.)

24 CHAIRMAN GARFINKEL: That document that was  
25 received in evidence, which is marked as Regulatory Exhibit 1  
will be received as if read. I don't think I stated that.

WSvo6-3-9

1 Will you make sure that it goes in?

2 MR. KARTALIA: It is your intention to have it  
3 bound into the transcript?

4 We have sufficient copies to make that possible.

5 CHAIRMAN GARPINKEL: Yes.

6 MR. KARTALIA: Mr. Grimes, have you reviewed the  
7 Davis-Besse plant that has made an accident analysis for the  
8 Davis-Besse plant?

9 MR. GRIMES: Yes. Myself in conjunction with a  
10 number of my branch have made an evaluation of the consequences  
11 of postulated accidents for the Davis-Besse plant using the  
12 guidelines of the proposed annex to Appendix E issued  
13 believe in December of 1971.

14 MR. KARTALIA: Would you describe how you went  
15 about that?

16 MR. GRIMES: Yes. We took each of the accident  
17 classes listed in the annex which range from small releases  
18 to the events which are postulated for evaluation of site  
19 acceptability and engineered safety feature design basis,  
20 and we tried to do a best estimate evaluation of the conse-  
21 quences of those postulated events. That is, as opposed to a  
22 very conservative estimate which is done for purposes of a  
23 safety evaluation report.

24 For each of these accidents we estimated a fraction  
25 of the 10 CFR Part 20 yearly limit that would be received at

WSvc6-3-10 1

the site boundary, and we also estimated a dose to the  
2 population within a 50-mile radius from each of these  
3 events.

4 MR. KANTALIA: Mr. Grimes, I ask you to examine  
5 what has been marked as Staff Exhibit 2 for identification,  
6 entitled "Summary of Radiological Consequences of Postulated  
7 Accidents," and can you identify that?

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1 MR. GRIMES: Yes. That is the evaluation --  
2 the result of the evaluation which we performed.

3 MR. KARTALIA: Are the figures in that document  
4 and the statements true and correct to the best of your  
5 knowledge?

6 MR. GRIMES: Yes, they are.

7 MR. KARTALIA: Do you adopt it as part of your  
8 testimony in this proceeding?

9 MR. GRIMES: I do.

10 MR. KARTALIA: Mr. Chairman, at this time I would  
11 ask that Staff Exhibit 2 for identification be received into  
12 evidence.

13 CHAIRMAN GARFINKEL: I am going to change my  
14 position and adopt your suggestion previously. Since it is  
15 talking in terms of testimony I will receive it not as an  
16 exhibit. Even though it is marked for identification you  
17 will follow the greater numbers. I will receive that as if  
18 read into the transcript.

19 MR. KARTALIA: That would require the reporters  
20 transcribing this into the transcript. I don't have enough  
21 copies to make available for them.

22 CHAIRMAN GARFINKEL: Leave it as an exhibit then.

23 MR. CHERNOFF: Mr. Chairman, I would submit that  
24 for purposes of ease and convenience I am sure the reporters  
25 would be gracious enough to reproduce it as it appears here



HDps7-1-2

1 and we will have it bound into the document together for  
2 everybody's use.

3 CHAIRMAN GARFINKEL: We will receive it as if  
4 read. Will you note, Mr. Reporter, in the table of contents  
5 that Regulatory Staff's Exhibit 2 for identification has been  
6 marked for identification and if received will be received as  
7 read. I want some indication of that if it is going  
8 to be received in evidence in your table of contents.  
9 Normally you list these exhibits in the table of contents.  
10 I want that to indicate that it is going into the body of  
11 the transcript.

12 Do you have any objections to the receipt of this  
13 Table 2?

14 MR. KALUR: No, sir.

15 MR. CHARNOFF: No, sir.

16 CHAIRMAN GARFINKEL: All right, it will be  
17 received in evidence as if read.  
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TABLE II

## SUMMARY OF RADIOLOGICAL CONSEQUENCES OF POSTULATED ACCIDENTS

Class	Event	Estimated Fraction of 10 CFR Part 20 at Site Boundary 1/	Estimated Dose to Population in 50 Mile Radius, man-rem
1.0	Trivial Incidents	2/	2/
2.0	Small releases outside containment	2/	2/
3.0	Radwaste system failures		
3.1	Equipment leakage or malfunction	0.052	7.2
3.2	Release of waste gas storage tank contents	0.20	29
3.3	Release of liquid waste storage tank contents	0.006	0.8
4.0	Fission products to primary system (BWR)	N.A.	N.A.
5.0	Fission products to primary and secondary systems (PWR)		
5.1	Fuel cladding defects and steam generator leaks	2/	2/
5.2	Off-design transients that induce fuel failure above those expected and steam generator leak	0.001	0.17
5.3	Steam generator tube rupture	0.068	9.5
6.0	Refueling accidents		
6.1	Fuel bundle drop	0.011	1.5
6.2	Heavy object drop onto fuel in core.	0.19	26

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<u>Class</u>	<u>Event</u>	<u>Estimated Fraction of 10 CFR Part 20 at Site Boundary 1/</u>	<u>Estimated Dose to Population in 50 Mile Radius, man-rem</u>
7.0	Spent Fuel handling accident		
7.1	Fuel assembly drop in storage pool	0.007	0.95
7.2	Heavy object drop onto fuel rack	0.027	3.8
7.3	Fuel cask drop	N.A.	N.A.
8.0	Accident initiation events considered in design basis evaluation in the Safety Analysis Report		
8.1	Loss-of-coolant accidents		
	Small break	0.1	29
	Large break	0.1	51
8.1(a)	Break in instrument line from primary system that penetrates the containment	N.A.	N.A.
8.2(a)	Rod ejection accident (PWR)	0.01	5.1
8.2(b)	Rod drop accident (BWR)	N.A.	N.A.
8.3(a)	Steam line breaks (PWR's outside containment)		
	Small break	0.001	0.1
	Large break	N.A.	N.A.
8.3(b)	Steam line breaks (BWR)	N.A.	N.A.

H0ps7-1-5

- 1 1/ Represents the calculated fraction of a whole body  
2 dose of 500 mrem or the equivalent dose to an organ.  
3 2/ These releases are expected to be in accord with  
4 proposed Appendix I for routine effluents (i.e.,  
5 5 mrem/yr to an individual from all sources.)

6 MR. KARTALIA: Dr. Frigerio, you have been in  
7 this hearing room off and on since yesterday when the hearing  
8 commenced. Is that not correct?

9 DR. FRIGERIO: That is right.

10 MR. KARTALIA: Have you heard the testimony of  
11 Dr. Martin of the Environmental Protection Agency?

12 DR. FRIGERIO: Yes.

13 MR. KARTALIA: And Dr. Goldman?

14 DR. FRIGERIO: Yes.

15 MR. KARTALIA: And you have heard some testimony  
16 to the effect that man is the most radiosensitive species  
17 and that if there is assurance that man is protected in the  
18 ecosystem then other elements in the ecosystem are protected?

19 DR. FRIGERIO: Yes, I have.

20 MR. KARTALIA: Did you agree with that assertion?

21 DR. FRIGERIO: I agree with that assertion provided  
22 the word "protection" is properly defined; that is, with  
23 respect to the absorbed dose to the organism rather than  
24 the exposure. I think this perhaps is where there is some  
25 confusion that arises. Two organisms exposed to the same

HDps7-1-6

1 radionuclide did not receive the same absorbed dose.  
2 Sometimes this differs by factors of a thousand or more.  
3 So that when one expresses the dose absorbed then without  
4 question man is the most radiosensitive organism we know.

5 MR. MARTALEA: Could you state for the record the  
6 reasons why you, with these qualifications, endorse the  
7 proposition I have just referred to.

8 DR. FRIGERIO: Well, reasons and science are of  
9 probative value but the observation is this and has been for  
10 many years, since about the turn of the century. The  
11 rationale of the companies is that man is highly organized  
12 and a relatively small disorganization is less easily repaired  
13 by man and as a consequence damage propagates and results in  
14 severe objective criteria relative to lower organisms.

15 In addition to this man has a much longer life  
16 span so that he has a much greater possibility of showing  
17 damage toward the end of his long life span than a short life  
18 span organism would.

19 In point of fact this is probably the driving  
20 force for the concentration on carcinogenesis, things that  
21 cause cancer. Carcinogenesis is relatively difficult to  
22 observe in the short-lived organisms because they simply don't  
23 live long enough to get it where as man does and this is part  
24 of the reason for his greater sensitivity.

25 So there are two underlying reasons; one that he is

Hops7-1-7 1

more easily damaged and more difficult to repair and the other one that he stands around to get wear and tear longer.

2

MR. KARTALIA: I have no further direct. That, in fact, concludes my case in chief.

3

4

MR. CHARNOFF: I am sorry, I thought I understand that Mr. Kartalia had said he was going to have Dr. Frigerio clarify Tables 1 and 2 and Paragraph 7.

5

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MR. KARTALIA: Oh, I thought that --

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CHAIRMAN GARFINKEL: Wait a minute. I think you said that but let me ask you another aspect of this. That finishes your case in chief, am I correct, Mr. Kartalia?

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MR. KARTALIA: Yes.

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MR. CHARNOFF: I don't understand. Mr. Kartalia previously introduced into evidence the document with the remark that he was going to have Dr. Frigerio clarify those tables and those doses. Now he hasn't done that unless he believes he did it earlier in the previous set of questions to Dr. Frigerio. It was on that basis that I agreed with - out objection to receive into evidence of the document including the tables on 19 and 20 and the paragraph on Page 26.

22

23

CHAIRMAN GARFINKEL: Mr. Kartalia, as I recall you were going to clarify --

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25

MR. KARTALIA: There was some discussion that I wasn't certain whether the agreement by all parties to receive

HDps7-1-8

1 Tables 1 and 2 into evidence didn't simply wash out that  
2 problem, but I will be glad to ask Dr. Frigerio now to  
3 address himself to the differences between Tables 1 and  
4 2 and the results of his own review.

5 CHAIRMAN GARFINKEL: Thank you, Mr. Kartalia.

6 MR. KALUR: I take it then they are reopening  
7 their case now?

8 CHAIRMAN GARFINKEL: No, I don't consider that  
9 reopening.

10 DR. FRIGERIO: The differences between Tables 1  
11 and 2 and my own calculations reflect a modification of  
12 my values quite uniformly for fission products by a factor  
13 of about 32, a nullification of my tritium values by a  
14 constant of 4 which is not quite appropriate since my values  
15 are a function of time and this is a flat system, and  
16 increases over my gas values of variable factors which I  
17 think I can identify largely as a difference in model and  
18 approach.

19 So there are differences -- they are all in the  
20 direction that all of the values in both of these tables  
21 are much higher than my own. I think I could analyze how  
22 this came about if anyone is interested.

23 CHAIRMAN GARFINKEL: How many minutes would that  
24 take?

25 DR. FRIGERIO: About one, I think.

HDD37-1-9

1 CHAIRMAN GARFINKEL: Would you do that for us?

2 DR. FRIGERIO: From conversations with members  
3 of the Staff and other technical people and so forth  
4 I conclude that what has occurred is that values of my own  
5 and of others -- for example, Oak Ridge, would utilize this  
6 similar method --has simply been normalized to a five curie  
7 fiat and this is based on some legal aspect which I don't  
8 understand.

9 In the case of the tritium number this is based  
10 on a simplified calculation rather than a detailed one and  
11 such simplified calculations will always give higher constant  
12 numbers.

13 If one takes all the factors into account the  
14 numbers are generally about one-fifth of this. Again this  
15 appears in the literature.

16 In the case of the gas values the major differences  
17 appear to involve differences of opinion as to what pathways  
18 will be available from leakages to the environment. Again  
19 these may be based on some legal criteria that I don't under-  
20 stand. But on technical grounds I find all of these quite  
21 high.

