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UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

- - - - -x

GENERAL PUBLIC UTILITIES CORPORATION, :
JERSEY CENTRAL POWER & LIGHT COMPANY, :
METROPOLITAN EDISON COMPANY and :
PENNSYLVANIA ELECTRIC COMPANY, :

Plaintiffs, : 80 CIV. 1683
: (R.O.)

-against-

THE BABCOCK & WILCOX COMPANY and :
J. RAY McDERMOTT & CO., INC., :

Defendants. :

- - - - -x

Deposition of METROPOLITAN EDISON
COMPANY, by EDWARD R. FREDERICK, taken by
Defendants, pursuant to Notice, at the
offices of Davis Polk & Wardwell, Esqs.,
One Chase Manhattan Plaza, New York, New York,
on Tuesday, May 4, 1982, at 9:40 o'clock in
the forenoon, before Joseph R. Danyo, a
Shorthand Reporter and Notary Public within
and for the State of New York.

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PDR ADUCK 05000289
T PDR



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CHARLES SHAPIRO, C.S.R.

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Also Present:

JONATHAN QUINN

ERIC ABRAHAMSON

* * *

1
2 IT IS HEREBY STIPULATED AND AGREED
3 by and between the attorneys for the
4 respective parties hereto that the sealing,
5 filing and certification of the within
6 deposition be, and the same hereby are,
7 waived; and that the transcript may be signed
8 before any Notary Public with the same force
9 and effect as if signed before the Court.

10 IT IS FURTHER STIPULATED AND AGREED
11 that all objections, except as to the form
12 of the question, shall be reserved to the
13 time of trial.

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2 E D W A R D R. F R E D E R I C K, residing
3 at 2141 Schoolhouse Road, Middletown,
4 Pennsylvania, having been first duly sworn by
5 the Notary Public (Joseph R. Danyo), was examined
6 and testified as follows:

7 EXAMINATION BY MR. FISKE:

8 Q How are you employed?

9 A I am employed by GPU Nuclear as a supervisor
10 of nonlicensed operator training.

11 Q How long have you held that position?

12 A Since March of this year.

13 Q That is March of 1982?

14 A Yes.

15 Q Is there a supervisor for licensed nuclear
16 training?

17 MR. SELTZER: Do you mean operator
18 training?

19 MR. FISKE: Yes.

20 A Yes, there is.

21 Q Who is that?

22 A There are actually two positions; one held
23 at TMI-1 and the other at TMI-2. The supervisor in
24 Unit 1 is Nelson Brown. The supervisor in Unit 2 is
25 Fred Scheimann.

2 Q Just so I understand, what is your
3 position again?

4 A I am supervisor of nonlicensed operator
5 training in both units.

6 Q Mr. Brown and Mr. Scheimann have held the
7 positions that you just described also since March of
8 this year?

9 MR. SELTZER: Are you asking whether they
10 began holding that position in March of this year?

11 MR. FISKE: Yes. Let's put it that way.

12 A No. They had different starting dates
13 than I did.

14 Q Just so I understand it, since March of
15 1982, there has been one supervisor of nonlicensed
16 operator training and that is you for both units, and
17 there are two supervisors of licensed operator training,
18 one for Unit 1 and one for Unit 2, one being Mr. Brown
19 and one being Mr. Scheimann, is that correct?

20 A That's correct. The position did exist
21 before I held it, though.

22 Q Who held it before you?

23 A Frank McCormick.

24 Q What position did you hold before March
25 1982?

1
2 A I was administrator of nuclear technical
3 training in Unit 2.

4 Q For both licensed and nonlicensed operators?

5 A Yes.

6 Q How long had you held that position?

7 A Since June 1979.

8 Q What position did you hold before that,
9 that is, before June 1979?

10 A I was a control room operator, TMI Unit 2.

11 Q Are you aware that in connection with
12 this lawsuit a request has been served on counsel for
13 GPU for the production of documents?

14 A Yes.

15 Q Have you personally made a search of your
16 own records to produce documents pursuant to that
17 request?

18 A Yes.

19 Q Do you have any documents relating to your
20 duties as a control room operator prior to the accident
21 that have not been produced to turn over to your
22 counsel?

23 A No.

24 Q One of the lawyers appearing here today
25 with you is Mr. Richard Seltzer from the Kaye, Scholer

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firm, is that correct?

A Yes.

Q And in addition to Mr. Seltzer, Ms. Penny is here from the law firm of Killian & Gephart. She is also representing you here today?

A Yes.

Q Is Mr. Seltzer representing you personally?

MR. SELTZER: I am representing him in his capacity as a company employee.

Q I would like to know the date when it was that you first retained Ms. Penny's firm.

A I will give you an approximate date. I believe it was April 1980.

Q Have you turned over any of your documents to Ms. Penny?

MR. SELTZER: Do you mean his only copy?

Q Have you given any copies of any documents that at any time were in your possession to Ms. Penny, whether they are originals or copies?

A Yes.

MR. FISKE: I would like to ask whether those documents that have been given by Mr. Frederick to you, Ms. Penny, have been included in the documents that have been reviewed

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for production pursuant to the document request?

MS. PENNY: I am certain they were.

Q Since the accident, you have given testimony and given interviews on a number of different occasions to different people, have you not?

A Yes.

Q I would just like to run through those with you to make sure that we understand all of the different people to whom you have given information since the accident.

You have been interviewed by people of the President's Commission, the so-called Kemeny Commission?

A Yes.

Q And you also gave a deposition, did you not, to a representative of the Kemeny Commission, questions and answers comparable to what we are doing here today?

A I believe so.

Q You also testified in a public hearing before the full Kemeny Commission?

A Yes.

Q Did you also testify before a commission known as the Rogovin Commission?

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MR. SELTZER: You are asking about a
deposition by Rogovin or a public hearing?

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MR. FISKE: Let's start with a deposition.

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Q Did you give a deposition to representatives
of the so-called Rogovin Commission?

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MR. SELTZER: That is also known as the
NRC Special Inquiry?

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MR. FISKE: Yes.

10

A Yes.

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Q Did you testify publicly before the
Rogovin Commission in addition to giving a deposition?

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MR. SELTZER: Objection. No foundation
that the Rogovin Commission had public hearings.

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A I am having difficulty separating all the
people that interviewed me during that time, what
their names were.

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Q So you don't remember one way or the
other?

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A No, I don't.

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Q Do you remember being interviewed by
representatives of the Nuclear Regulatory Commission
Inspection and Enforcement Group?

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A Yes.

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Q That was done up at Three Mile Island?

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A Not all of their interviews were held on Three Mile Island.

Q You were interviewed by them on more than one occasion?

A Yes.

Q You were also questioned, were you not, by representatives of Metropolitan Edison or GPU?

A Yes.

Q And you were interviewed right after the accident, were you not, by people from Met Ed?

A I was interviewed in the days following the accident, yes.

Q And then at some point after that, were you also not interviewed by the so-called Keaten Task Force? Robert Keaten.

A A GPU employee?

Q Yes.

A Again, I don't specifically recall that testimony. If there is record that I have, I wouldn't dispute that.

Q Were you aware at sometime after the accident that a group had been formed within GPU to conduct a post-accident review of the circumstances leading up to the accident?

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A Yes.

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Q Do you remember now being interviewed by anyone from that group?

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MR. SELTZER: Is this different from the questioning by Met Ed and GPU employees after the accident you referred to earlier?

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MR. FISKE: Yes.

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A I have no singular memory of that particular group interviewing me.

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Q Do you remember being interviewed by anyone that you knew at the time was a representative of GPU as opposed to Met Ed?

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A I made no differentiation between those two groups in my mind.

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Q Have you testified before anybody in connection with the TMI-1 restart proceedings?

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A No, I don't recall having done that.

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Q Specifically, are you aware of a report that was issued last week relating to cheating that went on in connection with certain tests given at Met Ed?

23

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MR. SELTZER: Are you asking does he know that such a report was issued?

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MR. FISKE: Yes.

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A I know that such a report was issued, yes.

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Q And my specific question is did you give any testimony in the proceedings that led to that report?

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A No.

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Q Have you received a subpoena to testify before a grand jury in connection with anything having to do with your employment as a control room operator before the Three Mile Island accident?

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A Yes.

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Q Have you in fact testified before the grand jury?

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A Yes.

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Q Have you given any testimony under oath in any proceeding other than the ones that I have covered in my questions up to now concerning anything, having anything to do with the Three Mile Island accident?

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(Discussion off the record between the witness and his counsel.)

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A Just from memory, I couldn't confirm that that is a complete list of all of the testimony I have given.

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Q Have you testified before any congressional

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committees?

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A Yes.

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Q In addition to that congressional testimony, adding the congressional testimony to the list of different testimony that you described up to now, having done that, can you think of any other testimony that you have given under oath before any agency?

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A You are trying to make a list just of the times that I testified under oath?

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Q Let's start with that. I am trying to break it down.

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A That is difficult for me to remember the times I was under oath and the times I was not. In the list that you have given me, it did not include I guess it was a congressional committee of the Department of Affairs, the so-called Udall Committee.

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MR. SELTZER: Mr. Fiske was including the congressional testimony in the list. Other than those interviews and the depositions and the interviews that you already described, do you remember any other occasions where you gave sworn testimony about the Three Mile Island accident?

MR. FISKE: I will withdraw the pending

question and simplify it.

Q As I understand, you already told us you gave testimony, sworn or unsworn, to the Kemeny Commission or its representatives, to representatives of the Rogovin Commission, to representatives of the Inspection and Enforcement Section of the Nuclear Regulatory Commission, to various individuals at Met Ed or GPU, before certain congressional committees including the Udall Committee and in the grand jury.

Having listed all of those, I would now ask you whether you gave any information, whether it was under oath or not, to any persons other than those that I have described up to now?

MR. SELTZER: I object to the question as too vague and ambiguous.

Q Have you been interviewed by anyone other than the groups I have just described?

A You mean any information that I have given to groups who were asking questions?

Q Yes.

A Yes, there were other groups.

Q Can you tell us who they are?