22 MR. KARTALIA: Would you say, then, that Tables 1  
23 and 2 reflect more conservative results than the results of  
24 your own --

25 DR. FRIGERIO: Without exception they represent much



HDps7-1-10

more conservative results.

2 MR. KANTALIA: Just so that the record may  
3 be clear, would you describe what your own review consisted  
4 of?

5 DR. FRIGERIO: Our own review consisted of  
6 collecting all of the available data on Davis-Besse, on  
7 other reactors built by the same companies and on similar  
8 pressurized reactors deriving from these constants that  
9 would apply to such things as fuel failure, transmissions,  
10 equilibria and so forth, and beginning with an assumption  
11 of 0.142 percent throughout the years, and with this  
12 assumption calculating explicitly each radionuclide produced  
13 and its history through the 40-year period.

14 This history was followed through the radiation  
15 waste system out into the environment, through the organisms,  
16 through the concentration factors, to the soil, to the  
17 North American continent and so forth. All of these results  
18 were summed up and put together. In this way we had those  
19 values for nearly every living thing within 2000 miles.

20 MR. KANTALIA: Have you completed?

21 DR. FRIGERIO: Yes.

22 MR. KANTALIA: Thank you. I have no further  
23 questions.

24 CHAIRMAN GARFINKEL: Mr. Charnoff, will you commence  
25 cross-examination, please?

ps7-1-11

MR. CHARNOFF: Yes. I think I have only one or two questions of Dr. Frigerio.

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IDVc-2-1

## 1 CROSS-EXAMINATION

2 MR. CHARNOFF: First of all, Doctor, I believe  
3 that in the preliminary statement with regard to this document  
4 before it was introduced you had indicated that using your  
5 bases in the way of releases on Tables 1 and 2, you would  
6 substantially reduce the doses afficiant to invertebrates  
7 that are projected and set forth in Paragraph 7 on Page 25,  
8 is that correct?

9 DR. FRIGERIO: That is correct.

10 MR. CHARNOFF: Did you say that that number  
11 would be in the neighborhood of one MR?

12 DR. FRIGERIO: That is right. Specifically it  
13 would be less than 1 MR.

14 MR. CHARNOFF: With respect to Tables on 1 and 2,  
15 are you also familiar with Tables 3, 4, 5 and 6 which are  
16 set forth on Pages 21 through 24?

17 DR. FRIGERIO: Yes, I am.

18 MR. CHARNOFF: If one were to use the lower  
19 releases that you calculate for Tables 1 and 2 as distinguished  
20 from what you described as taking a very conservative result  
21 as a result of the implementation of some quasi-legal fiat,  
22 would you arrive at lower levels and lower doses in Tables  
23 3, 4, 5 and 6 that are shown there?

24 DR. FRIGERIO: Yes, I would and have.

25 MR. CHARNOFF: And would they be significantly

HDvo7-2-2

1 lower, Doctor?

2 DR. FRIGERIO: They would be one to two orders  
3 of magnitude and in some cases, three.

4 MR. CHARNOFF: With regard to that quasi-legal  
5 fiat, would you say that that is another way of expressing  
6 arbitrary conservatism?

7 MR. KALUR: Objection.

8 CHAIRMAN GARFINKEL: Overruled. It is cross-  
9 examination.

10 MR. KALUR: This is out of the realm of expertise.  
11 He is asking for a legal conclusion.

12 MR. CHARNOFF: No, he is using the term "legal  
13 fiat." I was curious what he meant by that.

14 DR. FRIGERIO: I mean simply that a decision  
15 must have been made that this value characterizes such  
16 reactors in someone's mind because I have seen the value  
17 crop up many times.

18 How it is arrived at is outside my expertise.

19 MR. CHARNOFF: In your experience does that 5  
20 curie fiat represent reality?

21 MR. KALUR: Objection.

22 CHAIRMAN GARFINKEL: Sustained.

23 MR. CHARNOFF: Dr. Frigerio, there is another  
24 dose -- well, let me first address Tables 1 and 2. Do they  
25 set forth projected releases for iodine?

DR. FRIGERIO: Yes, they do.

MR. CHARNOFF: Is it only in the context of gases?

DR. FRIGERIO: It is only in the context of gases, although iodine is listed in Table 1 as part of the liquid effluent. It contributes relatively little to the dose.

So the iodine dose is primarily --

MR. CHARNOFF: And your remarks with regard to Tables 1 and 2 in general would also apply to the data on Pages 1 and 2 that specifically relates to iodine, is that correct?

DR. FRIGERIO: Yes.

MR. CHARNOFF: May I call your attention to Page 16, Dr. Frigerio, where in the second paragraph there is a calculation with regard to what iodine does to the thyroid of a child, assuming an intake of one liter of milk per day from a cow grazing at this site boundary for five months of the year and it was calculated at 40 millirems per year.

Dr. Frigerio, assume hypothetically that the nearest dairy cow, instead of being on the site boundary, is about two and a half miles away from the site boundary, and assuming all other factors that were entered into this 40 millirem calculation are the same, to what extent would that two and a half miles affect that particular calculation?

DR. FRIGERIO: The two and half miles would have

HDvo7-2-4

1 an effect on the order of a factor of 15.

2 MR. CHARNOFF: In addition to that if we also  
3 factored into the calculation your reduced gaseous effluent  
4 or total affluent of iodine from the plant that you would  
5 have substituted for the numbers on Tables 1 and 2, would  
6 you get a further reduction in the thyroid dose to the  
7 child?

8 DR. FRIGERIO: Yes, I would.

9 MR. CHARNOFF: Could you give me an estimate as  
10 to the factor of reduction that might be involved?

11 DR. FRIGERIO: The number I obtained was .03  
12 millirem per year.

13 MR. CHARNOFF: That number of .03 millirem per  
14 year was based on a cow grazing at this site or two and a  
15 half miles away from the site?

16 DR. FRIGERIO: It was based on a cow grazing  
17 just beyond the boundary at 0.73 kilometers.

18 MR. CHARNOFF: Kilometers?

19 DR. FRIGERIO: Approximately half a mile.

20 MR. CHARNOFF: Then if you moved that cow from  
21 0.73 kilometers to two and a half miles away there would be  
22 an additional reduction possibly in the neighborhood of 15  
23 or a little bit less, I take it?

24 DR. FRIGERIO: A little bit less. IN this case  
25 about 10.

1 MR. CHARNOFF: So your .03 would be -- could  
2 you translate .03 millirems per year reduced by a factor of  
3 10 for me, please?

4 DR. FRIGERIO: .003, or 3 microrams per year.

5 MR. CHARNOFF: Thank you very much. I have no  
6 further questions.

7 CHAIRMAN GARFINKEL: Mr. Kalur, it is your turn  
8 to cross-examine the witnesses. If you want a five-minute  
9 recess I will give you a five-minute recess.

10 MR. KALUR: It is five to 12:00. Is it possible  
11 to break for lunch now and start afterward? I would prefer  
12 the time since I have four witnesses to cross-examine.

13 CHAIRMAN GARFINKEL: All right, what time do you  
14 want to start? Is 1:00 o'clock good enough?

15 MR. KALUR: 1:00 o'clock.

16 CHAIRMAN GARFINKEL: Fine. We will adjourn until  
17 1:00 o'clock.

18 (At 11:55 o'clock a.m. the hearing was recessed,  
19 to reconvene at 1:00 o'clock p.m.)

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WSv08-2

1 CHAIRMAN GARFINKEL: Will the hearing come to  
2 order?

3 Mr. Kalur, will you commence with your cross-  
4 examination of the witnesses for the Regulatory Staff?

5 MR. KALUR: Mr. Grimes, how long have you been  
6 employed by the AEC?

7 MR. GRIMES: Approximately eight and a half  
8 years.

9 MR. KALUR: How long have you been doing project  
10 accident analyses?

11 MR. GRIMES: For the Safety Evaluation purposes  
12 I have been involved in that approximately since the time of  
13 my employment in some capacity or another with respect to  
14 estimated environmental impacts approximately for the last  
15 half year.

16 MR. KALUR: How many plants have you reviewed  
17 during that six-month period?

18 MR. GRIMES: Approximately 15, as I indicated  
19 earlier.

20 MR. KALUR: Davis-Besse is one of those 15?

21 MR. GRIMES: Yes.

22 MR. KALUR: Did you evaluate possible harm to  
23 animal life as a result of an accident?

24 MR. GRIMES: No. Our evaluation --

25 MR. KALUR: That's all I want is a yes or no.



WSvo8-2

1 Did your investigation include an on-site  
2 inspection?

3 MR. GRIMES: I don't understand the question.

4 MR. KALUR: Did you go to the site of the Davis-  
5 Besse plant and look at it during the time you were working  
6 on your accident analysis?

7 MR. GRIMES: No.

8 MR. KALUR: Did any member of your staff do so  
9 for that analysis?

10 MR. GRIMES: No.

11 MR. KALUR: I presume you relied on certain  
12 figures to reach your conclusion about an accident with  
13 respect to radiation doses, is that correct?

14 MR. GRIMES: I don't know what you mean by  
15 certain figures.

16 MR. KALUR: Well, did you have figures that would  
17 estimate radiation release from the plant during normal  
18 operation?

19 MR. GRIMES: Yes.

20 MR. KALUR: Who supplied those figures to you?

21 MR. GRIMES: I'm sorry. You said during  
22 normal operation, and our evaluation was for accidental  
23 release.

24 MR. KALUR: All right. Do you need any figures  
25 to make a hypothetical accident release figure?

WSv08-3

1 MR. GRIMES: Yes. You must know the inventory  
2 fission products in the reactor core.

3 MR. KALUR: Where do you get those figures?

4 MR. GRIMES: Fairly standard figures in the  
5 literature. I don't have them in mind for each nuclide.

6 MR. KALUR: What literature?

7 MR. GRIMES: I can't give you a specific reference.  
8 I think perhaps Etherington's hand book for Nuclear Engineering.

9 CHAIRMAN GARFINKEL: Mr. Grimes, you are going to  
10 have to speak a little louder. We are having some difficulty  
11 here.

12 MR. KALUR: Would you spell that?

13 MR. GRIMES: T-t-h-e-r-r-i-n-g-t-o-n would  
14 perhaps have fission product figures. I'm not certain. The  
15 various publications, for example, the Oak Ridge National  
16 Laboratory and other national laboratories which are  
17 readily available. I don't have the numbers.

18 MR. KALUR: Do you remember which if any of these  
19 sources you consulted with respect to the Davis-Besse plant?

20 MR. GRIMES: No. We have extracted from a number  
21 of these documents the specific inventories which we used.  
22 They are consistent with the inventories used in the Safety  
23 Analysis Report of the applicant.

24 MR. KALUR: Do you know how these figures that  
25 you used to determine the accident results are obtained?

The sources that you consult, where do they obtain the  
figures?

MR. GRIMES: Yes, from calculations of an experimental measurement, calculations can be done based on fission product yield information of the amount of each nucleid that is formed in the core.

MR. BALUR: Is it your understanding that when you do an environmental report you restrict yourself solely to accident effects on human beings?

MR. GRIMES: My part of the evaluation is restricted to accident effects on human beings, yes.

HDvo9-1

1 MR. KALUR: Is there anyone else in the investi-  
2 gation that has the responsibility for investigation as to  
3 effect on other forms of animal life?

4 MR. GRIMES: We have a Radiological Assessment  
5 Branch that, if requested, does evaluate this. In a particular  
6 instance they may evaluate the effect on aquatic life, for  
7 example.

8 MR. KALUR: Did they do so with respect to the  
9 Davis-Besse plant?

10 MR. GRIMES: Not with respect to the Davis-  
11 Besse plant.

12 MR. KALUR: Are you personally aware that the  
13 Davis-Besse plant is adjacent to a national wildlife refuge?

14 MR. GRIMES: I have heard that fact mentioned  
15 in the hearings.

16 MR. KALUR: Did your investigation of accidents  
17 deal with possible accidents during transportation of spent  
18 fuel products?