A The Essex Corporation.

Q What were the circumstances under which you

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2 gave information to the Essex Corporation?

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A The Essex Corporation was given the assignment of trying to develop a detailed sequence of events for the day of the accident, and I was asked to assist them in doing that.

Q Who did you meet with from the Essex Corporation in connection with that effort?

A I don't remember any of their names.

Q How many different occasions did you meet with them?

A Only one or two.

Q Did they complete a sequence of events?

MR. SELTZER: What do you mean by the verb "complete"?

Q Did they produce a completed version of the sequence of events?

A I believe they did.

Q Did you see it before it was in its final form?

A Only during the occasions that we were discussing it while it was under development.

Q I guess my question is did you see a draft of the sequence of events under circumstances where you were shown the draft and given an opportunity to

1

2 comment on it?

3 A No.

4 Q Did you see any draft of the final sequence
5 of events before it became final?

6 A No.

7 Q So do I understand correctly that the first
8 time you saw a written sequence of events produced by
9 the Essex Corporation, it was the final version?10 MR. SELTZER: I object. That is contrary
11 to his earlier testimony.12 MR. FISKE: I am trying to find out. If
13 that is contrary, then tell me why.14 MR. SELTZER: He said they had shown him
15 something that they were drafting at the
16 interview sessions.17 MR. FISKE: Then he just said a minute
18 ago that he didn't see any written version of it
19 before the final.20 MR. SELTZER: No, he said they didn't ask
21 him to comment on it.22 MR. FISKE: Would you go back so we are
23 not confusing Mr. Frederick. Would you read back
24 the last question and answer.

25 (Record was read back.)

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A I don't recall reviewing their sequence of events after it was completed.

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Q I am not sure I understand the last answer. Are you saying that you never even saw the final version?

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A I don't recall seeing it, no.

8

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Q Do you know for a fact that there is a final version?

10

A No, I do not.

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Q Are there any other individuals to whom you have provided information about the accident in response to questions other than the ones that you have identified up to now?

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A I don't recall any other groups at this time. I don't want to imply that the list that you have given me is total and complete without having checked some of my records and testimony files.

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Q Did you participate in discussions within the GPU organization leading to the construction of a sequence of events that eventually became the LER that was filed with the NRC?

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MR. SELTZER: Objection. No foundation that this witness knows what the basis was for the preparation of the sequence of events in the

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LER.

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Q Do you understand the question?

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A Yes.

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Q Can you answer?

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A The question actually had two parts, as

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I understand it. Did I participate in discussions and

8

were those discussions used in the development of the

9

LER.

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Q If you want to break it down that way,

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that is fine.

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A As I said, I did discuss with members of

13

the GPU staff and the Met Ed staff, but how those

14

discussions and testimony were used in the development

15

of the LER, I am unaware.

16

Q Have you seen the LER that was filed by

17

GPU with the NRC for the Three Mile Island accident?

18

It was filed, I believe, in September 1980.

19

A Yes.

20

(Discussion off the record between the

21

witness and his counsel.)

22

Q Did you see any drafts of that LER before

23

it was filed?

24

A No.

25

Q Did you see any drafts of any sequence of

1
2 events of the accident which you understood was being
3 prepared by GPU for the purpose of filing with the
4 NRC?

5 A I don't recall having seen it.

6 Q Other than the discussions that you had
7 with the Essex Corporation, and I am putting those
8 aside, did you ever see any draft of any sequence of
9 events of the Three Mile Island accident?

10 I will change that question without the
11 qualifying phrase at the beginning. Let me just ask
12 you simply, did you at any time see any draft of a
13 sequence of events of the events during the accident?

14 A Yes.

15 Q Under what circumstances?

16 A I don't recall the circumstances.

17 Q Who showed it to you?

18 A I don't remember that either.

19 Q Did you ever discuss any written draft of
20 the sequence of events of the accident in a group which
21 contained, in addition to yourself, other control room
22 operators who had been on duty during the accident?

23 A Yes.

24 Q Was there more than one such discussion?

25 A I only remember one at this time.

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Q Where did that discussion take place?

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A That was a session led by an NRC I&E Group at the Skyways Motel in Harrisburg.

5

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Q Was there a tape recording made of that interview?

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A Yes.

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Q Putting that aside, I am talking now of -- I am asking you now whether you had a discussion about a written -- I am asking you whether you had a discussion concerning a written sequence of events in draft form, which discussion was participated in by not only yourself but other operators that were on duty on the day of the accident?

15

16

A No, I don't recall any specific times where a review of that nature took place.

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Q You don't remember a time where the group of you that were on duty during the accident were sitting around discussing with others at GPU a proposed draft of the sequence of events?

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A No.

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Q Let me ask you specifically, do you remember attending any meetings of the TMI-2 PORC in about the middle of May 1979 concerning an annotated sequence of events?

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2 A I don't recall attending a meeting of that
3 sort.

4 (Ccintinued on the following page.)
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Q Let me show you a document which we will mark as B&W Exhibit 645, which is a letter written by you to Mr. Paul Collins at the Nuclear Regulatory Commission on July 5, 1977.

(Letter from Mr. Frederick to Mr. Paul Collins at the Nuclear Regulatory Commission dated July 5, 1977, was marked as B&W Exhibit 645 for identification, as of this date.)

Q Have you had a chance to look at this document?

A Yes, I have read it briefly.

Q This is a letter you wrote to the Nuclear Regulatory Commission in support of your application for a reactor operator's license examination; isn't that correct?

A This is a letter that was composed for my signature.

Q Who composed it?

A The administrator in the training department.

Q You reviewed it and were satisfied that it was accurate, correct?

A Yes.

Q Including the enclosure?

A Yes.

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Q As I understand the section 2 of your letter to Mr. Collins, you graduated from Passaic High School in 1967?

A Yes.

Q And you spent a year at Paterson State Teachers College after that?

A Yes.

Q And then you joined the navy?

A I joined the navy in March 1968.

Q In the second page of the letter describing your experience in the U. S. Navy, the first duties aboard the USS SAM RAYBURN --

Do you see that?

A Yes.

Q -- can you tell us what the USS SAM RAYBURN was?

A The USS SAM RAYBURN is a United States Navy submarine.

Q A nuclear powered submarine, I take it?

A Yes.

Q This says that your duties included testing and initial start-up at the S3G core.

A S3G.

Q What does that refer to?

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A That is the designator given to the type
3 of reactor core loading on that vessel.

4

Q Was that a pressurized reactor?

5

A Pressurized water reactor, yes.

6

Q Before you went aboard ship, did you
7 have training on a pressurized water reactor?

8

A Yes.

9

Q Where was that training conducted?

10

A Bainbridge, Maryland, and Windsor,
11 Connecticut.

12

Q What did that training consist of?

13

A Studies in science and mathematics and
14 practical training.

15

Q Were there reactors at either of those
16 places, Windsor or Bainbridge, training reactors?

17

A There is a prototype or training reactor
18 located at Windsor, Connecticut.

19

Q Did you have responsibilities aboard the
20 RAYBURN for actually operating the reactor as opposed
21 to testing it and initial start-up?

22

A No, the testing and initial start-up here
23 refers to the entire plant, not just the reactor. Not
24 just the core.

25

Q So you had the responsibility for testing

1
2 and initial start-up of the entire plant, correct?

3 A Specifically, I worked as an electrical
4 operator and was concerned with that portion of the
5 plant.

6 Q Is what you are saying that even in the
7 testing and initial start-up, your duties were as
8 an electrical operator and maintenance supervisor?

9 A Yes.

10 Q Just to put it in its simplest terms,
11 did you ever operate the reactor itself?

12 A No.

13 Q If this is a comparison that is meaningful,
14 did you perform functions when you were on board the
15 RAYBURN which were comparable to functions performed
16 by an auxiliary operator at Met Ed?

17 A Some of the duties performed by me on the
18 RAYBURN would be similar to those performed as an
19 auxiliary operator.

20 Q That would be to the extent that an
21 auxiliary operator at Met Ed has responsibility for
22 maintenance or electrical operation; is that correct?

23 A The auxiliary operator at Met Ed has no
24 responsibility for maintenance, just operating
25 equipment.

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Q You left the navy in 1973 and joined
Met Ed?

A Yes.

Q What was your rank in the navy when you
left?

A E5.

Q Is it correct that during the period 1968
to 1973 there was a program in effect in the navy
whereby someone could start on a course of study
which would lead to becoming a navy control room
operator?

A What was the time period again?

Q At the time you were there. There was a
designated path that you could start down, at the
end of the line becoming a control room operator.

A You are particularly referring to me
that there was a course I could have taken?

Q No. There was such a program in
existence during that period of time? Some people
that went into the navy embarked on a program course
of study which was designed to at the end qualify them
to be a control room operator.

MR. SELTZER: By "control room operator,"
do you mean holding an AEC or NRC license?

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2 MR. FISKE: Sufficient to operate the
3 reactor on the submarine.

4 MR. SELTZER: I am not sure you need an
5 NRC or an AEC license to operate a reactor on
6 a submarine.

7 MR. FISKE: That's why I didn't tie it to
8 a license.

9 Q Putting it in simplest terms, the navy
10 has nuclear submarines. Submarines are operated by
11 people that run the submarine, whether they have a
12 license or not. I am simply asking, isn't it a fact
13 that during this period of time there was a program
14 in the navy where people who joined the navy could
15 start out on a course of study that would lead them
16 to become qualified to operate the nuclear reactor
17 on a submarine.

18 A The course that you may be describing is
19 the end point for certain personnel ~~was~~ to be
20 qualified as a reactor operator aboard an individual
21 submarine as opposed to all submarines. It was not
22 an elective type course. You were chosen for that
23 early on in your naval career.

24 Q Were you, Mr. Frederick, chosen for that
25 program on the SAM RAYBURN?

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A No.

3

Q I think a minute ago we had just finished

4

your navy career and we were starting at Met Ed.

5

That was in November 1973, according to your letter

6

to Mr. Collins.

7

A Yes.