19 MR. GRIMES: No, it did not.

20 MR. KALUR: Is there anybody in your organization  
21 that concerned themselves with that type of investigation?

22 MR. GRIMES: Not in my branch, but there is a  
23 part of the AEC which for each environmental statement does  
24 an analysis of transportation accidents.

25 MR. KALUR: Do you know if anyone has prepared

HDvo9-2

1 one with respect to Davis-Besse?

2 MR. CRIMES: No, I do not.

3 MR. KALUR: During your direct you used the  
4 term "best estimate" with respect to accident analysis.  
5 Will you give me a definition of what that means?

6 MR. CRIMES: Yes. At each stage of assumption,  
7 where an assumption is required, we could use our best  
8 engineering judgment based on available data as to the expected  
9 performance of a certain system or the expected transport of  
10 a particular radio nucleid rather than taking an extremely  
11 conservative upper bound estimate as it taken for the purposes  
12 of safety evaluation.

13 MR. KALUR: Would you say it is the policy of the  
14 Atomic Energy Commission, or at least your Division, to use  
15 "conservative" figures whenever analyzing an accident?

16 MR. CRIMES: As I explained, there are two  
17 different purposes that we do it for. For the one purpose  
18 of establishing site acceptability and establishing design  
19 bases for engineering safety features which prevent or  
20 mitigate consequences, we do as a policy use conservative  
21 estimates.

22 For the purposes of estimating environmental risks  
23 we do not necessarily use conservative estimates.

24 MR. KALUR: How do you define conservative  
25 estimates?

HDvo9-3

1 MR. GRIMES: Estimates which are based on inter-  
2 pretation of physical phenomena which is clearly supported  
3 by the literature to apply to a postulated accident in the  
4 environment.

5 This is taking into consideration all the un-  
6 knowns, all the combinations of things which might occur and  
7 the uncertainties of precisely the condition that would obtain  
8 during an accident.

9 It does not ignore physical phenomena but it takes  
10 what I would consider to be an upper limit estimate of the  
11 particular -- in terms of increasing consequences.

12 MR. KALUR: Did you make a study of the possible  
13 loss-of-coolant accident and the resulting dose rate?

14 MR. GRIMES: Yes, we did.

15 MR. KALUR: Can you give me any of those figures  
16 with respect to whole body dose?

17 MR. GRIMES: On the table that was introduced  
18 into evidence loss-of-coolant accidents are estimated under  
19 8.1 as an estimated fraction of 10 CFR Part 20 as point 1.  
20 We have combined there thyroid and a whole body dose.  
21 Point 1 of 10 CFR Part 20 in this context could be inter-  
22 preted to be 50 MR whole body or it could be interpreted to  
23 be 150 MR thyroid dose.

24 MR. KALUR: 105 MR thyroid dose?

25 MR. GRIMES: Yes. I don't have the precise

HDvo9-4

1 breakdown which this point 1 represents but it is a weighted  
2 average of those two dose paths.

3 MR. KALUR: Your estimate of these figures is  
4 based on a certain number of assumptions with regard to  
5 operation of plant safety equipment, is it not?

6 MR. GRIMES: That is correct.

7 MR. KALUR: Do those figures take into con-  
8 sideration whether or not the emergency core coolant system  
9 would operate efficiently?

10 MR. GRIMES: It assumes the emergency core  
11 cooling system would operate as designed.

12 MR. KALUR: Would you say that falls in line with  
13 your conservative responsibilities in light of the fact that  
14 the emergency core cooling system is certainly in doubt as  
15 to its ability to work?

16 CHAIRMAN GARFINKEL: I will not --

17 MR. KARTALIA: I think that mischaracterizes his  
18 testimony.

19 CHAIRMAN GARFINKEL: I won't allow that question  
20 to be answered.

21 MR. KALUR: Have you done any accident analyses  
22 reports in which you assumed that the emergency core cooling  
23 system failed to operate?

24 MR. GRIMES: No.

25 MR. KALUR: If it failed to operate and there was a

HDvo9-5

1 meltdown of the core wouldn't the chances of substantial  
2 environmental damage because of leakage be increases sub-  
3 stantially?

4 MR. GRIMES: Yes.

5 MR. KALUR: Are there any regulations or orders  
6 from the Atomic Energy Commission that bars the consideration  
7 of that type of an accident occurring?

8 MR. KARTALIA: Objection. It calls for a legal  
9 conclusion.

10 MR. KALUR: He is familiar with his own regu-  
11 lations.

12 CHAIRMAN GAPPINKEL: Sustained.

13 MR. KALUR: Do you know of any regulations which  
14 prevent --

15 MR. KARTALIA: Same objection.

16 CHAIRMAN GAPPINKEL: I will let that part go in,  
17 does he know of any regulations, without the contents of the  
18 regulation.

19 MR. GRIMES: For the purpose of the environmental  
20 impact there is a statement in proposed Appendix 1 which states  
21 that -- Excuse me. There is a proposed annex to Appendix D  
22 issued last December which indicates that Class 9 accidents,  
23 as I recall, need not be considered.

24 MR. KALUR: What other assumptions do you make,  
25 especially with regard to weather, in a loss-of-coolant



HDvo9-5

1 accident?

2 MR. GRIMES: Again there are two different  
3 analyses performed. The analysis done for the purposes of  
4 siting assumes very poor meteorological conditions.

5 In fact, meteorological conditions which -- in  
6 which there would be worse meteorological conditions not more  
7 than 5 percent of the time.

8 For the purposes of estimating environmental  
9 risks we make an estimate of approximately 50 percent for  
10 meteorology.

11 In other words, meteorology would be better than  
12 that 50 percent of the time and worse than that 50 percent  
13 of the time.

14 MR. KALUR: Corresponding, the whole body dose  
15 could be worse 50 percent of the time and better 50 percent  
16 of the time?

17 MR. GRIMES: That is correct.

18 MR. KALUR: No further questions.

19 Thank you.

20 CHAIRMAN GARFINKEL: Do I understand you are  
21 finished with the cross-examination of all of the witnesses?

22 MR. KALUR: No, Mr. Grimes.

23 CHAIRMAN GARFINKEL: Just Mr. Grimes. O. K.

24 MR. KARTALIA: I have no redirect.

25 CHAIRMAN GARFINKEL: Any cross of Mr. Grimes?

HDvo9-7

1 MR. CHAMOFF: No, sir.

2 CHAIRMAN GARPINKEL: Mr. Grimes is excused.

3 (Witness Grimes excused.)

4 MR. KALUR: Mr. Knighton, there is a great deal  
5 of confusion about what went in and what didn't. What part  
6 of this testimony do you sponsor and adopt as your own?

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WS-10-1-1

1 MR. KARTALIA: I, of course, don't know where  
2 Mr. Kalur is headed, but I have a guess based on some  
3 information that I gave him earlier this week.

4 I told him at the time that Mr. Knighton  
5 would sponsor Section 5.

6 MR. KNIGHTON: Page 13.

7 MR. KARTALIA: D-5 and Section F-5 which is  
8 transportation. Does that concur with your notes?

9 MR. KALUR: I want to know what the witness says  
10 he is sponsoring.

11 MR. KARTALIA: Well, I am trying to explain that  
12 there was an oversight on my part.

13 CHAIRMAN GARFINKEL: Okay. Let the witness  
14 answer, though, Mr. Kartalia. He is capable of reading the  
15 document. Let him answer the question directly.

16 MR. KARTALIA: Before I sit down could I just  
17 point out that actually Section F-5 remains unsponsored  
18 due to the fact that in my notes as to who was sponsoring  
19 that section I had left that one out.

20 CHAIRMAN GARFINKEL: Well, ask him which one he  
21 is sponsoring. This is the question in issue right now.

22 MR. KNIGHTON: Page 18, Item 5, Radiological  
23 Environmental Monitoring.

24 CHAIRMAN GARFINKEL: Are you sponsoring any  
25 other item, Mr. Knighton? You answer the question without

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1 looking at Mr. Kartalia.

2 MR. KNIGHTON: I prepared the section on Page 29  
3 entitled "Transportation." Twenty-five and 29.

4 MR. KALUR: Those two sections?

5 MR. KNIGHTON: Yes, sir.

6 MR. KALUR: All right. How long have you been  
7 with the AEC, Mr. Knighton?

8 MR. KNIGHTON: Fifteen months.

9 MR. KALUR: Have you occupied the same position  
10 during those 15 months or have you changed?

11 MR. KNIGHTON: I have changed.

12 MR. KALUR: Would you tell me what the progress  
13 has been?

14 MR. KNIGHTON: In March of this year I have  
15 changed to the environmental project.

16 MR. KALUR: What were you doing before that?

17 MR. KNIGHTON: Senior project leader on safety  
18 evaluation.

19 MR. KALUR: That was in March of '72 you changed  
20 over to environmental projects?

21 MR. KNIGHTON: That's correct.

22 MR. KALUR: Am I correct in saying then that you  
23 are not a part of the original non-suspension order issued  
24 by Mr. Munczing?

25 MR. KNIGHTON: That's correct, sir.

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2 MR. KALUR: On Page 29, the second paragraph  
3 I notice you start off by saying, "radiation exposure  
4 during normal accident free transport." Have you ever  
5 made any studies about radiation exposure during non-normal  
6 accident pre-transportation?

7 MR. KNIGHTON: Excuse me --

8 MR. KALUR: -- or transportation in which an  
9 accident might occur?

10 MR. KNIGHTON: I have not, no, sir.

11 MR. KALUR: Not in connection with Davis-Besse?

12 MR. KNIGHTON: That's right.

13 MR. KALUR: Do you know what the intended plans  
14 of the applicant are with respect to transportation of its  
15 spent fuel products?

16 MR. KNIGHTON: I only know what he has prepared in his  
17 environmental report which is presently under review.  
18 I don't remember the details however.

19 MR. KALUR: Can you tell me what the status of  
20 the NEPA impact statement for the applicant within the AEC is?

21 MR. KNIGHTON: It has been initiated by our teams,  
22 the studies, detailed study has been initiated on the draft  
23 statement.

24 MR. KALUR: What type of studies have been initiated?

25 MR. KNIGHTON: The laboratory team which covers the  
26 primarily technical evaluation has initiated their study, which

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includes biological.

2 MR. KALUR: Do they go out to the site and make a  
3 study?

4 MR. KNIGHTON: Yes, they have had that site visit.

5 MR. KALUR: Do they come up with their own figures  
6 on radiation release or do they rely on those supplied by the  
7 applicant?

8 MR. KNIGHTON: They develop their own, sir.

9 MR. KALUR: Have you been in on other plants that  
10 have had NEPA impact statement reports produced?

11 MR. KNIGHTON: Yes.

12 MR. KALUR: About how many?

13 MR. KNIGHTON: We have issued since I have been  
14 in the new position 11 detailed -- draft statements, excuse  
15 me, and two final statements.

16 MR. KALUR: After the draft statement comes out  
17 there is a period of comment by other agencies and an opportunity  
18 for hearing and some other things?

19 MR. KNIGHTON: And the public, yes.

20 MR. KALUR: Two of the 11 have been finally  
21 issued, is that correct?

22 MR. KNIGHTON: Yes.

23 MR. KALUR: What plants were those for?

24 MR. KNIGHTON: Midland and Palisades.

25 MR. KALUR: Do you remember if both of those

1 received the AEC approval?

2 MR. KNIGHTON: With conditions, yes, sir.

3 MR. KALUR: How about the other 9 draft statements,  
4 do they recommend approval of the plants?

5 MR. KNIGHTON: With conditions.

6 MR. KALUR: How many approximately have you been  
7 involved in with respect to preparing a report on suspension  
8 of the facility during the NEPA review for those facilities  
9 given construction permit approval before Calvert Cliffs?

10 MR. KNIGHTON: One when I was in Licensing,  
11 that was Calvert Cliffs, and one, this one, since I have  
12 been here, they're proceeding right now.

13 MR. KALUR: You haven't been involved in any  
14 other suspension proceedings?

15 MR. KNIGHTON: No, sir.

16 MR. KALUR: Do you know of your own personal  
17 knowledge whether the Commission or any of these other  
18 tiered level divisions have issued any guidelines for  
19 consideration of suspension?

20 MR. KNIGHTON: No, sir.

21 CHAIRMAN CARPINKEL: I would like to ask the  
22 next question.

23 Are there any guidelines issued regarding suspension  
24 that you know of?

25 MR. KNIGHTON: Not that I know of, sir.

WSpsi0-1-6 1

MR. KALUR: Who makes the final Agency determination on whether a plant's construction permit should be suspended pending the full NEPA review?

2

MR. KNIGHTON: Mr. Muntzing signs it.

3

MR. KALUR: If he signs it he makes it, doesn't he?

4

MR. KNIGHTON: His staff recommends.

5

CHAIRMAN GARFINKEL: That is a conclusion now.

6

MR. KALUR: I apologize.

7

CHAIRMAN GARFINKEL: Please, it's argumentative as well as a conclusion.

8

MR. KALUR: But if Mr. Muntzing doesn't sign a suspension termination it is not made, is it?

9

MR. KNIGHTON: That's right, sir.

10

MR. KALUR: How many people work with you on considerations on the environmental projects on these analyses?

11

MR. KNIGHTON: Around 15 on a given project. I believe that is what you mean.

12

MR. KALUR: Who is your immediate superior?

13

MR. KNIGHTON: Mr. D. R. Muller, Assistant Director.

14

MR. KALUR: Would you spell that?

15

MR. KNIGHTON: M-u-l-l-e-r.

16

MR. KALUR: Can you characterize his responsibilities,

17



WSps10-1-7 1

if you know, there?

2

MR. KNIGHTON: He is responsible for three branches of project people who are involved in the environmental projects evaluation.

3

4

5

MR. KALUR: What are those?

6

MR. KNIGHTON: I don't understand.

7

MR. KALUR: The three branches, what are they?

8

MR. KNIGHTON: One, two and three.

9

10

MR. KALUR: Can you give me the responsibilities for No. 1?

11

12

MR. KNIGHTON: I have the responsibilities for No. 1, yes, sir.

13

MR. KALUR: How about 2?

14

MR. KNIGHTON: No. 2 is Mr. Dicker.

15

MR. KALUR: How about No. 3?

16

MR. KNIGHTON: Mr. Youngblood.

17

MR. KALUR: What are Mr. Youngblood's responsibilities?

18

MR. KNIGHTON: Similar to mine.

19

MR. KALUR: Tell me what your responsibilities are?

20

MR. KNIGHTON: My responsibility is as I mentioned earlier.

21

22

MR. KALUR: Again, I have forgotten.

23

24

25

MR. KNIGHTON: To develop, to review, to direct and coordinate, and I do this with about 3 professional project managers.

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1 They in turn coordinate technical groups in the  
2 Directorate of Licensing, Directorate of Regulatory Standards,  
3 AEC National Laboratories and Federal Agencies, and then  
4 State and local government agencies.

5 MR. KALUR: Do you know how many suspension  
6 proceedings have gone through the AEC?

7 MR. KNIGHTON: No, I don't.

8 MR. KALUR: Do you know if any of those proceedings  
9 have resulted in the suspension of a construction permit?

10 MR. KNIGHTON: I believe there have been some  
11 that have partial suspensions.

12 MR. KALUR: Do you know of any where work on the  
13 main reactor building has been stopped?

14 MR. KNIGHTON: Offhand, I don't.

15 MR. KALUR: Isn't it true that the only stop  
16 orders have been related to outside main plant building  
17 structures such as coolant canal areas?

18 MR. KNIGHTON: I really can't say factually what  
19 they were.

20 MR. KALUR: In your review of the radiological  
21 environmental monitoring, what research did you do with  
22 regard to the flow characteristics of the western base end  
23 of Lake Erie?  
24  
25

MDv011-1 1 MR. KNIGHTON: I would like to clarify this, that  
2 this is not a NEPA review that I have here.

3 This is a quick evaluation that was requested  
4 because of this particular hearing.

5 MR. KALUR: How quick was it? How long did it  
6 take?

7 MR. KNIGHTON: Two weeks.

8 MR. KALUR: So this was prepared specifically for  
9 today's hearing, is that right?

10 MR. KNIGHTON: Last April, yes, sir.

11 MR. KALUR: Has your Department done any en-  
12 vironmental sampling of Lake Erie in connection with the  
13 Davis-Besse plant?

14 MR. KNIGHTON: No, the laboratory is just starting  
15 their evaluation.

16 MR. KALUR: Since they are just starting you have  
17 no way of knowing what their determinations will be, do you?

18 MR. KNIGHTON: That is right.

19 MR. KALUR: Would you consider it important?

20 MR. KNIGHTON: Yes, and also for the detailed  
21 NEPA review.

22 MR. KALUR: Would you consider it important for  
23 that review for your Department to study the possible dis-  
24 charges that plant might make to Lake Erie?

25 MR. KNIGHTON: We consider all the plants at the

HD-11-2 1 time we are given the work on the NEPA review. We are in  
2 no position to know whether the plans will be carried out.

3 MR. KALUR: The AEC regularly projects what it  
4 expects plants to discharge?

5 MR. KNIGHTON: That is another division. I am  
6 in licensing.

7 MR. KALUR: So if there were to be two or three  
8 projected plants around the Lake in other years in the future  
9 but they hadn't obtained construction permits you wouldn't  
10 consider them?

11 MR. KNIGHTON: That is correct.

12 MR. KALUR: What about plants that are operating  
13 like the Fermi plant? Would you take it into consideration  
14 in reaching an environmental decision, and its discharges?

15 MR. KNIGHTON: Yes, sir.

16 MR. KALUR: What about the Plum Brook Lab, would  
17 you take that into consideration also?

18 MR. KNIGHTON: I am not sure at the present time.

19 MR. KALUR: I assume you know the Fermi plant is  
20 operating. Do you know of any others operating on Western  
21 Lake Erie?

22 MR. KNIGHTON: Off the top of my head, no, I  
23 can't give you an answer to that.

24 I don't believe so.

25 MR. KALUR: Did your NEPA review consider the

HD-11-3

1 possibilities of accident and the resulting harm to the  
2 environment not concerned with human life?

3 MR. KNIGHTON: The accident analysis we are  
4 performing right now does not consider it.

5 MR. KAMUR: Thank you, Mr. Knighton. That is all  
6 I have.

7 CHAIRMAN GARPINKEL: Mr. Charnoff, do you have  
8 any cross-examination?

9 MR. CHARNOFF: Of Mr. Knighton?

10 CHAIRMAN GARPINKEL: Yes.

11 MR. CHARNOFF: No, sir.

12 DR. LYMAN: I would like to ask Mr. Knighton one  
13 question. You said you report to Mr. Miller?

14 MR. KNIGHTON: That is right.

15 DR. LYMAN: And to whom does he report?

16 MR. KNIGHTON: Mr. Stambuso.

17 DR. LYMAN: And to whom does he report?

18 MR. KNIGHTON: Mr. O'Leary.

19 DR. LYMAN: What is Mr. O'Leary's title?

20 MR. KNIGHTON: He is Director of the Directorate  
21 of Licensing.

22 DR. LYMAN: To whom does he report?

23 MR. KNIGHTON: He does report to Mr. Mantzing.

24 DR. LYMAN: I see. Thank you.

25 CHAIRMAN GARPINKEL: Is there any further

HDyc11-4

1 cross based on the statements in answer to the questions of  
2 Dr. Lyman?

3 Mr. Chazneff?

4 MR. CHAZNEFF: No, I am always pleased to hear  
5 an up to date status report on AEC organization. It was  
6 very helpful. I don't know whether it will be tomorrow.

7 CHAIRMAN GARFINKEL: Mr. Kalur?

8 MR. KALUR: No.

9 CHAIRMAN GARFINKEL: You are excused.

10 MR. KARTALIA: I have some questions by way of  
11 redirect.

12 CHAIRMAN GARFINKEL: I am sorry.

13 REDIRECT EXAMINATION

14 MR. KARTALIA: Mr. Knighton, when you stated in  
15 answer to a question by Mr. Kalur that the accident analysis  
16 did not consider radiological impact on species other than  
17 humans, you meant the accident analysis prepared by Mr.  
18 Grimes?

19 MR. KNIGHTON: That is correct.

20 MR. KARTALIA: No further questions.

21 CHAIRMAN GARFINKEL: Before you leave, Mr.  
22 Knighton, I have this outstanding motion to certify. Are you  
23 going to renew that motion in view of the testimony of Mr.  
24 Knighton? I don't want him to go home until we resolve this  
25 whole point.

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1 MR. KARTALIA: It is not only Mr. Knighton. We  
2 have Mr. Shortt here who is prepared to testify should Mr.  
3 Kalur get into Mr. Shortt's area.

4 MR. KALUR: I think we are going to need Mr.  
5 Shortt before I can make a determination on whether --

6 CHAIRMAN GARFINKEL: Mr. Knighton should leave to  
7 go back?

8 MR. KALUR: I will have no further questions of  
9 Mr. Knighton.

10 MR. CHARNOFF: Mr. Chairman, may I request that  
11 while Mr. Knighton, as far as I am concerned, can be excused,  
12 I would propose that Mr. Knighton would not leave and return  
13 to Washington until we do hear further discussion with re-  
14 spect to Mr. Kalur's outstanding motion?

15 MR. KARTALIA: Mr. Knighton will not leave.  
16 However, if Mr. Shortt can be excused we would appreciate it  
17 because --

18 CHAIRMAN GARFINKEL: I can't do that because --

19 MR. KARTALIA: I realize that. I am just saying  
20 that it is Mr. Shortt that we are anxious to get back to  
21 Washington.

22 Mr. Knighton is planning to stay through the  
23 hearing.

24 CHAIRMAN GARFINKEL: Mr. Kalur, on this point  
25 is there any reason why we can't put Mr. Shortt on for the

HDv011-6

1 question of the motion and have him available for your exami-  
2 nation on this point right now, just on this point?

3 MR. WALSH: All right.

4 CHAIRMAN CARPENTER: Very well. Is Mr. Shortt  
5 here?

6 Mr. Shortt, will you take the witness stand? Let  
7 us swear you in.

8 CHARLES E. SHORTT

9 was called as a witness and, having been first duly sworn,  
10 was examined and testified as follows:

11 DIRECT EXAMINATION

12 MR. KARTALIA: Mr. Shortt, would you state your  
13 full name for the record, please?

14 MR. SHORTT: Charles E. Shortt.

15 MR. KARTALIA: By whom are you employed?

16 MR. SHORTT: Atomic Energy Commission.

17 MR. KARTALIA: What is your position with the  
18 Atomic Energy Commission?

19 MR. SHORTT: I am an economist with the cost-  
20 benefit branch, Directorate of Licensing, AEC.

21 MR. KARTALIA: And what are your responsibilities  
22 in that position?

23 MR. SHORTT: Development of guides and information  
24 related to the formulation of guides and some technical review  
25 work with the branch.



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1 MR. KARTALIA: You said guides?

2 MR. SHORTT: Guides like the May 1972 guide that  
3 is the basis for the filling out of the forms and so forth  
4 that the applicar had to fill out a few days ago.

5 MR. KARTALIA: You are referring to the May 1972  
6 draft of the cost benefit guide for defined classes of  
7 partially completed plants?