8

Q Again referring to your letter, paragraph 2

9

on page 2, it says, "My experience as an auxiliary

10

operator for A-Nuclear included studying systems

11

and writing operating procedures and alarm responses.

12

I also operated systems and equipment for plant

13

start-up and acceptance testing and performed switching

14

and tagging."

15

Then I would refer to the next page,

16

which is enclosure 1, item 1, which is captioned

17

"Auxiliary Operator A-Nuclear Training Program,

18

March 1974 to August 1974."

19

Do you see that?

20

A Yes.

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Q Do the items listed under paragraph 1 set

22

forth the training that you received as an auxiliary

23

operator?

24

A I think that is pretty accurate. Rather

25

than saying item 1 includes all the training I had

received, we have to include this paragraph you read a moment ago, part 2. It would require a bit more clarification to make it more accurate, I think.

Q Taking paragraph 2 in the letter plus item 1 in the enclosure, do those two together describe the training that you received as an auxiliary operator?

A Again, this paragraph under section 2, it is not exactly a clear representation of the peripheral duties that I had other than this classroom type training.

Q Just so we can move ahead, as I understand it, paragraph 1 in the enclosure describes that classroom training that you received; is that correct?

A Except item J was in-plant training.

Q Your testimony is that in addition to the classroom training and in addition to what is listed in item J, you did some other things?

A It says here that we were studying systems. That would be covered under item J, revising operating procedures, and alarm responses. What I did was make revisions to draft procedures, and as the systems were installed, we would walk them through to see if they were applicable. Operating systems and plant equipment

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2 for start-up was often done under the instruction of
3 engineers during the turnover of plant equipment,
4 performing acceptance tests, again as an entirely
5 independent action.

6 Q Going back to enclosure 1, there are
7 10 different paragraphs there; is that correct?

8 A Yes.

9 Q Item 2 is captioned "Unit 2 Control Room
10 Operators' Training." That begins in August 1975 and
11 continued through November 1975; is that correct?

12 MR. SELTZER: You are just asking him to
13 verify that that is what the document says?

14 MR. FISKE: Yes.

15 MR. SELTZER: We will stipulate to that.

16 Q Is it correct that everything from
17 paragraph 2 to the end of this enclosure refers to
18 control room operators' training?

19 A Yes.

20 Q One thing that is not completely clear
21 to me, when you talk about auxiliary operator training
22 programs and then you also talk about control room
23 operator training programs, is there a program that
24 you start out with in order to become an auxiliary
25 operator and then once you become an auxiliary

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operator, you then enter control room operator training, or do you start out right from the beginning as an auxiliary operator and are trained as an auxiliary operator right from the beginning?

MR. SELTZER: Objection. That is a compound question.

MR. FISKE: I am just trying to find out which of those two. I am sure it is compound. I am trying to find out which of those two works.

MR. SELTZER: Can you ask him one question. I don't understand the question.

MR. FISKE: Let's put it in terms of Mr. Frederick's experience.

Q Item 1 under enclosure 1, March 1974 through August 1974, auxiliary operator A-Nuclear training program. Were you in fact an auxiliary operator while you went through that program?

A Yes.

Q You start March 4th as an auxiliary operator and when it is all over on August 1974 you are still an auxiliary operator?

A Yes.

Q At what point in time do you become a

1

2 "control room operator" for the purpose of the headings
3 that are used in this outline?

4

A The progression from auxiliary operator A
5 to control room operator is not a mandatory
6 progression. It is a matter of a job being available
7 in that category, control room operator, and then
8 requesting to fill that vacancy.

9

Q But within the terminology, you can be
10 trained at Met Ed as a control room operator even
11 though you have not yet been licensed by the NRC?

12

A After having taken the control room
13 operator's job, you can then be trained.

14

Q So, in other words, during the period
15 August 1975 through November 1975, which is item 2 on
16 this enclosure, you were going through a Unit 2
17 control room operator's training program, correct,
18 even though you had not yet been licensed?

19

A Yes.

20

Q Is it correct that all of the training that
21 is listed on this enclosure was training that you
22 had completed prior to the time that you applied to
23 take the application for a license?

24

MR. SELTZER: Applied to take the
25 application?

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Q Applied for an application for an operator's license examination.

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A This letter is an application for a reactor operator license examination that was sent in 1977. The courses listed here were either completed or in progress at the time of the application.

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Q Item 4 on enclosure 1 refers to the Unit 2 cold license simulator certification training, April 5, 1976 to July 8, 1976.

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MR. SELTZER: It says July 9th on my copy.

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14

MR. FISKE: I am sorry. July 9th.

15

16

Q Do you see that?

A Yes.

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Q That refers to an eight-week course conducted by Babcock & Wilcox at Lynchburg?

A Yes.

19

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21

22

Q Item 9 refers to a simulator training program, June 6, 1977 to June 10, 1977, which is referred to as a one-week course at Lynchburg, Virginia.

23

Do you see that?

24

A Yes.

25

Q Did you have any training at Lynchburg,

1
2 Virginia at any time after June 1977 before the
3 Three Mile Island accident?

4 Putting it simply, was the last time that
5 you were at the simulator before the Three Mile
6 Island accident the week of June 6th to June 10, 1977?

7 A I don't recall. I made several trips to
8 the simulator. Other than the fact that the dates
9 of them are written here, I don't recall when they were
10 or if there was an additional one after this
11 application was sent.

12 Q You did in fact receive a license, did
13 you not?

14 A Yes.

15 Q And you received that license sometime
16 in 1977?

17 A Yes.

18 Q My question is at any time after you
19 received that license, did you ever go back to
20 Lynchburg, Virginia for training on the simulator
21 at any time before the Three Mile Island accident?

22 A Again, I don't remember if there was an
23 additional trip in there or not.

24 Q Is that a subject that you thought about
25 before you came here today, whether you had any

1
2 simulator training at B&W at any time after you
3 received your operator's license in 1977?

4 MR. SELTZER: Did he ever think about
5 that?

6 Q In thinking about the testimony that you
7 were going to be asked to give in this deposition, did
8 you think about the question of whether or not before
9 the accident you had any simulator training at B&W
10 at any time after June of 1977?

11 A No, I don't recall trying to remember
12 the dates that I was down there, no.

13 Q So before you came here today, you have
14 not made any effort to try to determine that?

15 MR. SELTZER: You mean in the course of
16 his getting ready to testify?

17 MR. FISKE: Yes.

18 A No.

19 MR. FISKE: Let me show you two documents,
20 one, which we will mark as B&W 646 consisting
21 of two pages, and the other consisting of
22 several pages which will be marked as B&W 647.

23 (Two-page document was marked as B&W
24 Exhibit 646 for identification, as of this
25 date.)

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2 (Document consisting of several pages was
3 marked as B&W Exhibit 647 for identification,
4 as of this date.)

5 MR. SELTZER: B&W 647 seems to be
6 somebody's assemblage of pages from different
7 documents stapled together. It creates a
8 rather confusing panache.

9 Can you explain what the origin of these
10 pages is?

11 MR. FISKE: The copy that I gave Mr.
12 Frederick was not stapled together. They were
13 held together by a paper clip. What I was
14 going to ask Mr. Frederick to do is go through
15 the different pages and ask if he can identify
16 any of them. I am not representing to Mr.
17 Frederick that those pages necessarily were all
18 stapled together in any one place or any one
19 time.

20 MR. SELTZER: In fact, they weren't.
21 The numbers are not consecutive. The
22 appearance of the photocopying shows holes at
23 the top on some and holes on the side on the
24 others.

25 MR. FISKE: So these were not from one

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document.

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BY MR. FISKE:

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MR. FISKE: I said that. I said what I would like Mr. Frederick to do is ask him whether he can identify any of those pages. I was going to refer to certain material on there and ask him whether or not he could identify the particular document itself.

MR. SELTZER: Could you indicate what the origin of these documents is, starting with 646 which bears no document production numbers on it?

MR. FISKE: I am not even sure myself.

MR. SELTZER: Do any of your associates or assistants know where it came from?

MR. WURTZ: I am informed that Exhibit 646 comes from the materials provided at Kaye, Scholer on April 14, and we got a Xerox copy ^{before} when the stamping process or the microfilming process occurred.

Q Let me show you a document which we will mark as Exhibit 646-A which is a collection of a number of pages all stapled together, all of which were produced by your counsel to us on April 14th, and the documents that are part of Exhibit 646 as well as

1
2 the documents that we previously marked as 645 are
3 all part of this collection that was produced stapled
4 together by your counsel.

5 (Collection of documents was marked
6 as B&W Exhibit 646-A for identification, as
7 of this date.)

8 MR. FISKE: If it helps you to analyze
9 Exhibit 646 by looking at 646-A, you are free
10 to do so.

11 Q Referring to Exhibit 646, have you ever
12 seen that document before?

13 A I have seen documents similar to this one,
14 but I don't recall specifically reviewing this one.

15 Q After you completed the simulator training
16 course at B&W in 1976, did you receive from B&W
17 at some point a list of the evolutions and emergencies
18 in which you had participated and the number of times
19 they were performed?

20 A No.

21 Q Did you ever see at any time after you
22 completed the simulator training any kind of a record
23 of which particular transients had been simulated
24 while you were there? Let me withdraw that.

25 Did you at any time after you finished

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the simulator training receive any written statement
of which particular simulated transients you had
been trained on?

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A No.

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Q Directing your attention to Exhibit 647
which is a collection of pages that you have before
you, have you had a chance to look through those?

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A Yes.

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Q Have you ever seen any of those pages
before?

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A Yes.

13

Q Can you tell us which ones?

14

15

A There is a sheet in the packet entitled
"Simulator Evaluation" which has my name on it,
handwritten.

16

17

Q "Ed Frederick" up in the right-hand corner?

18

A Yes.

19

20

Q Does the number 23083 appear on the
bottom?

21

A It appears to be 25083.

22

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Q It is a document containing handwriting;
is that correct?

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MR. SELTZER: That is what he said.

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Q That is your handwriting?

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A Yes.

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Q Is there any handwriting on that page that is not yours?