8 MR. SHORTT: That is right.

9 MR. CHARNOFF: That is no longer a draft, I  
10 understand.

11 MR. KARTALIA: Could you state for the record  
12 where you received your formal education in your profession?

13 MR. SHORTT: Right. I received my Bachelor's  
14 degree in my MBA at Texas Tech University. My Bachelor's was  
15 in 1961 and the MBA in 1965.

16 That is the extent of my educational background.

17 MR. KARTALIA: Thank you. I have no further  
18 questions.

19 CHAIRMAN GARFINKEL: Mr. Kalur, I will let you  
20 cross-examine at this time on the question of dealing with  
21 the motion and any other question you may have of Mr.  
22 Shortt.

23 MR. KALUR: I am not sure we have a representation  
24 that this witness is a substitute for Mr. Muntzing. Unless  
25 that representation is made I don't see that I have any

HDVcll-3

1 cross-examination.

2 CHAIRMAN GARFINKEL: It is my understanding earlier  
3 on the record that Mr. Shortt and Mr. Knighton were being  
4 sponsored by Mr. Kartalia as a substitute for Mr. Muntzing  
5 and that they are most familiar with the NEPA process that  
6 is performed by the Atomic Energy Commission.

7 So I think that is on the record. If it is not  
8 on the record, you already have my comment based on what I  
9 understand --

10 MR. KALUR: If Mr. Kartalia agrees to that I  
11 will proceed.

12 MR. KARTALIA: Mr. Chairman, I think I have  
13 said twice on the record that I am not making the representation  
14 that these individuals will be able to answer Mr. Kalur's  
15 questions or that they are a substitute for Mr. Muntzing.  
16 I don't know what he is going to ask.

17 He has described only in very vague terms who he  
18 is going to produce.

19 I have insisted from the start that he has not  
20 made out a case for the production of Mr. Muntzing. Since he  
21 has indicated to me that he wants to talk generally about the  
22 NEPA process, cost benefit considerations, et cetera, I have  
23 produced these two people who in my opinion can testify in  
24 that subject.

25 To what extent I can't tell, because I don't know  
what line -- what specific line of examination Mr. Kalur

HDv011-9  
1 contemplates.

2 CHAIRMAN GARFINKEL: With that statement I think  
3 we have a basis for you to inquire of Mr. Shortt regarding  
4 his knowledge and his role in the NEPA process.

5 We already have Mr. Knighton's role in that  
6 process. I think it is incumbent upon you at this time to  
7 inquire of Mr. Shortt concerning his role in this process,  
8 and based on your examination then you can indicate what  
9 your position with regard to your motion is to be.

10 The motion is still outstanding. I haven't denied  
11 any motion but I think we should continue with the examination  
12 of Mr. Shortt and let's see what happens to your motion.

13 CROSS-EXAMINATION

14 MR. KALUR: Tell me what your responsibilities  
15 are, Mr. Shortt.

16 MR. SHORTT: My primary responsibility has been  
17 to assist in the development of guides and cost benefit for  
18 balancing costs and benefits regarding nuclear power plants.

19 MR. KALUR: What are guides?

20 MR. SHORTT: These are the guides that are used  
21 to instruct utilities on how they are to fill out information  
22 and the type of information that has to be submitted and  
23 provide for a framework for evaluation of that information.

24 MR. KALUR: What type of information do you want  
25 them to supply? In relation to what?

NDv011-10

1 MR. SHORTT: To regard to both economic and  
2 environmental parameters concerning the aquatic system,  
3 concerning the area impacts, land impact.

4 MR. KALUR: When you get this information what do  
5 you use it for?

6 MR. SHORTT: We then turn around and make an  
7 independent evaluation of the information supplied to  
8 evaluate the impact of nuclear power plants in the environment.

9 MR. KALUR: Do you make that evaluation?

10 MR. SHORTT: In a sense yes, in a partial sense.  
11 There are a number of experts in the various areas that  
12 evaluate the impact of the power plants on the aquatic system  
13 and various other systems.

14 MR. KALUR: Did you yourself personally participate  
15 in the original suspension decision on Davis-Besse?

16 MR. SHORTT: No, I did not.

17 MR. KALUR: When did you assume your present  
18 position with the Agency?

19 MR. SHORTT: November of 1971.

20 MR. KALUR: And you have been engaged with the  
21 task which you just described for me since that time?

22 MR. SHORTT: That is correct.

23 MR. KALUR: How many other suspension proceedings  
24 have you been involved in?

25 MR. SHORTT: None.

EDv011-11 1 MR. KALUR: Mr. Chairman, I will ask that my  
2 motion be granted at this time.

3 CHAIRMAN GARPINKEL: Based on the testimony of  
4 the two witnesses and based on the fact that I don't think  
5 there has been an exceptional showing for the need of Mr.  
6 Murtzing, your motion is denied.

7 MR. KARTABIA: Could I then excuse Mr. Shortt and  
8 ask for a brief recess at this point?

9 CHAIRMAN GARPINKEL: It all depends. Do you  
10 contemplate using Mr. Shortt for any other purpose?

11 MR. KALUR: No.

12 DR. LYMAN: Mr. Shortt, to whom do you report in  
13 the AEC?

14 MR. SHORTT: I report to a Mr. Harold Denton,  
15 who is the Assistant Director for Site Safety.

16 He reports to Mr. Giambuso and also reports to  
17 Mr. John O'Leary.

18 DR. LYMAN: Right; we have had that already.

19 CHAIRMAN GARPINKEL: I have a few questions.  
20  
21  
22  
23  
24  
25

WFOs12-1-11

1 CHAIRMAN GARFINKEL: In terms of the need for  
2 process itself, are you familiar generally about the need  
3 of process and how it operates within the Atomic Energy  
4 Commission?

5 MR. SHORTT: In a general sense, yes.

6 CHAIRMAN GARFINKEL: That's all I have. You  
7 may be excused.

8 MR. SHORTT: Thank you.

9 CHAIRMAN GARFINKEL: Wait a minute. Dr. Lyman  
10 may have a question.

11 You are excused.

12 MR. KARTALIA: Could I renew that request for a  
13 brief recess?

14 CHAIRMAN GARFINKEL: How many minutes?

15 MR. KARTALIA: Five.

16 CHAIRMAN GARFINKEL: You have it.

17 MR. KARTALIA: Thank you.

18 (Short recess taken.)

19 CHAIRMAN GARFINKEL: May we be on the record.

20 Mr. Kartalia, do you have any more direct  
21 questions? Are you finished with your case in chief?

22 MR. KARTALIA: I am.

23 CHAIRMAN GARFINKEL: Mr. Kalur, the applicant  
24 has finished his case in chief, the Regulatory Staff has  
25 finished their case in chief. You have cross-examined

NSps12-1-2

1 both the parties with respect to their cases in chief.

2 It is now your turn.

3 MR. KALUR: I have two witnesses yet to cross-  
4 examine for the staff.

5 CHAIRMAN GARFINKEL: I'm sorry. You haven't  
6 finished the cross-examination. I apologise.

7 MR. KALUR: Mr. Glauberman, you are responsible  
8 for Pages 14 through 18, is that correct?

9 MR. GLAUBERMAN: Yes, to the top of 18, with the  
10 exception to references to Tables 1 and 2.

11 MR. KALUR: I'm sorry. Could you use that  
12 microphone?

13 MR. GLAUBERMAN: Your statement is correct with  
14 the exception of Part 5 on Page 18, and any references to  
15 Tables 1 and 2.

16 MR. KALUR: Under Roman Numeral I, where did  
17 you get the 20,000 gallons per minute figure?

18 MR. GLAUBERMAN: That's from the Applicant's  
19 environmental report.

20 MR. KALUR: In the sentence following that 20,000  
21 gallons per minute figure are a couple of other figures.  
22 Explain to us exactly what those figures mean to you?  
23 What are they supposed to represent?

24 MR. GLAUBERMAN: This represents the concentrations  
25 at discharge for the fission and activation products and the

WSps12-1-4

critium, based on Table 1.

1 MR. KALUR: That is based on a thousand curies  
2  
3 per --

4 MR. GLAUBERMAN: That is correct.

5 MR. KALUR: Where did you get those figures?

6 MR. GLAUBERMAN: The thousand curies?

7 MR. KALUR: No, the figures on Page 14. I'm  
8 sorry.

9 MR. GLAUBERMAN: Oh, that is using the five  
10 curies and the 20,000 gallons per minute dilution and just  
11 making a simple division of five curies per year divided  
12 by the gallons and that gives you the flow.

13 MR. KALUR: Where do you get the five curie  
14 figure from?

15 MR. GLAUBERMAN: That is Table 1. That is  
16 fission activation products.

17 MR. KALUR: Where do they get the five curies  
18 in Table 1?

19 MR. GLAUBERMAN: What was the question?

20 MR. KALUR: Where do the five curies in Table 1  
21 come from?

22 MR. GLAUBERMAN: That is supplied to us by  
23 the effluent treatment system branch.

24 MR. KALUR: Do you know of your own personal  
25 knowledge where they get the figure?



MS0312-1-4 1 MR. GLAUBERMAN: I believe it is based on their  
2 calculations, but I have not confirmed them in any way.

3 MR. KALUR: Where did you get the dilution factors  
4 on page 15?

5 MR. GLAUBERMAN: That is the model that was indicated  
6 again in the Applicant's report on Page 7-3(3) and using that  
7 equation that documents the calculations were made for the  
8 concentrations at the three different distances and then a  
9 ratio was developed between the concentration at the discharge  
10 divided by the concentrations calculated for those places and  
11 that is how the dilution factors are arrived at.

12 MR. KALUR: You accepted the figures supplied by  
13 there?

14 MR. GLAUBERMAN: Not the figures, the equation.

15 MR. KALUR: The equation?

16 MR. GLAUBERMAN: Right.

17 MR. KALUR: Have you ever used that equation  
18 before on another project?

19 MR. GLAUBERMAN: I have not, no.

20 MR. KALUR: Are you personally familiar with any  
21 of the flow characteristics of the western Lake Erie basin?

22 MR. GLAUBERMAN: Not other than what I saw in the  
23 Applicant's report.

24 MR. KALUR: Do you know if the Atomic Energy  
25 Commission entered into any of its own studies then on the

WSps12-1-5 1 western Lake Erie basin?

2 MR. GLAUBERMAN: No, I do not.

3 MR. KALUR: Did you make any inquiry as to the  
4 radiation discharge effect on the migratory birds that  
5 inhabit the marsh?

6 MR. GLAUBERMAN: No, I did not.

7 MR. KALUR: Wouldn't an animal consuming water at  
8 the outlet of the plant get much less dilution than would be  
9 found in the water taken, for example, at Camp Perry?

10 MR. GLAUBERMAN: Yes.

11 MR. KALUR: Do they report about dilution factors  
12 used as a basis in the equation give you any information with  
13 respect to the dilution factor immediately outside the plant  
14 discharge?

15 MR. GLAUBERMAN: Yes. We have made calculations  
16 at the discharge, but without that equation. That was a  
17 straight calculation based on the Table 1, and that first  
18 number that you saw, that was the concentration point  $1.25$   
19  $\times 10^{-7}$  microcuries per cc.

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MSvol12-2

1 MR. KALUR: That's all I have.

2 CHAIRMAN GARFINKEL: Any cross-examination?

3 MR. CHARNOFF: No, sir.

4 CHAIRMAN GARFINKEL: Any redirect examination?

5 MR. KANTALIA: I have none.

6 CHAIRMAN GARFINKEL: Dr. Lyman?

7 DR. LYMAN: I have one question I would like to  
8 ask.

9 Were you concerned -- On Page 16, Paragraph 2.

10 MR. CLAUBERMAN: What was the question, please?

11 DR. LYMAN: Did you prepare the material in  
12 Paragraph 2 on Page 16?

13 MR. CLAUBERMAN: Yes, I wrote that.

14 DR. LYMAN: Then I would appreciate it if you  
15 could explain to me what X/Q means?

16 MR. CLAUBERMAN: That is kye over Q, and that  
17 is the atmospheric dispersion factor.

18 DR. LYMAN: What is kye?

19 MR. CLAUBERMAN: That is actually the dispersion  
20 part in units of curies per cubic meter and the Q is the  
21 release rate in curies per second.

22 So the factor adds up in terms of seconds per  
23 cubic meter.

24 DR. LYMAN: Thank you.

25 CHAIRMAN GARFINKEL: Any cross based on the

WSvol12-3

1 questions of Dr. Lyman?

2 MR. CHARNOFF: We understood that answer very  
3 clearly.

4 CHAIRMAN GARFINKEL: Mr. Kalur?

5 MR. KALUR: Of this witness?

6 CHAIRMAN GARFINKEL: Yes, based on Dr. Lyman's  
7 question.

8 MR. KALUR: No.

9 CHAIRMAN GARFINKEL: You are excused, unless you  
10 have some redirect.

11 MR. KARHALIP: I have no redirect.

12 CHAIRMAN GARFINKEL: You are excused.

13 MR. CHARNOFF: Might we ask Mr. Glauberman who  
14 he reports to?

15 MR. GLAUBERMAN: I report to Dr. Kastner, who is  
16 the Chief of the Radiological Assessments Branch.

17 MR. CHARNOFF: Thank you.

18 CHAIRMAN GARFINKEL: You are excused.

(Witness excused.)

19 CHAIRMAN GARFINKEL: Mr. Kalur, do you have any  
20 cross-examination of Dr. Frigerio?

21 MR. KALUR: Yes, I do.

22 Dr. Frigerio, does the term "gross beta emitter"  
23 include tritium?

24 DR. FRI GERIO: Not ordinarily. It should not  
25

WSvol12-3

1 because of the experimental difficulties involved, and I think  
2 you will find in the literature that it invariable does not.

3 For example, in the customary reports of the  
4 Radiological Alert Networks, gross beta is separate from  
5 tritium. They are different tables.

6 MR. KALUR: Tritium is a beta emitter, is it not?

7 DR. FRIGERIO: Tritium is a beta emitter. I  
8 guess all one can say is it isn't very gross.

9 MR. CHARNOFF: It is not or is it?

10 DR. FRIGERIO: It is not.

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HDV013-1 1 MR. KALUR: Would you agree that a pressurized  
2 water reactor gives off more tritium in operation than a  
3 boiling water reactor?

4 DR. FRIGERIO: In the United States this has been  
5 the case. This is not because it is a pressurized water  
6 reactor but because the conventional types in the United  
7 States have utilized boron as a part of a burnable poison  
8 and boron in the presence of a neutron flux results in a  
9 considerable amount of tritium, much more than is the case in  
10 a boiling water reactor where boron is not used in the same  
11 way.

12 MR. KALUR: Davis-Besse is in that category?

13 DR. FRIGERIO: Davis-Besse is in that category.

14 MR. KALUR: Is it possible to -- would it be  
15 possible to change Davis-Besse from being a pressurized water  
16 reactor to a boiling water reactor?

17 DR. FRIGERIO: In theory, certainly. In practice  
18 I suspect that it would require a complete reconstruction,  
19 not to mention re-engineering.

20 MR. KALUR: Is it possible to recycle tritium  
21 within a pressurized water reactor and not let it out into  
22 the lake?

23 DR. FRIGERIO: It is certainly possible  
24 theoretically. At the present state of the art the possibility  
25 of so-doing would be maybe 10 percent. By that I mean perhaps

1 10 percent of all the plants in the United States could  
2 actually manage to do this over a 40-year period.

3 MR. KALUR: Do you have any opinion as to Davis-  
4 Besse's ability to do it at this stage of construction?

5 DR. FRIGERIO: I think Davis' ability would be  
6 in the upper fifth of the country. That is to say, they  
7 perhaps have a 20 to 25 percent chance of doing it.

8 MR. KALUR: What objections would you see from a  
9 radiation danger standpoint of recycling tritium?

10 DR. FRIGERIO: Really none. I have calculated  
11 the equilibrium concentration of tritium in the plant under  
12 conditions of perfect recycling.

13 It would come to about two or three microcuries  
14 per cc. of tritium, and while this is certainly not drinking  
15 water, on the other hand it is not hazardous per se.

16 MR. KALUR: On Table 3, at the top of Table 3  
17 it is headed up "Annual Doses at Equilibrium Conditions."

18 Can you define equilibrium conditions for me?

19 DR. FRIGERIO: As used in these tables I suspect  
20 that it is intended to mean what a physical chemist calls  
21 steady state.

22 That is to say, as releases occur from the plant  
23 and as they diffuse through the environment and as losses  
24 accumulate going out of the Western Basin and out of the  
25 system eventually there comes a point at which the concentration

HDvol13-3

1 changes for a little with time.

2 I suspect this is in fact what is meant in  
3 Table 3.

4 MR. KALUR: That would become stable if --

5 DR. FRIGERIO: And it would re-establish itself.

6 MR. KALUR: Assuming no abnormal operation?

7 DR. FRIGERIO: It would always re-establish it-  
8 self but it might have more or fewer bumps in it.

9 MR. KALUR: If you had a plant such as Davis-  
10 Basse where you wished to put in a recycling of tritium, is  
11 there a point in construction where it would become much more  
12 economic -- much more of an economic problem to do so than  
13 at another point?

14 DR. FRIGERIO: No. In fact, in my opinion it  
15 would probably be best done after construction was essentially  
16 complete.

17 I don't pretend to any great expertise in this,  
18 but the problems in recycling are chiefly problems in water  
19 management rather than problems in nuclear engineering.

20 MR. KALUR: Can you give us any more detail on  
21 what these problems of water management are?

22 DR. FRIGERIO: Not very much. One of them would  
23 be the possibility or probability of retaining material in  
24 the water that damaged the turbines or damaged the other  
25 parts of the system mechanically. This is probably the chief



HDvol13-4

1 reason why conventional plants blow down as much as they do  
2 as a way of getting rid of what you and I would call dirt.

3 MR. KALUR: Is there any plant currently in  
4 operation in the United States that recycles its tritium?

5 DR. FRIGERIO: No.

6 MR. KALUR: Do you know of any that are planned?

7 DR. FRIGERIO: Yes, I do, one; Midland.

8 MR. KALUR: Do you agree with the concept that  
9 tritium is probably the least dangerous radionuclide?

10 DR. FRIGERIO: Yes.

11 MR. KALUR: Nothing else.

12 CHAIRMAN GARTENBERG: Any cross-examination, Mr.  
13 Charnoff?

14 MR. CHARNOFF: Just one question. It might  
15 follow from the last question by Mr. Kartalia.

16 You have testified, Dr. Frigerio, I believe, that  
17 it would not be particularly hazardous to recycle the tritium  
18 and maintain it within the plant and you also testified that  
19 tritium is not a particularly hazardous radioisotope.

20 DR. FRIGERIO: No.

21 MR. CHARNOFF: Is it your view that if the tritium  
22 were released over the period of time as it was built up in the  
23 plant also instead of being held within the plant that it  
24 also would not be particularly hazardous to the public  
25 health?

HDvol13-5

1 DR. FRIGERIO: Yes. In fact, if public health  
2 were the dominating factor I would actually recommend that  
3 it be released on a high recycle basis.

4 By that I mean recycle perhaps 80 percent and  
5 release perhaps 20 percent out of your total pool. The  
6 reason for this is that a balancing of hazards here suggests  
7 that a total retention might be more hazardous to the plant  
8 personnel than a release would be to the public.

9 This is a very fine balance and if public desire  
10 went the other way I would have no strong feeling.

11 MR. CHAMNOFF: Thank you. I have no further  
12 questions.

13 CHAIRMAN GARFINKEL: Mr. Kalur, do you have  
14 anything?

15 MR. KALUR: No.

16 CHAIRMAN GARFINKEL: Dr. Lyman?  
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DR. LYMAN: Yes.

Dr. Frigerio, is tritium preferentially concentrated in tissues?

DR. FRIGERIO: It is preferentially deconcentrated. This is a characteristic of living organisms, that heavier nuclides tend to be left out. The factor is .96 so it is not significant one way or the other.

DR. LYMAN: Yesterday we had some units called pico curies and today we had micromicrocuries. Could you explain the difference?

DR. FRIGERIO: These are the same units in fact and differ only in which side of an international commission ruling you are on.

DR. LYMAN: We have had some units expressed as cc. I suppose that means cubic centimeters?

DR. FRIGERIO: Yes.

DR. LYMAN: And we have had some that are ml. That means millilitre?

DR. FRIGERIO: Yes.

DR. LYMAN: What is the conversation between these two?

DR. FRIGERIO: 1.00942, hardly significant.

DR. LYMAN: In other words, they are the same thing?

DR. FRIGERIO: Right.

HDpsl3-1-2 1

2 DR. LYMAN: And a thousand cubic centimeters  
3 is a litre?

4 DR. FRIGERIO: Is a litre.

5 DR. LYMAN: I think you testified that on Tables  
6 2 and 3, on Pages 20 and 21 here, that these numbers were  
7 considerably higher and therefore in a sense more conservative  
8 than your numbers?

9 DR. FRIGERIO: Yes.

10 DR. LYMAN: Could you characterize the harm to the  
11 environment that would result from the values that are now  
12 contained in Tables 2 and 3 in comparison with the harm which  
13 would result from your numbers?

14 DR. FRIGERIO: Yes. To the best of my ability  
15 to analyze the current radiobiological data there is no  
16 question of harm. There is some question of beneficence  
17 but I would not want to raise that here.

18 I base this on studies of human effects of low  
19 level radiation of this sort and in point of fact no effects  
20 have been seen, but more importantly, no effects have been  
21 seen where they could have been predicted. In other words  
22 this zero was obtained for such things as carcinogenic  
23 effects where in fact numbers in the order of many thousands  
24 would have been expected.

25 So on the basis of this discrepancy between a  
prediction and an observation I have concluded that the

HJ2413-1-3 :

1 damage to man at these levels is zero and for reasons we have  
2 discussed previously the damage to other organisms must  
3 therefore also be zero. So even at 200 millirads per year  
4 I would not expect there to be any damage at all. This  
5 is actually a question of biological recovery.

6 DR. LYMAN: And we had some discussion of boiling  
7 water reactors versus pressurized water reactors. In your  
8 opinion would there be any benefit from changing the Davis-  
9 Besse system from one to the other?

10 DR. FRIGERIO: No. It is an almost even-stave  
11 tradeoff in that a Davis-Besse type of reactor will result in  
12 less tritium and more gas and the boiling water will result  
13 in more gas and less tritium.

14 But since the dominant isotope is at the lowest  
15 end of the damage scale, in one case krypton 83 and xenons  
16 and in the other case tritium, these are the least damaging  
17 nuclides in our entire table and it really is no different.

18 DR. LYMAN: Are krypton and tritium concentrated  
19 in biological systems?

20 DR. FRIGERIO: No, they are not.

21 DR. LYMAN: That is all I have.

22 CHAIRMAN GARBINKEL: The Board has no further  
23 questions. Mr. Kaluz, do you have any questions?

24 MR. KALUZ: No.

25 CHAIRMAN GARBINKEL: Mr. Charnoff?

HDps13-1-4

1 MR. CHARNOFF: Just a semantic question, Dr. Frigerio.

2 I think I understood exactly what you were saying  
3 but you did in immediate response to Dr. Lyman's question  
4 say that there would be no question of harm in the context  
5 of these tables. I think you went on to say by that that there  
6 would be no harm, so that the no question of harm was intended  
7 to say in your judgement there would be no harm?