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A There doesn't appear to be.

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Q Can you tell us when you prepared that document?

8

A There is no date on it.

9

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Q Do you remember whether it was after your first trip to the simulator or your second trip?

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MR. SELTZER: Objection, no foundation that it has to be one of those two. He said he can't recall whether he had gone more than two times.

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A I only would be guessing to tell you when I wrote this.

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MR. FISKE: Why don't we mark that particular page as Exhibit 648.

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(Document in handwriting of Mr. Frederick was marked as B&W Exhibit 648 for identification, as of this date.)

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Q Are there any other pages in 647 that you recognize?

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A Again, your question is have I ever seen it or do I recognize it? I have seen sheets like this

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2 one that say "Plant Operations Training Classroom
3 Schedule," "Control Room Schedule." I have seen
4 schedules like that in the past, but whether or not
5 I have reviewed this particular schedule, I don't
6 remember.

7 Q Any other document in that exhibit that
8 you can identify?

9 A This simulator training summary sheet
10 which is also a part of this group appears to be very
11 similar to the document that you marked 646. Since
12 I said I had seen others like 646, this would be
13 included in that group, I would think.

14 Q Were you aware that at some time in
15 1977-1978-1979, in that time period, a decision was
16 made by Met Ed to send licensed operators to the
17 simulator for training only once every two years
18 instead of every year as had been the practice before?

19 A Just as you mentioned, I do remember that
20 being discussed, but I don't know that it was
21 initiated.

22 Q Is it your testimony that you don't know
23 whether or not such a decision was made?

24 A I think my testimony is that I recall that
25 decision pending, but I don't know what the outcome

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was.

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Q Is it your testimony that you understood that that question was being considered but that no decision had been made by the time of the accident?

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A I am not aware that any decision was made. At least, I don't recall it at this time.

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Q Did you ever express an opinion to anyone in the training department that they should not make such a decision?

12

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A I don't recall making that type of suggestion, no.

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(Recess taken.)

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Q Before you actually took the NRC examination to become a licensed control room operator, was there a program at Met Ed where an organization called General Physics came in and conducted oral examinations of the candidates for an operator's license?

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A Yes.

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Q Did you in fact have such an oral examination yourself by representatives of General Physics in the summer of 1977?

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A I had an oral examination by General

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Physics Corporation. I don't remember the date.

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Q But it was shortly before you were scheduled to take your NRC examination, was it not?

5

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A I remember it being several months, four or five months prior to the examination date.

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Q Wasn't one of the purposes of this program to be able to determine in advance whether the people who were candidates for the NRC examination would be likely to pass the exam?

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A It is my understanding that the purpose of the examination was to discover areas in each examinee which would require further study prior to the examination date to concentrate our studies in our weak areas rather than be unaware of them until the exam date.

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Q And this General Physics exam program was given to all of the people who were at that time considered to be candidates nearing the point where they would be taking their NRC exam?

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A It was my impression at the time that everyone who was going to be examined by the NRC had a General Physics exam as well, but I don't know that that was the case.

25

Q At the time they gave the examination to

1
2 you, they were also giving it to a number of other
3 people, were they not?

4 A Yes.

5 Q Did you receive a report from General
6 Physics on the results of that examination?

7 A When the examiner completed the oral
8 examination, he spoke with me about his impressions,
9 but I did not receive a report on the examination.

10 Q Did you learn at any time after you had
11 taken the examination that you had received a grade
12 of marginal fail?

13 A Yes.

14 Q Did you ever see any written report that
15 was prepared by General Physics for Met Ed concerning
16 the results of this examination program that they
17 administered in 1977?

18 A Other than the time I mentioned when the
19 oral examiner reviewed his notes with me, I don't
20 recall seeing another report besides that.

21 Q Let me show you a document which will be
22 marked as 649.

23 (Document was marked as B&W Exhibit
24 649 for identification, as of this date.)

25 Q I just ask you whether you ever saw a copy

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of that document in 1977.

MR. SELTZER: Is this another part of a document rather than being a complete document?

MR. WURTZ: It is part of a document. I believe it is complete as far as what it is.

MR. SELTZER: For example, the last page of what you handed us ends with "A specific comment is included with each operator." I don't see any specific comments for any operators here.

MR. FISKE: Let me show you two additional pages which bear the heading "Oral Audit Examination Results, Applicant E. R. Frederick, Examiner, A. Mangine." I will add those two pages to the document that has been marked.

If he can answer the question of whether or not he has seen the document that is in front of him, we will move on to the next subject and at a recess we can get you the complete document from which this is taken.

MR. SELTZER: In other words, from the fragments that he has handed you, do you recognize any of these fragments? They have not given you the whole document.

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recall seeing a copy of the report that General Physics made to Met Ed concerning this testing program other than the portion of the report which contained the comments on your own oral exam, and as to that, you are not sure whether you saw the page or whether you simply received oral comments to the effect of what is on the page. If that is your testimony, we can move on.

10

A I think that is substantively correct.

11

Q Let me show you the next exhibit, which

12

we will mark as B&W 650, which is a memorandum from

13

Mr. Tsaggaris to Mr. Lawyer, dated July 18, 1977,

14

subject, "General Physics Audit Exam Results."

15

(Memorandum from Mr. Tsaggaris to Mr.

16

Lawyer, dated July 18, 1977, subject, "General

17

Physics Audit Exam Results," was marked as

18

B&W Exhibit 650 for identification, as of this

19

date.)

20

Q Do you have B&W 650 in front of you?

21

A Yes.

22

Q In July 1977, what position did Mr. Tsaggaris

23

hold at GPU?

24

A I don't know what his position or title

25

was.

1
2 A I don't recall seeing any of these letters
3 or lists or parts of the documents other than the
4 last two pages that you gave me entitled "Oral
5 Audit Examination Results" with my name at the top
6 of the page.

7 Q You did receive that?

8 A I don't remember specifically seeing this
9 results sheet, but I do remember these comments,
10 whether they were read to me or I saw the sheet.

11 MR. WURTZ: We have here also the
12 complete document as produced by BPU containing
13 the evaluations of the other operators, if you
14 are interested in looking at that.

15 MR. FISKE: I believe that what was produced
16 to you, Mr. Frederick, was the complete document
17 other than individual comments on operators
18 other than yourself. But if you would like to
19 look at the rest of the document consisting of
20 the comments relating to the other operators,
21 you are free to do so.

22 THE WITNESS: Are you asking me to state
23 whether I have seen this portion of it or
24 that portion of it?

25 Q As I understand your testimony, you do not

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Q Did you know Mr. Tsaggaris in 1977?

A I knew Mr. Tsaggaris while he worked on the Island but pinning down this time frame might be difficult. He worked on the Island for a time and then he moved off the Island. I knew him while he was there.

Q What was his position in the summer of 1977?

A He had several jobs. I don't know what his position was at this time.

Q Was there any point in time when Mr. Tsaggaris has anything to do with training at Med Ed?

A Yes, he did work in the training department.

Q But you don't remember now in what capacity?

A No.

Q Did you know Mr. L. Lawyer in the summer of 1977?

A I don't recall having met Mr. Lawyer until after I began working in the training department in 1979.

Q Had you heard of Mr. Lawyer in the summer of 1977?

A I think so.

Q What did you understand his position was?

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MR. SELTZER: Objection. No foundation
that he had an understanding of his position.

A I don't recall whether I had an
understanding or was aware of his position in the
company at that time.

Q Directing your attention to the last page
on the bottom, there are four individuals referred to
there. G. P. Miller, J. Floyd, R. Zechman and D.
Goodman.

Did you know the position that any of those
individuals held in the summer of 1977?

A R. Zechman worked in the training
department and D. Goodman worked in the training
department. Jim Floyd and Gary Miller were in the
operations department.

Q Did you see a copy of this document in
the summer of 1977?

A I don't recall having seen this document
at all.

Q I think you said earlier that after the
Three Mile Island accident in or about June 19, 1979,
you became administrator, technical training, for
Unit 2 --

A Yes.

1
2 Q -- and as such, you then became part of the
3 Met Ed training department, correct --

4 A Yes.

5 Q --with responsibility for training others?

6 A Yes.

7 Q Let me show you a document that we will
8 mark as Exhibit 651.

9 (Memorandum from Mr. Frederick to Mr.
10 Zechman, dated September 7, 1979, was marked
11 as B&W Exhibit 651 for identification, as of
12 this date.)

13 Q Do you have that document in front of you?

14 A Yes.

15 Q Is that a memorandum that you wrote --

16 A Yes.

17 Q -- on or about September 7, 1979?

18 A Yes.

19 Q And that was to Mr. Zechman?

20 A Yes.

21 Q What was his position at that time?

22 A He was a supervisor in the training
23 department.

24 Q Do you still have in front of you a copy
25 of your letter to Mr. Collins and the enclosure which

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summarizes your training?

A Yes.

Q Part of the training that is listed in paragraph 3 of enclosure 1 is reactor theory. Do you see that?

A Yes.

Q Did you receive training at Met Ed on reactor theory?

A Yes.

Q Did you in the course of that training that you received at Met Ed learn, if you didn't know before, how it is that a pressurized water reactor works?

MR. SELTZER: I object. That is a compound question, since it is asking whether he had previously learned it, and if he had not previously learned it, did he learn it then.

(Continued on the next page.)

2 Q By the time you finished the training
3 program that is listed in paragraph 3 of enclosure 1,
4 did you understand how a pressurized water reactor
5 works?

6 MR. SELTZER: My guess is there are
7 professors at MIT who teach nuclear physics who
8 don't understand how everything in a nuclear
9 reactor works.

10 Maybe you want to be precise what elements
11 of PWR technology you are referring to.

12 Q Do you have trouble with the question?

13 A Yes.

14 Q Did you understand that the purpose of
15 the power generating equipment on which you were being
16 trained was to generate electricity?

17 A Are you still asking about my impressions
18 in this cold license training program?

19 Q No. Mr. Seltzer made an objection to an
20 earlier question, so I rephrased it and I will put it
21 again so there is no question about it.

22 I am talking now, just for the purposes of
23 simplicity in putting this question, about the period
24 of time after which you had completed the training
25 program which is referred to in paragraph 3 of enclosure

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1 which includes the course on reactor theory. That is the point in time I am asking about for the moment.

I am asking you whether at that point in time you understood that the purpose of the unit which you were studying to become licensed to operate was to generate electricity?

A I understood at that time that one of the goals and part of the purpose of that station was to produce electrical power for the consumer.

Q Did you understand that the electrical power was generated by a turbine?

MR. SELTZER: As opposed to a generator?

A As best I can recall, I think my understanding of the unit would have included the basic understanding that the turbine was involved in the process which produced electricity.

Q Did you understand that steam was generated which drove the turbine in order to produce electricity?

A Yes.

Q Did you understand that that steam was produced by hot water which circulated through pipes into a steam generator which contained water and in the process turned that water into steam?

A At this point, I was aware that that is how

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the Navy-type systems worked. The purpose of this course we were discussing was to give me an introduction to how the commercial plant worked.

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Q Did you understand that that is the way it worked also at TMI-2?

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A I don't recall what my understanding was about this particular steam generator at that time. It would certainly be colored by my understanding today, and separating the two might be difficult.

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Q Let's make it real simple. Let's take it to the period of time --

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(Discussion off the record between the witness and his counsel.)

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A Let's take it up to the period of time when you were applying for your license, when you were about to take the exam. At that time, did you understand that the way steam was generated at TMI Unit 2 was by hot water that circulated through pipes in the steam generator and turned the water in the steam generator into steam?

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MR. SELTZER: You are talking about secondary side water, feedwater?

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MR. FISKE: Read the question back.

(Record was read back.)

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2 Q If you have a problem with that question,
3 let me know.

4 MR. SELTZER: Why don't you just explain,
5 so we can get this over with, how you understood
6 at the time you were getting ready for your
7 license exam, how steam was generated.

8 MR. FISKE: That would be fine.

9 A The reason I was having a problem with
10 your question is it seems too simplified and not
11 precise in its description of how the steam plant
12 works. The specifics of the operation of the B&W
13 steam generator as we learned in the classroom and
14 simulator training given to us in the B&W program
15 was the water level in the generator is not actually
16 discernible from the point at which it passes through
17 the orifice point at the base of the steam generator.
18 There is no steam generator level.

19 Q I think you are getting ahead of what is
20 a very simple question. It may be at some point in
21 this deposition you might want to inject that kind of
22 testimony in response to a question to which it may be
23 more responsive.

24 My question couldn't be more simple. We
25 are talking about the very basic fundamentals of how

1
2 steam is generated in a pressurized water reactor.

3 That is all I am talking about right now. I am not
4 anywhere near as refined as the answer that you just
5 gave would suggest. We may get to that sometime down
6 the road, but let's start at the simple part of it.

7 MR. SELTZER: Do you want to say something,

8 Mr. Frederick?

9 A The confusion I had with your question is
10 you had asked me isn't this how it operates and isn't
11 this what you understood at the time of your licensing
12 exam, and the explanation I gave was a clarification
13 of what I understood at the time I gave the exam.

14 Q I am just asking about the process of how
15 the water in the steam generator is turned into steam.
16 Isn't it a fact that that process takes place as a
17 result of water that circulates through the steam
18 generator in what is commonly referred to as the
19 reactor coolant system?

20 A No.

21 Q You are familiar with something called a
22 reactor coolant system? Does that phrase mean something
23 to you?

24 A Yes.

25 Q In simple terms, that consists, does it

1
2 not, of a series of pipes through which water flows
3 essentially in a circle or around and around through
4 the same set of pipes?

5 MR. SELTZER: It is not a circle. I object.

6 It is a circuit or a loop.

7 Q A circuit.

8 A No.

9 MR. SELTZER: Why don't we, just to get
10 over this, because I think this is taking up more
11 time than it is probably worth to anybody, why
12 don't you just ask Mr. Frederick if he could
13 explain simply but correctly how he understood
14 steam was generated at or about the time he was
15 preparing for his licensing exam?

16 MR. FISKE: Let's put it very simply.

17 Q The reactor is referred to as a pressurized
18 water reactor, correct?

19 A For TMI-2, yes,

20 Q Where is the water that is pressurized?

21 A It is in the reactor coolant system.

22 Q During normal operations of the reactor,
23 at what temperature is the water?

24 A There are in various places in the system
25 different temperatures.

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Q The water is heated, is it not?

A Under normal operations. The water which is being pumped to the reactor coolant system is heated.

Q What heats the water?

A The water passes by the hot fuel elements in the reactor vessel.

Q And are the hot fuel elements commonly called the core?

A As a group, they are, yes.

Q To what temperature is the water heated in normal operations as it passes through the core?

A At 100 percent power, it is heated to approximately 608 degrees.

Q After it passes through the core and is heated to the 608 degrees Fahrenheit, it is then in what is often referred to as the hot leg of the reactor coolant system, is it not?

A After it leaves the reactor vessel, yes.

Q And then it proceeds from there and goes in the same pipes through the steam generator, does it not?

A When it reaches the steam generator, it divides into many, many pipes.

Q And then passes through the steam generator

1
2 still enclosed in those pipes?

3 A Yes.

4 Q And in the process of passing through the
5 steam generator, it turns water in the steam generator
6 into steam, isn't that correct?

7 MR. SELTZER: Different water, right?

8 MR. FISKE: Yes.

9 A Water on the outside of the tubes, yes.

10 Q In that process, heat is transferred from
11 the pipes in the reactor coolant system to the water
12 in the steam generator vessel, is that not correct?

13 A It returns from the steam generator to the
14 reactor vessel? Is that what you said?

15 Q Yes, after having transferred some heat
16 to the water in the steam generator.

17 MR. SELTZER: To the secondary water in
18 the steam generator?

19 MR. FISKE: Yes.

20 A Again, your characterization of fluid on
21 the opposite side of the tubes is not in conjunction
22 with my understanding of how it occurs, but the water
23 does leave the steam generator and returns to the
24 reactor vessel.

25 Q There is water in the steam generator?

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2 Mr. Seltzer refers to it as secondary water. There is
3 secondary water in the steam generator, correct?

4 A You can refer to it as a fluid, but to
5 characterize it as water would be incorrect.

6 Q The water in the primary system goes
7 through that fluid in the primary system pipes,
8 transfers heat and turns the fluid in the steam
9 generator into steam, correct?

10 A Yes.

11 Q Then when it leaves the steam generator,
12 the primary system water has been cooled down, has it
13 not, below 608 degrees?

14 A The primary water, yes.

15 Q What temperature is it at at that point
16 in normal operations?

17 A Approximately 556 degrees.

18 Q Now, at this stage, is it in what is
19 commonly referred to as the cold leg?

20 A Yes.

21 Q Then it continues through the pipes and
22 goes back through the core and is heated up once again,
23 is it not?

24 A Yes.

25 Q Then in the process of going through the

2 core, the water is heated back to 608 degrees and at
3 the same time the water serves the function of cooling
4 the core, does it not?

5 A Yes.

6 Q At atmospheric pressure, water boils at
7 212 degrees, does it not, Fahrenheit?

8 A It is a fair approximation.

9 Q What is it that keeps the water in the
10 primary system from boiling?

11 A The majority of the water in the reactor
12 coolant system other than that water which is trapped
13 in the pressurizer is not undergoing boiling because
14 it is under a high pressure.

15 Q And at what pressure is that water kept
16 during normal operations?

17 A 2,155 pounds.

18 Q Is it correct that it is the pressurizer
19 which produces the pressure that keeps the water from
20 boiling?

21 A The pressurizer system does that, yes.

22 Q And you understood, did you not, before
23 the Three Mile Island accident that the purpose of
24 the pressurizer is to keep the water from boiling?

25 A Yes.

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2 Q Isn't it a fundamental principle of
3 operating a pressurized water reactor that you should
4 keep the water in the primary system from boiling?

5 MR. SELTZER: You are asking whether this
6 was a fundamental principle that Mr. Frederick
7 was aware of before the Three Mile Island
8 accident?

9 MR. FISKE: Sure.

10 Q Did you understand before the accident
11 that it was a fundamental principle of operating a
12 pressurized water reactor that you should keep the
13 water in the primary system from boiling?

14 A I think my understanding could be more
15 clearly characterized by stating that it was my
16 understanding that the system was designed so that
17 under normal and emergency conditions, that system
18 would normally be kept from boiling.

19 Q And that it was a very important principle
20 of operating a reactor that the water should not be
21 allowed to boil?

22 MR. SELTZER: He said the system was
23 designed so that under both normal and emergency
24 conditions it wouldn't boil. I don't understand
25 how your next question is different.

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MR. FISKE: Maybe it isn't. Maybe you
can tell me.

Q Didn't you understand prior to the Three
Mile Island accident that it was important under both
normal and emergency conditions to keep the water in
the reactor coolant system from boiling?

MR. SELTZER: You mean important for the
operators to keep it from boiling? Is that
what the subject of the question is?

MR. FISKE: I don't think the question
could be much simpler.

MR. SELTZER: It is an intransitive
sentence. Passive voice sentence. I don't
know which. I am trying to find out who is
the actor in the sentence. What is the actor
that is supposed to keep the plant from boiling?
Is it the design that should keep it from boiling
or the operators that should keep it from boiling?

MR. FISKE: Let's make it real simple.

Q Did you understand before the accident
that it was important that during operation and emergency
conditions that the water in the reactor coolant
system not boil?

A Other than brief remarks made in the

2 description of the design and the original safety
3 analysis, and comments made during the initial B&W
4 training and in the refresher training given at Met
5 Ed, I don't remember that being emphasized as a point
6 of extreme importance.

7 Q Whether it was emphasized by Met Ed or not,
8 the question is just simply, in your understanding
9 of the system at the time of the accident, didn't
10 you understand that it was important that in both
11 operations and in emergency conditions that the water
12 not be allowed to boil?