8 DR. FRIGERIO: Yes, that there was some substance  
9 to the question of "question" as well. That is in the light  
10 of recent data having to do with humans particularly the  
11 customary linear extrapolation which has been utilized by  
12 public health services for so long it is found to be totally  
13 invalid applied directly to humans at these particular levels.  
14 So therefore if one were to accept this as appropriate  
15 evidence then there is no longer a question of harm, as well  
16 as no harm.

17 MR. CHARNOFF: I understand. There was intended  
18 to be some time gap between the word "no" and "question"  
19 of harm.

20 CHAIRMAN GARPINKEL: Mr. Kalur?

21 MR. KALUR: No.

22 CHAIRMAN GARPINKEL: The witness may be excused.

23 MR. KARTALIA: I have a couple of questions I  
24 would like to ask him.

25 CHAIRMAN GARPINKEL: Oh, do you? Go ahead, Mr.

HDps15-1-51

Kartalia.

## REDIRECT EXAMINATION

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2  
3 MR. KARTALIA: Just a minute ago you referred to  
4 some recent work.

5 DR. FRIGERIO: Yes.

6 MR. KARTALIA: Whose work is this?

7 DR. FRIGERIO: This is my own work.

8 MR. KARTALIA: Has any publication resulted from  
9 that work?

10 DR. FRIGERIO: It has been submitted to the  
11 magazine Nature.

12 MR. KARTALIA: Could you just briefly describe the  
13 work involved?

14 DR. FRIGERIO: It has to do with cancer  
15 epidemiology, that is to say, the study of cancer mortality  
16 and incidence in various nations of the world, particularly  
17 in the United States. Particularly in the last 18 years  
18 was the data I treated because this is the post-Bikini  
19 era, from 1950 on.

20 One can from our ICRP data, from the presentations  
21 of Drs. Goffman and Tamplin, Dr. Pauling and others, predict  
22 the number of cancer mortalities in each of the various  
23 international classifications of death categories. One can  
24 then compare this against actual American experience.

25 At the Goffman and Tamplin suggested level the

HDps13-1-6

1 discrepancy was of the order of  $10^{10}$ . That is to say, the  
2 probability that the actual American experience could have  
3 been obtained by chance while still following the prediction  
4 was something like a part in a billion. At one end  
5 of this level it had gone down to 3 part in a few hundred  
6 thousand. A hundredth of this level had gone down to about  
7 one in 40.

8 So I was finally forced to conclude that the  
9 actual level of damage, if one were to ascribe all the levels  
10 of cancer to radiation, was about one-millionth of a person  
11 per reactor per year, something of this order. This is all  
12 detailed for all the various cancer types and so on.

13 Since the time that was sent off for publication  
14 I have been fortunate enough to have all the Scandinavian  
15 experience from Dr. Ringertz, who has mailed that to me.  
16 This follows the same pattern.

17 MR. KARTALIA: One final question, Dr. Frigerio.  
18 In response to questions by Mr. Kalur and by Dr. Lyman  
19 you have indicated that tritium is at the low end of the  
20 radioisotope damage continuum. Could you state your reasons  
21 for this conclusion, your basis for it?

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1 DR. FRIGERIO: Well, the first observation is  
2 simply to take up the International Commission on Radiation  
3 Protection Guide, and notice that its permissible concentra-  
4 tion is among the very highest.

5 In other words, its dose is considered to be  
6 among the very lowest.

7 However, the reasons behind that are that it is a  
8 very weak beta emitter that is not preferentially concentrated  
9 anywhere, and so as a consequence it is diluted by the very  
10 large mass of hydrogen which the body normally contains,  
11 and about 90 percent of all the atoms in the body are  
12 hydrogen.

13 So that it is largely a question of dilution  
14 combined with weak emission.

15 MR. KARTALIA: Thank you. I have no further  
16 questions.

17 CHAIRMAN GARFINKEL: Mr. Kalur.

18 MR. KALUR: No.

19 CHAIRMAN GARFINKEL: Mr. Charnoff?

20 MR. CHARNOFF: No, sir.

21 CHAIRMAN GARFINKEL: You are excused.

22 As I view the situation, Mr. Kalur, you finished  
23 the cross examination of the entire case of the regulatory  
24 staff, and now it is the time for the direct case of the  
25 intervenors, and what is your preference in terms of

WSvol4-2

1 beginning? I am prepared to give you an hour if you want the  
2 hour to continue.

3 MR. KALUR: The Coalition won't present any  
4 evidence.

5 CHAIRMAN GARFINKEL: Will not?

6 MR. KALUR: No.

7 CHAIRMAN GARFINKEL: That means you are resting  
8 your case in chief?

9 MR. KALUR: We are.

10 CHAIRMAN GARFINKEL: O. K. Now, Mr. Charnoff,  
11 do you have any rebuttal evidence?

12 MR. CHARNOFF: It seems to me there is nothing  
13 to rebut, Mr. Chairman. The answer is no.

14 CHAIRMAN GARFINKEL: Then the hearing for the  
15 reception of evidence is closed.

16 Let me note that as I indicated there will be  
17 no proposed findings from any of the parties. Wait, there is  
18 one thing here.

19 I will allow the parties ten minutes now to  
20 present any summary argument if they so desire.

21 Each party will have ten minutes and then the  
22 record will be closed, and then there will be no proposed  
23 findings, and I want the record to show that the failure of  
24 the parties not to present proposed findings will not be  
25 construed as a waiver of any rights that they may have with

WSvcl4-3

1 regard to exceptions that may be filed upon the receiving of  
2 an initial decision by this Board.

3 So consequently once the initial decision is  
4 issued the parties may file any exceptions they may have to  
5 the appeal board in accordance with the mandate of the  
6 Commission's order of June 29, 1972.

7 It is my understanding in reading that mandate  
8 that the parties will have to midnight of the date following  
9 the issuance of the initial decision in which to file  
10 exceptions to the initial decision.

11 I also indicated in my informal telephone  
12 conference with counsel for the parties, and I believe also on  
13 the record, that this Board will render its initial decision  
14 here in Cleveland. It will stay in session until it renders  
15 an initial decision.

16 It will endeavor to serve that initial decision  
17 on the parties here in Cleveland indicating to the Secretary  
18 of the Public Proceedings Branch of the Atomic Energy  
19 Commission of the time and date when I made that service on  
20 the parties.

21 With that comment I will now hear a closing  
22 argument and only ten minutes for each party regarding this  
23 proceeding commencing with the applicant first.

24 MR. CHARNOFF: May we have ---

25 CHAIRMAN GARFINKEL: I will give you a five-minute

S7014-4

1 recess.

2 MR. CHARNOFF: A five-minute recess, and I would  
3 like to excuse all of our witnesses at this point.

4 CHAIRMAN GARFINKEL: That is up to you. The  
5 case for the reception of evidence is closed.

6 MR. CHARNOFF: I would like to have a five-  
7 minute recess if I may.

8 CHAIRMAN GARFINKEL: A five-minute recess is  
9 granted.

10 (Five-minute recess taken.)

11 CHAIRMAN GARFINKEL: Will this hearing come to  
12 order?

13 As I indicated prior to the recess I am giving  
14 each party ten minutes to summarize this proceeding in any  
15 fashion they so desire, as to what they think the record  
16 will indicate and what their conclusions are.

17 There will be no rebuttal on this. That is, there  
18 will only be the ten-minute statement at one crack a piece.  
19 So there won't be any reserving of time for rebuttal.

20 So Mr. Charnoff.

21 MR. CHARNOFF: The applicant should go last under  
22 these circumstances.

23 CHAIRMAN GARFINKEL: No, the applicant shall go  
24 first and make a ten-minute statement.

25 And the Regulatory Staff will go second and Mr.

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1 Kaiur will be the one who can summarize this case.

2 MR. CHARNOFF: Does that mean he has the burden?

3 CHAIRMAN GARFINKEL: No, he doesn't have the  
4 burden of proof.

5 MR. CHARNOFF: Well, I am going to take one  
6 minute and then let Mr. Silberg sweat it out.

7 I would like to make just two general observa-  
8 tions, sir, and one is that the interesting factor that has  
9 developed in this hearing is that the intervenor's environ-  
10 mental case with regard to operational effects was solely in  
11 the area of radiological matters.

12 The intervenors had a full case opportunity at  
13 the Davis-Besse construction permit hearing to consider and  
14 contest the plant with regard to radiological matters.

15 Thereafter they appealed to the commission and  
16 to the courts because they were concerned there ought to have  
17 been consideration on non-radiological environmental matters  
18 and the only thing that is in this record other than  
19 radiological matters is the question as to whether a few  
20 birds will hit the cooling towers or not.

21 Secondly, at the last hearing there was an offer  
22 of proof made by the intervenors indicating what they would  
23 have offered had the Licensing Board permitted the receipt  
24 of testimony with regard to operational effects.

25 I think the record clearly shows that no testimony

MSvol4-6

1 was offered when the opportunity was extended.

2 With regard to the motion concerning the appearance  
3 of Mr. Nuntzing, I would like it to be clear, and I think the  
4 Board's record is clearly correct, that the motion offered  
5 by the Coalition indicated was concerned with all the final  
6 NEPA review would take into account in incremental investment,  
7 and nevertheless the whole line of questioning which was  
8 addressed to the witnesses made available by the staff dealt  
9 with how many suspension cases did the people who were on the  
10 stand participate in and what were the results of those  
11 suspensions.

12 Mr. Silberg.

13 MR. SILBERG: The issues in this remand hearing  
14 is basically the effects of operation and post-NEPA con-  
15 struction.

16 The reason that these issues are relevant is in  
17 order to perform some sort of a preliminary cost benefit  
18 analysis in order to meet the Court of Appeals criterion  
19 on the effect of the additional expenditures on the final  
20 NEPA review.

21 We thus are directed to ascertain some basis as  
22 to how the final NEPA review will turn out.

23 As to the first aspect of the criterion, the  
24 costs, this item was not re-opened in this hearing.

25 As the Board properly found in its initial

HDvol14-7

1 decision, Paragraph 61, the additional unrecoverable cost of  
2 abandonment of the facility, if construction is allowed to  
3 proceed, would have been \$28 million, assuming a suspension  
4 on June 1.

5 Since in fact no suspension on June 1 took place  
6 additional moneys have been expended on the plant, thus  
7 reducing the amount of additional incremental expenditures.

HDvol15-1

8 The additional expenditures are shown in  
9 Applicant's prepared testimony on Page 26 and total approxi-  
10 mately \$4 million for the month of June plus some fraction  
11 of the nearly \$5 million to be spent in the month of July.

12 When you add that together with additional interest  
13 during construction it is clear that the additional irretrievable  
14 expenditures would be considerably less than \$24 million.

15 As to the effects of post-NEPA construction there  
16 are only three aspects of construction that would have any  
17 conceivable environmental effect.

18 The first is finishing the grading of roads,  
19 surfacing and landscaping. This would have a beneficial  
20 effect.

21 Second, it is clearing of 54 acres of secondary  
22 growth wooded acreage, along a 15-mile portion of one of the  
23 transmission lines. This acreage is scattered in various  
24 small segments.

25 The third is the dredging of a temporary channel

Dv015-2 1 for the installation of intake and discharge pipes.

2 As, Dr. Hurdendorf's prepared testimony clearly  
3 indicated, this will have no significant impact on the  
4 environment.

5 As far as the effects of operation, the major  
6 concern alleged by the intervenors deals with radiological  
7 matters. The testimony clearly shows that there is no adverse  
8 effect either on man or any other organisms.

9 With respect to the doses, the applicant's  
10 computation of the dose from normal operation shows that a  
11 maximum individual dose would be 1.18 millirem per year.  
12 This compares with the existing background level of about  
13 125 millirem per year and the proposed Appendix B level of  
14 5 millirem per year.

15 The transcript citation for that is Page 2985  
16 and also Table 14-1 in the Supplement to the Environmental  
17 Report.

18 The dose to the total population within a 50-mile  
19 radius would be slightly more than one half man rem per year.  
20 This compares with the total population dose from naturally  
21 occurring background radiation within that same radius of over  
22 300,000 man rem per year.

23 The citation for that is Table 14-1, Supplement to  
24 the Environmental Report.

25 Dr. Trigeric testified that the staff values were



EDV013-3

1 considerably higher than his expert calculations or the  
2 calculations put forward by applicants, and also that the  
3 isotopes which would be released from the plant are among the  
4 least dangerous to any organisms.

5 As far as the effects of these normal radioactive  
6 releases, all the testimony indicated that these levels would  
7 have no impact on the environment.

8 All three experts who testified, Drs. Prigerio,  
9 Goldman and Martin, concurred in this.

10 The staff concluded in their prepared statement  
11 on Page 18 that "Routine operation is expected to contribute  
12 an extremely small incremental dose to that which area  
13 residents already receive as a result of natural background."

14 That again is Page 18 of the staff testimony.  
15 The staff reached that conclusion even though they used much  
16 higher values of releases than would actually have occurred,  
17 as Dr. Prigerio testified this afternoon.

18 The testimony also clearly indicates that  
19 applicants will comply with the proposed numerical dose  
20 limits of Appendix I to 10 CFR Part 50.

21 The testimony on that is at Transcript Page 2994.

22 Appendix I, as you know, is the Commission's  
23 determination of that level of radioactive effluent in  
24 releases which is "As low as practicable."

25 As indicated in the AEC's Guide for Preparation of

HDvol5-4

1 Cost-Benefit Analyses, no further consideration of alternate  
2 radwaste systems is needed upon compliance with proposed  
3 Appendix I.

4 As far as tritium is concerned, another of the  
5 intervenor's alleged concerns, the expert testimony of Dr.  
6 Goldman clearly indicated that tritium is the least significant  
7 from a health standpoint of all radionuclides which are pro-  
8 duced artificially.

9 He said that at Transcript Page 2187. This was  
10 supported, of course, by Dr. Frigerio. Tritium that would  
11 be released would be so small in comparison to natural levels  
12 that there would be no effect on any organisms.

13 This is based on many years of experience that  
14 facilities where the releases of tritium are considerably  
15 higher than those for the Davis-Besse facility.

16 Transcript reference for that is at Page 2991 to  
17 2992. Any hazard from tritium release is made even less  
18 significant because the tritium does not reconcentrate in  
19 organisms and the large amount of stable hydrogen available  
20 for biological dilution.

21 Reference for that is Transcript Page 2993.

22 Dr. Goldman also testified that tritium recycle  
23 is undesirable from a biological standpoint. Dr. Frigerio  
24 indicated that the recycle of tritium would produce no  
25 measurable benefits from a biological standpoint and in any

ADvol5-5 1 case he testified that there would be no foreclosure of the  
2 adoption of recycle for tritium at the Davis-Besse facility  
3 should that be necessary.

4 In fact, he testified that recycle of tritium  
5 would be easier to install upon completion of the facility.

6 Another alleged concern of the intervenors was  
7 the effect of radioactive releases on the biota in both  
8 the Lake and the marsh.

9 Both Dr. Goldman and Dr. Martin testified that man  
10 is the most radiosensitive animal. By protecting man we  
11 automatically protect other forms of life. The reference is  
12 Transcript Pages 2912, 2938 and 2992 through 2993.

13 Dr. Frigerio agreed with that statement and  
14 indicated that the extreme low dose to fish and invertebrates  
15 that would actually be received from the Davis-Besse facility  
16 is less than one millired.

17 Dr. Goldman also testified that radwaste dis-  
18 charges will have no effect on the marsh because the liquid  
19 to be discharged would be discharged more than 300 feet off-  
20 shore.

21 It would reach the marsh only after significant  
22 dilution. Noble gases will not be re-concentrated or absorbed  
23 in the marsh area. Quantities of radioiodine are too small  
24 to have any effect, even considering re-concentration.

25 Transcript 2994, 2997.

HDvol5-6 1 Similarly, there would be no effect on the biota  
2 in the Lake. The reference to that is 2997 through 2999.

3 In both cases, the evidence accumulated with  
4 respect to exposure over many years to all the types of biota  
5 which would be in the environs of Davis-Besse shows no effect  
6 from exposure to significantly greater doses and concentrations  
7 of radioactivity than would be released from this facility.

8 Reference to that is Transcript Pages 2995 and  
9 2996.

10 With respect to accidents, testimony submitted  
11 by the applicants indicates that for no class of accidents  
12 would there be a dose to the individual at the site boundary  
13 in excess even of the AEC's non-accident radiation limits  
14 set forth in Part 20 to 10 CFR.

15 The reference to that is the Supplement to the  
16 Environmental Report, Section 3.9 and Table 3-1.

17 Dr. Goldman attested to the reasonableness of the  
18 dose calculations that are set forth in Section 3. The staff  
19 generally concurs with the conclusions of this analysis  
20 that is on Page 27 of their testimony.

21 As far as probability, Dr. Goldman testified that  
22 there is a very little possibility of serious accidents  
23 occurring and that in fact the ECCS system has worked in  
24 power reactors.

25 As far as transportation and the effects of both

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1 normal and accident operation of the transportation systems,  
2 Section 5 of Applicant's Supplement to the Environmental  
3 Report contains uncontradicted testimony that the effects,  
4 if they occur, will have no significant impact on the  
5 environment.

6 CHAIRMAN GARFINKEL: Mr. Sillberg, you have only  
7 one more minute.

8 MR. SILLBERG: The testimony introduced by applicant  
9 also shows that the thermal discharges will have no impact.  
10 Similarly, the atmospheric discharges from the cooling tower  
11 will have no impact.

12 The same holds true for chemical and sanitary  
13 discharges. All this is discussed in considerable detail in  
14 the Supplement to the Environmental Report.

15 Finally, applicants presented cost data on a  
16 number of alternatives, both the radiological, the radwaste  
17 treatment system and the cooling system.

18 This testimony indicates the unlikelihood that  
19 any of these modifications would be required as a result of the  
20 NEPA review. It further indicates by showing the cost of these  
21 alternatives that the additional cost of any of the segments,  
22 even if required, is insignificant in terms of the existing  
23 plant investment.

24 CHAIRMAN GARFINKEL: Your time has run out. It  
25 was perfectly timed.

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1 Mr. Kartalia, you have ten minutes and it is now  
2 2:32 and a half.

3 MR. KARTALIA: I don't think it is necessary  
4 I shall not try to compete with that. I intend to make only  
5 a couple of brief observations and conclude with a statement  
6 of the staff's position in this case.

7 First of all, I would like to mention the matter  
8 of the request for Mr. Muntzing's presence at this hearing.  
9 I think the Board's decision in this regard was clearly  
10 correct for the reasons cited by the Board, that there  
11 simply was no showing of exceptional circumstances, and I  
12 would submit for the reasons that I gave in my argument on  
13 the first day of the hearing.

14 I would go so far as to say that even if the rules  
15 did not provide for a showing of exceptional circumstances  
16 for the issuance of this kind of a subpoena, but the quality  
17 of the showing made by the intervenors, coupled with the  
18 nature of Mr. Muntzing's responsibilities, would justify the  
19 Board's ruling simply as a matter of the sound discretion of  
20 a presiding officer or a trial judge.

21 This hearing has been concerned primarily with  
22 radiological effects. It is our position that the evidence  
23 points all in one direction and that is that the conclusion  
24 of the NEPA review with respect to radiological effects is  
25 very likely to be that the effects of this plant are acceptably

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1 minimal and pose no danger to humans or to animal life,  
2 plant life, and in particular migratory water fowl.

3 However, the NEPA review is not complete and there  
4 is, of course, the possibility that the staff would ultimately  
5 recommend some modification in the applicant's radwaste system

6 That can be ruled out, of course, until the review  
7 is complete.

8 However, I think that as to radiological effects  
9 and in fact as to all operational effects on the evidence  
10 which is now in the record, the Board can and should conclude  
11 that the expenditures, the outlays that are to be made by the  
12 applicant during the NEPA review period, are simply not likely  
13 to influence the outcome of the NEPA decision.

14 I think the evidence is very clear on that point  
15 that there is no evidence that suggests that the decision  
16 may be influenced by an outlay to be made by the applicant  
17 during this period.

18 So as I suggested very early in the proceeding  
19 when I was addressing myself for the first time to the  
20 question of waiver, I think that the waiver is simply  
21 immaterial, that the ultimate NEPA decision by this Agency  
22 is not likely to turn on whether the expenditures during this  
23 review period are taken into account.

24 So we conclude and urge the Board to conclude  
25 that suspension in this case is not warranted.

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1 CHAIRMAN GARFINKEL: Mr. Kalar, it is approxi-  
2 mately 2:56. You have ten minutes.

3 MR. KALUR: Members of the Board, there is a  
4 paramount issue that was established by the Court of Appeals  
5 that guides these proceedings. That is the effect of the  
6 incremental expenditure on the final NEPA review. This case  
7 is to inquire into that.

8 I presume from that that the applicant had the  
9 burden of proof on that issue. I don't know what burden,  
10 if any, the regulatory staff had. I had been told they are  
11 supposed to represent the public interest, and I go on that  
12 assumption.

13 But there is no evidence before this Board as to  
14 what the eventual decision -- the effect of the incremental  
15 expenditure of \$28 million -- is going to have on the final  
16 NEPA decision. The applicant made no effort at all to  
17 determine that from the staff's witnesses who were here.  
18 Intervenor, without having the burden, attempted to do that  
19 but in our opinion was unable to do that because the staff  
20 refused to have Mr. Muntzing present.

21 I think we would have to determination under that  
22 Court opinion as to how the AEC reacts internally to the  
23 addition of this money on its decisional process in making a  
24 determination whether to give a go-ahead when a NEPA review  
25 is completed.



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1 The record in this case is totally barren of  
2 any of that. Not one iota of evidence as to how they will  
3 weigh this added cost increment.

4 What did the evidence show? We know what it  
5 didn't show. What did it show? It showed first that they  
6 haven't made any studies, neither the applicant nor the  
7 staff, of the marsh and its environs and how they will react  
8 to the radiation from the plant, both normal and abnormal.

9 There is no study of current lake conditions by  
10 the AEC. There are no studies of what could happen in the  
11 Lake with added plants.

12 We have heard in testimony that the Detroit  
13 Edison proposes to put extra plants there. The Fermi plant  
14 is already there. There is a complete lack of concern

15 Mr. Martin was on the witness stand and said that  
16 he didn't care what was in the Lake now. It was his job  
17 to find out what was going in from the Davis-Besse plant and,  
18 in a typical bureaucratic fashion, that was the end of his  
19 responsibility.

20 I would suggest to the Board that this evidence shows  
21 a total disregard for the consequences of the actions on these  
22 marsh areas. We haven't seen any evidence, any reports.

23 I constantly asked these witnesses "What reports  
24 have you made? What studies have you made? Name them.  
25 Submit them to us. Show us what consideration you have had for

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1 the National Environmental Policy Act besides the normal  
2 Atomic Energy Commission concern with public health, safety  
3 and welfare."

4 I submit to the Board that the responsibility  
5 imposed by NEPA is far in excess of looking at man dose.  
6 I asked members of the Regulatory Staff if they considered  
7 anything but the man dose. The record is negative.

8 I submit to this Board that the applicants have  
9 not carried their burden and the Regulatory Staff has not  
10 added to that but joined in it.

11 Thank you.

12 CHAIRMAN GARRINBLE: With that the hearing is  
13 closed for the reception of evidence and it will await the  
14 issuance of an initial decision.

15 Thank you very much. I want to extend my  
16 appreciation for the fine efforts of counsel for all parties.  
17 Thank you.

18 The hearing is adjourned.

19 (At 3:00 o'clock p.m. the hearing in the above-  
20 entitled matter was closed.)

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