13 A I have to state that my understanding was
14 that that was a part of the design of the plant, and I
15 don't recall having fixed any greater importance to
16 it than that.

17 Q Did you understand that in operating the
18 plant, one of the things that you were supposed to do
19 in operating it was not to allow it to boil?

20 A My recollection of the limits and
21 precautions and operating procedures and the
22 demonstrations given during my classroom and simulator
23 training was that that was not pointed out as one of
24 my duties.

25 Q Are you telling us that you did not

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understand as of the day of the accident that one of your responsibilities as an operator during operating or emergency conditions was to keep the water in the primary system from boiling?

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A Yes, I have to say that that was in my mind. I understood that to be part of the design of the plant that that would happen in normal and emergency conditions without any operator action.

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Q Let's make sure I understand that last answer. You understood that the water would boil in the primary system if pressure fell to a certain level, did you not?

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MR. SELTZER: What are you assuming about temperature and pressure?

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Q Let's assume if you want to build that into it, you understood that the water would boil if the pressure/temperature ratio reached what was known as saturation point, did you not?

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MR. SELTZER: What do you mean by

"temperature pressure ratio"? As a fraction with temperature on top and pressure on the bottom?

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Q Do you have a problem with that?

A Can you read it back.

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Q If you have a problem with that, I will put it again.

A You understood that at any given temperature in the plant there was a ratio between temperature and pressure at which if pressure came down to a certain point, the water would start to boil?

A We are talking about the water?

Q In the primary system.

A The reactor coolant system water?

Q Yes.

A No, I don't believe I had that understanding.

Q You mean you never understood before the accident that if the temperature of the water in the primary system stayed at the 608, 558 levels that they were at, and the pressure fell below 2155 and continued to fall, that the pressure would reach a point at which the water in the primary system would start to boil?

A I guess I am saying that I don't remember having training or understanding of that type of transient at which boiling began or some kind of accident or drop in pressure.

Q That wasn't my question. I am asking a question about your understanding of the system in the

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2 way it works. That is what we have been asking you
3 about for the last 20 or 25 minutes. I think you
4 testified that the water in the primary system is
5 heated at temperatures well above the levels at
6 which water boils at sea level and what keeps the
7 water from boiling is the fact that it is under
8 pressure. My question is really a very simple one.
9 Didn't you understand as part of your knowledge of
10 the system that if that pressure that kept the water
11 from boiling was not there, the water would boil?

12 A I think in answer to that question, I did
13 have the theoretical knowledge that the pressure is
14 what kept the water from boiling, but I don't at
15 this time recall having an understanding which was
16 derived from training or experience which showed me
17 the application of that theory in any of the procedures
18 or evolutions that I had ever seen so that I could
19 anticipate what you are saying would happen.

20 Q In other words, your testimony is nobody
21 had told you about a specific transient in which that
22 would happen?

23 MR. FISKE: Could you read back the last
24 answer.

25 (Record read.)

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A Your saying I was never taught about a specific transient is probably more detailed than I had testified. I don't remember being told of any transients in which that would happen.

Q Is the term "voiding" commonly used as a term which means formation of steam?

A Is it a currently used term?

Q Is it a commonly used term when people talk about voiding in the context of water in the reactor coolant system? Is that a term that is commonly used to refer to the formation of steam?

MR. SELTZER: Are you talking about commonly used to Mr. Frederick's understanding since the accident or before the accident?

MR. FISKE: Before the accident.

A It was not a commonly used term prior to the accident.

Q Have you used the term since the accident?

A Yes.

Q What does it mean, as you understand it, as it is used since the accident?

A It is the formation of steam in the reactor coolant system.

Q And is it correct that steam formation

1
2 results from boiling?

3 Q Yes.

4 Q Didn't you know before the accident that
5 it was possible to have voiding, as you have just
6 defined the term, in the core as a result of a loss-
7 of-coolant accident?

8 A I recall that prior to the accident in our
9 safety analysis lectures conducted by engineers and
10 instructors at B&W and generally endorsed at Met
11 Ed, we talked of a scenario in which there was a large
12 break LOCA and the system volume would be evacuated
13 from the core and there would be steam in the core
14 then. But, again, the term "voiding" was not attached
15 to that.

16 Q And the voiding that you referred to or
17 the formation of steam that you referred to is a
18 condition that is caused by a drop in pressure, is it
19 not?

20 A No, by the evacuation of the inventory
21 system through the leak.

22 Q With a drop in pressure?

23 MR. SELTZER: Are you asking him for
24 his understanding before the accident whether
25 the loss-of-coolant accident with the dropping

of inventory created a drop in pressure?

Q Let me just read you some questions and answers from the deposition that you gave to the Kemeny Commission. I am reading from page 111.

The questions and answers are as follows:

"Question: I understand. In what context did you understand about voiding in the core?

"Answer: I knew that it was possible in a loss-of-coolant accident.

"Question: How would that occur? What would have to occur first?

"Answer: Loss of inventory.

"Question: O. K., what other conditions?

"Answer: Decrease in pressure and high temperature.

"Question: Saturation?

"Answer: Yes, saturation or above, yes, it is possible to have superheating, too."

Were you asked those questions and did you give those answers?

A I don't have a specific recollection of this testimony, but I would concur that I was answering questions in this deposition.

(Luncheon recess taken at 12:20 p.m.)

AFTERNOON SESSION

2:00 p.m.

E D W A R D E. F R E D E R I C K, resumed.

EXAMINATION (continued)

BY MR. FISKE:

Q In the discussion we were having before

lunch, I think you had testified that the water that

goes through the core in the reactor coolant system

plays a cooling function in the sense that as it goes

through the core, it cools the core.

MR. SELTZER: I am just indicating to

him that there is no question pending.

Q Is that correct?

A I believe I agree with your characterization.

Q Did you understand before the accident that

if steam formed in the water as it went through the core,

that that made the heat removal more difficult?

A No. The understanding I had of the most

optimum method of heat transfer involved the formation

of steam bubbles.

Q That is so-called nucleate boiling?

A Yes.

Q That indeed occurs during normal operations,

does it not?

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A Yes, in a small fraction of the core.

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Q Could you describe this phenomenon known as "nucleate boiling" in as short a description as possible?

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A Nucleate boiling is the formation of steam bubbles at nucleation sites through the concentration of heat flux in a small area.

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Q And these are very small bubbles, are they not?

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MR. SELTZER: What do you mean by "very small"?

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MR. FISKE: Smaller than small.

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MR. SELTZER: What diameter?

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Q Let's ask Mr. Frederick to describe to us the size of the steam bubbles.

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A They are bubbles which in relation to the entire size of the fuel clad surface are small.

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Q Did you understand that if steam formed in the core beyond the normal nucleate boiling that you described, that the formation of that additional steam not present in normal operations could make it more difficult to remove heat from the core?

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A Yes.

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Q Did you understand that the presence of

1
2 quantities of steam in the core making it more
3 difficult to remove heat from the core could lead to
4 core damage?

5 A I understood that the formation of these
6 large amounts of steam could result in difficulty
7 in removing heat and then damage to the fuel
8 elements, yes.

9 MR. FISKE: Let me mark as Exhibit 652
10 a collection of pages, and mark as Exhibit 653
11 an excerpt from those pages.

12 (Collection of pages was marked as
13 B&W Exhibit 652 for identification, as of this
14 date.)

15 (Excerpt from pages marked as B&W Exhibit
16 652 was marked as B&W Exhibit 653 for
17 identification, as of this date.)

18 Q I am only going to be asking you about the
19 pages that are marked Exhibit 653. Those pages
20 are part of a larger collection of pages, all of which
21 have been marked in 652, and you are perfectly free
22 to look at the entire 652 but I am only going to be
23 asking you about 653.

24 MR. SELTZER: Is this from GPU's files
25 or B&W's files?

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2 MR. WURTZ: From GPU's files.

3 MR. SELTZER: Do you have the original
4 from which this exhibit was copied so that the
5 writing would be legible? On my copy, I can't
6 read the handwriting.

7 MR. FISKE: There is only one part of
8 the handwriting that I am going to ask Mr.
9 Frederick to look at. Maybe we can all work
10 our way through it when we get to it.

11 MR. SELTZER: We may be able to work our
12 way through that, but there might be a context
13 that is created by adjacent portions which are
14 also illegible. I think it would be better to
15 get the most legible copy if we are going to
16 have testimony from this exhibit and give the
17 witness and his counsel the opportunity to read
18 the document before questions are asked.

19 MR. FISKE: Just so we can move along,
20 this Exhibit 653, at least as I understand it,
21 consists of a series of separate questions put
22 to Mr. Frederick in an examination and handwritten
23 answers by Mr. Frederick to those questions.
24 I only intend to ask him about one discrete
25 question. I have no objection to at some point

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2 before the deposition is over to making
3 available the entire original of the exhibit,
4 assuming you still don't have it.

5 MR. SELTZER: I don't have it with me.
6 I certainly didn't anticipate that you were
7 going to ask questions on it. Otherwise, I
8 might have tried to bring the original with me.
9 But to be confronted at 2:05 with this document
10 for the first time and be told that "I can't
11 read it" I don't think is very satisfactory.

12 MR. FISKE: I think we are blowing this
13 a little bit out of proportion. As I said, there
14 is one question and one answer consisting of
15 about five lines that I am going to ask Mr.
16 Frederick about, and we are not going to finish
17 this deposition today. If you want to go back
18 and look at the original before this deposition
19 is over, you are certainly free to do it.

20 MR. SELTZER: Why don't you put the
21 question and then we will see if the
22 illegibility so obscures what it is that you
23 are examining on that we can't proceed.

24 BY MR. FISKE:

25 Q I am referring to Exhibit 653 and

specifically to the second page of that document which contains a number of separate questions, all of which are typed.

Do you see that page?

A Yes.

Q What I would like to do is ask my colleague Mr. Wurtz, whose eyesight is better than mine, to read into the record the typed question that appears at the bottom of that page.

MR. WURTZ: This is question B-5, "The procedure for loss of all reactor coolant pumps requires in the immediate actions that emergency feedwater establish natural circulation cooling."

Then sub A under that question is, "Explain emergency feed to OTSG's on loss of all RCP's."

Then sub B is, "Why is natural circulation required?"

Q Then I would like to direct your attention to the last page of this document. There is some handwriting at the top of the page.

Do you have that in front of you?

A Yes.

Q Do you recognize that handwriting?

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2 A It is most difficult by the copy to verify
3 that it is mine. I suspect that it is mine but it
4 doesn't look like the other sample that you showed me
5 is.

6 Q Why don't you go back and look at the page
7 immediately before the one I just showed you. That
8 is an entire page of handwriting, is it not?

9 A Yes.

10 Q Is that your handwriting?

11 A Yes, I think it is.

12 Q Having identified your handwriting on the
13 page immediately preceding, can you now look at the
14 last page of the document again and tell us whether
15 that is your handwriting?

16 A It looks to be similar to the handwriting
17 on the previous page. Again, I would think that was
18 probably mine.

19 Q I will give you an opportunity, if you like,
20 Mr. Frederick, to read that into the record or if you
21 prefer, we can ask Mr. Wurtz to do it.

22 A You can ask Mr. Wurtz to do it. I can't
23 make out some of the words.

24 Q Let's have Mr. Wurtz do it, and as he does
25 it, if you disagree with any particular words that he

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2 has read into the record, you let us know.

3 MR. WURTZ: This is an answer to the
4 prior question B-5, sub B, and at the top of
5 the page are the letters B-5B underlined.
6 Then the answer reads, "Since all reactor
7 coolant pumps are idle, there is no
8 mechanically induced circulation. Natural
9 circulation by heat transfer through the
10 OTSG's is required to remove core decay heat" --

11 MR. SELTZER: "Decay" that word is?

12 MR. WURTZ: Decay.

13 MR. SELTZER: Where do you see the "d"?

14 MR. WURTZ: I will read it and --

15 THE WITNESS: I think that phrase is
16 "decay heat" but it is difficult to make out.

17 MR. WURTZ: "Natural circulation by heat
18 transfer through the OTSG's is required to
19 remove core decay heat for natural circulation
20 system cooldown. There must be an active means
21 of decay heat removal to prevent steam
22 formation in the core and possible core damage."

23 Q Do you have any disagreement with
24 Mr. Wurtz's reading of your handwriting as it appears
25 on that page?

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A No, his deciphering of these inscriptions seems to be accurate.

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MR. SELTZER: May I suggest that in the future we would be willing to provide you with our original of something that is as difficult to read as this so that it would be easier to follow, and I would also suggest that it would have been a lot easier if for this short passage a stenographer had retyped it so we have the adjacent page to follow instead of having to sit and just listen to it orally for the first time.

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MR. FISKE: Your suggestions are noted.

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Q When you referred to steam formation in this answer, were you referring to steam formation other than nucleate boiling?

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A I don't recall writing the answer, nor do I remember what it is I had in mind any further than what is written.

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Q I think you testified in the beginning of the deposition that at one point you had given testimony before the full President's Commission in the course of a public hearing.

Do you remember giving that testimony?

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A Before the President's Commission in Washington?

Q Yes.

A Yes.

Q I would like to read to you a question and answer that appears on the bottom of page 199 and the top of 200. It is a question by Commissioner Pickford, "Mr. Frederick, at the time of the accident, were you also aware of the importance that the temperature be kept below the boiling point?"

"Mr. Frederick: Yes."

Do you see that question and answer in the transcript?

A Yes.

Q I take it you were also aware before the accident of the importance that the pressure be kept above the boiling point?

A Say that again.

Q You told Commissioner Pickford before the accident you were aware of the importance that the temperature be kept below the boiling point; correct?

A Yes.

Q Is it fair to say that you understood by the same token before the accident that it was

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2 important that pressure be kept above the point where
3 the water would boil?

4 A Yes, I also saw the maintenance of high
5 pressure as being an important part of the design of
6 the plant, yes.

7 Q By "maintenance of high pressure," are
8 you referring to the fact that it was important to
9 maintain high pressure?

10 A By maintenance, I meant that the system
11 was designed to do that. That was the job of the
12 pressurizer.

13 Q I think you testified earlier that there
14 was a time when you were interviewed by representatives
15 of the President's Commission.

16 MR. SELTZER: By members of the
17 President's Commission?

18 Q By staff members of the President's
19 Commission. By the staff of the President's Commission.

20 A This isn't an interview, is that right?

21 Q What you just put your hand on is the
22 testimony that you gave to the public before all the
23 members of the President's Commission.

24 A Yes.

25 MR. SELTZER: You testified you were

2 interviewed by the staff, deposed by the staff,
3 and testified before the full Commission. Now
4 he is talking about the interviews by the
5 staff.

6 Q Specifically, I am asking you about an
7 interview that you had with a gentleman named Michael
8 Hollis, a gentleman named Bill Bland, and a woman
9 named Ruth Dicker of the President's Commission in
10 May 1979.

11 A Again, I don't have a clear recollection
12 of that testimony, but those names do sound familiar.

13 Q I would like to show you a transcript of
14 that interview. I don't think we need to mark this
15 as an exhibit.

16 Maybe we better mark it. Let's mark this
17 transcript as B&W Exhibit 654.

18 (Transcript of interview had by Mr.
19 Frederick with Michael Hollis, Bill Bland and
20 Ruth Dicker was marked as B&W Exhibit 654 for
21 identification, as of this date.)

22 Q On the cover page it says "Interview of
23 Ed Frederick by the President's Commission, Hollis,
24 Dicker, Bland, May 10, 1979."

25 Directing your attention to the first page,

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2 it starts with page No. 12, at the top it says,
3 "Pape 3, Side 2."

4 Do you see that?

5 A Yes.

6 Q Do you remember that when you were
7 interviewed by Mr. Hollis and Mr. Bland and Ms.
8 Dicker, that there was a tape recording of the
9 interview?

10 A Clearly, this document indicates that there
11 was a tape, and there were tape machines present at
12 many of the interviews that I had. I would have no
13 reason to doubt that this was a taped transcript.

14 Q Do you see on the first page the first
15 answer where it says, "I attended Paterson State
16 Teachers College"?

17 A Yes.

18 Q And the words "Paterson State" are written
19 in above something that is crossed out?

20 A Yes.

21 Q Do you know whose handwriting that is?

22 A No, I do not.

23 Q Directing your attention to page 18, do
24 you see the word "bided" in the sixth line on that
25 page?

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A Yes.

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Q Do you know whose handwriting that is?

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A No, I do not.

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(Continued on the next page.)

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2 Q I would like to direct your attention to
3 page 17, and I might indicate that this is the second
4 page 17. The numbers start all over again. They go
5 to 29, and then they start again. I am referring
6 to page 17 in the second set.

7 I would like to direct your attention to
8 the answer that you gave beginning on page 17 and
9 continuing over to page 18.

10 Have you had a chance to read that?

11 A Yes.

12 Q I would like to read the answer beginning
13 on page 17 through page 18, part of the answer on
14 page 18, and I would like to ask you a question.

15 Do you see where it says "Can I draw you
16 a little picture" in your answer on page 17?

17 A Yes.

18 Q Then there is written in the margin the
19 word "diagram," and then the transcript reads as
20 follows: "This is the reactor and it is a heat
21 source. It is hot. Then you have a pump and another
22 tank, and this tank is divided in half. This is for
23 illustrative purposes. It has a wall down the middle
24 of it. The purpose of this pump is to circulate this
25 hot water in the loop, so that hot water comes out

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2 of the reactor and goes through this tank, comes back
3 and goes into the reactor. From this side of the wall
4 is water. Now this hot water passing from this side
5 will cause that water to boil on the other side of the
6 wall, and that water will boil, cause steam, go into
7 the turbine and generate electricity. Now, as this
8 water passes through the steam generator and heats
9 that water up, it becomes cold. So that if this is
10 hot, this is relatively cold. It is only about
11 50 degrees or so. We are talking 603 degrees on the
12 inlet, and 556 degrees on the outlet, so it is not that
13 much different. This hot to cold is what protects the
14 reactor. In other words, as long as you have this
15 cooling water coming in to take the heat away from
16 the reactor, and put it in this tank, then you have
17 the normal sequence. Anything that you can do that
18 would stop this or reduce it in any way will cause
19 the reactor to heat up. O.K.? And all of the
20 safeguards that we have are designed to prevent an
21 overheating or a boiling condition in the reactor."

22 Do you remember making that statement to
23 the representatives of the President's Commission on
24 tape?

25 MR. SELTZER: When you say members of the

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commission --

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Q Members of the staff of the President's Commission.

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A No, I don't specifically remember saying these words. I have no reason to doubt that this is an accurate transcription, but I was often in the position during this testimony of describing to lawyers and other representatives who were not familiar with how the plant worked and trying to explain to them what goes on basically in a nuclear power plant, and this appears to be an attempt to use a simplified diagram to explain the design of the system.

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Q At the time you were doing that, were you trying to do that as accurately as you could?

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A No, this is a very, very simplified explanation.

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Q Were --

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A It is quite obvious that the steam generator is not divided in half and has a wall and that sort of thing.

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Q What you were giving to the members of the staff of the President's Commission was sort of a layman's description in simple terms of how the system works, isn't that correct?

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2 A I think earlier on in the testimony, I
3 was dealing on a layman's level, and then he asked me
4 to clarify it further, and I had to go even more
5 simple than that. He asked me, "Can you tie these two
6 together for us," on page 17. He wanted a further
7 explanation of what I had explained.

8 Q But it was in that context of making it
9 as simple for him as you could that you made the
10 statement I just read?

11 A Yes.

12 Q Isn't it correct that the reason why it
13 was important before the accident to prevent a situation
14 where boiling occurred in the primary system was to
15 prevent the formation of steam in the core which could
16 cause core damage?

17 MR. SELTZER: I object. No foundation
18 that the witness had the understandings that you
19 are implying in your question and that he had
20 those understandings before the accident.

21 MR. FISKE: You can note that objection
22 for the record if you want. I believe I have
23 established a sufficient predicate for it.
24 If I am wrong, you can tell me later. Meanwhile,
25 I would like to have Mr. Frederick answer.

1
2 MR. SELTZER: Why do you have to make a
3 speech? I simply stated the objection.

4 MR. FISKE: I am responding to your
5 statement.

6 MR. SELTZER: You don't have to argue
7 the motion.

8 MR. FISKE: You stated an objection. I
9 am responding why I am choosing not to accept it.

10 MR. SELTZER: The deposition would get on
11 much faster and much more constructively if you
12 would not keep responding to my objections.
13 I usually do not bridle and respond to your
14 objections.

15 MR. FISKE: It is not a matter of bridling.
16 It is a matter of responding.

17 MR. SELTZER: It would not offend me if you
18 didn't respond to my objections.

19 MR. FISKE: It wouldn't offend me if you
20 didn't make the objection in the first place.

21 MR. SELTZER: It is my duty to make the
22 objections if they are warranted.

23 Are you asking for his present understanding
24 of why it is important, or are you asking for an
25 understanding that he had before the accident

1
2 since you didn't make any time connection in
3 your question?

4 MR. FISKE: Read back the question.

5 (Record was read back.)

6 MR. SELTZER: Are you asking for his
7 understanding post-accident or pre-accident?

8 MR. FISKE: I will start again.

9 Q The testimony that I have read to you
10 from the President's Commission said that you
11 understood before the accident that it was important
12 that the temperature be maintained below the boiling
13 point.

14 In the other answers that you gave earlier,
15 you said that you knew before the accident that if
16 steam formed in the core, other than as a result of
17 nucleate boiling, that could cause core damage.

18 All I am simply trying to do is ask you,
19 putting those two together, didn't you understand
20 before the accident that a reason why it was important
21 not to allow boiling to occur in the primary coolant
22 system was to prevent or to avoid the formation of
23 steam in the core which could cause core damage?

24 MR. SELTZER: I object. There is no
25 foundation that he has previously testified that

1
2 he had an understanding before the accident that
3 it was important to avoid boiling in the reactor
4 coolant system.

5 MR. FISKE: I will stand on the record on
6 that. It is just three questions and answers
7 back.

8 MR. SELTZER: I think that is your
9 synthesis of a lot of different answers and you
10 are entitled to do a summation however you want.

11 MR. FISKE: I would like an answer to the
12 question.

13 Q You understand, and I am sure Mr. Seltzer
14 explained before the deposition that simply because he
15 interposes an objection, that doesn't mean that you
16 don't answer the question. He makes the objection and
17 we sort that out later. In the meantime, you and I
18 go on.

19 Would you like to hear the question again?

20 A Didn't you have two questions that you
21 asked me?

22 Q One question based upon two prior answers.

23 A I would like to hear that again.

24 (Record was read back.)

25 A No. I guess I am having a problem following

1
2 through what you said just before you asked the question
3 and then you asked the question. This was a discussion
4 I was having with these people and trying to tell
5 them how the plant worked. Then you asked me didn't I
6 understand how steam formation was dangerous.

7 Q Is your answer to my last question no?

8 A Yes.

9 Q I will read you the question and answer
10 again that you gave to the President's Commission in
11 public. This is your public testimony before all the
12 members of the commission. Page 199 and 200.

13 "Commissioner Pickford: Mr. Frederick, at
14 the time of the accident, were you also aware of the
15 importance that the temperature be kept below the
16 boiling point?

17 "Mr. Frederick: Yes."

18 A I am talking now --

19 MR. SELTZER: There is no question pending.

20 Q You testified previously that you understood
21 before the accident that boiling could cause steam,
22 correct?

23 A Yes.

24 Q And you testified before earlier that you
25 knew before the accident that the formation of steam

2 in the core could cause core damage, isn't that
3 correct?

4 MR. SELTZER: Is that something you knew
5 before the accident?

6 Q Isn't that something you testified to
7 just less than an hour ago, that you knew before the
8 accident that the formation of steam in the core other
9 than nucleate boiling could make it more difficult to
10 remove heat from the core and thereby cause core
11 damage?

12 A Yes, you asked me that question and I
13 think I clarified it by saying damage to the fuel
14 elements progressing from nucleate boiling.

15 Q And damage to the fuel elements is damage
16 to the core, is it not?

17 A My impression now of what damage to the
18 core is in light of the accident is not what I thought
19 damage to the core was then.

20 Q I am talking about the answer that you
21 gave to this question that we previously read into the
22 record, 653, where you said, "There must be an active
23 source of decay heat removal to prevent steam formation
24 in the core and possible core damage."

25 MR. SELTZER: Mr. Frederick previously

1
2 testified that he didn't recall writing this
3 and couldn't recall what he meant when he wrote
4 this.

5 Q In light of the discussion we have been
6 having in the last several questions and answers, let
7 me ask this question:

8 Is it your testimony today that before the
9 accident that you did not understand that one reason
10 it was important to keep the water in the primary
11 system from boiling was to prevent the formation of
12 steam in the core which could cause core damage?

13 A Correct me if I am wrong, but I think I
14 testified earlier that I thought that was an important
15 part of the design of the plant.

16 Q So your answer is yes, you did have that
17 understanding?

18 A The answer was I thought it was an important
19 part of the design.

20 Q In other words, you thought that it was an
21 important part of the design of the plant to keep the
22 water in the primary system from boiling in order that
23 steam not be created in the core which could cause core
24 damage?

25 A No, I felt that it was an important part of

1
2 the design of the plant which was carried out by
3 the design of the plant, which maintained it as a
4 pressurized water reactor.

5 Q I am not clear what you mean by your
6 answer. You felt what was important?

7 A We were talking about prevention of the
8 water from boiling.

9 Q Right. And that one of the reasons that
10 it was important to keep the water from boiling,
11 whether that was by the design of the plant or by any
12 other means, was to prevent the formation of steam in
13 the core which would cause core damage, isn't that
14 correct? Didn't you have that understanding?

15 A No, I didn't understand it the way you
16 are stating it now.

17 Q So is it your testimony that before the
18 accident, you didn't understand that boiling in the
19 primary system could cause the creation of steam?

20 A I understood that boiling would cause
21 steam.

22 Q And didn't you understand before the
23 accident that the formation of steam in the core other
24 than nucleate boiling could cause core damage?

25 A No.

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Q Do you remember being interviewed in the summer of 1979 by members of the staff of the Subcommittee on Nuclear Regulation of the United States Senate Committee on Environment and Public Works?

A This is not one of the groups that you mentioned before, is it?

Q We referred generally to congressional committees before. I don't think we identified this one specifically.

MR. SELTZER: Who is the lead public representative on that?

Q The people listed as participating in this interview are Drew Arena, chief counsel, Steven Blush, investigator.

A I don't have a specific memory of that interview. Mr. Arena's name sounds familiar.

Q Let me show you a transcript of that interview. I would like to direct your attention to page 14. The question by Mr. Blush, "Had you had any experience prior to March 28th with fuel failure?

"Mr. Frederick: You mean actual operating experience?

"Mr. Blush: Yes, operating experience.

"Mr. Frederick: No.

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"Mr. Arena: In the course of your training, what are you trained to anticipate as the causes of fuel failure?

"Mr. Frederick: I suppose the emphasis is on overheating due to excessive flux peaking at the clad which causes melting or overheating due to the steam blanketing of the fuel that prevents the heat from transferring out of the element and damages the clad."

I would like to ask you was it that type of core damage that you were referring to in the answer to the exam questions that we showed you earlier?

A You are referring to the question on this Exhibit 653?

Q Yes.

A The answer is no. The characterization I am giving here of core damage is post-accident understanding.

MR. SELTZER: Maybe it would help, and I hesitate even to suggest it, but you could ask before the accident what understanding did Mr. Frederick have that steam formation in the core could cause core damage, and I think that

1
2 is different from anything that you have asked
3 and may get at what you are trying to find out.

4 MR. FISKE: I think Mr. Frederick has
5 already answered that question. I think the only
6 thing he hasn't answered is the connection
7 between that and boiling.

8 Q Is it your testimony that before the Three
9 Mile Island accident you were not aware that steam
10 blanketing of the fuel in the core could prevent the
11 heat from transferring out of the core and could cause
12 damage to the clad?

13 A No, I was referring to the answer that I
14 gave in this United States Senate testimony, and it
15 says here that I understood that it was overheating
16 due to excessive flux peaking at the clad which causes
17 melting or overheating, and due to steam blanketing,
18 and what I am stating is that that characterization of
19 the process is post-accident knowledge.

20 Q Whatever the process was, you did understand
21 before the accident that the formation of steam in the
22 core beyond nucleate boiling could cause a reduction
23 in the transfer of heat from the core?

24 A Yes.

25 Q And that that could cause core damage?

1
2 A If the definition of core damage remains
3 within the context of my understanding of what core
4 damage was prior to the accident, I would agree with
5 that.

6 MR. SELTZER: So the record isn't
7 ambiguous, why don't you state what your
8 understanding is of what core damage is in the
9 sense that you are using it.

10 A Previous to the accident, core damage,
11 I understood core damage to be you could have a steam
12 production that would cause damage to the service of
13 the clad and it would cause tiny fissures in the clad,
14 cracks, and since the accident, my idea of core damage
15 would have been greatly altered.

16 What I would characterize as core damage
17 now would coincide with some of the post-accident
18 analyses that have been done on the damage that is
19 supposed to have happened to TMI-2.

20 Q Did you understand the type of core damage
21 that you just described could result in a release of
22 fission products to the reactor core?

23 MR. SELTZER: You mean his pre-accident
24 knowledge of what core damage could be?

25 MR. FISKE: The limited definition he just

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2

gave.

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A Yes.

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Q Did you understand that was undesirable?

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A I understood that the type of damage that

6

I was referring to existed even to some small degree

7

during normal operations and that the release of fission

8

products due to that damage was within the operating

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limitations and capabilities of the plant, even

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though it was undesirable.

11

Q I am not asking now whether there were other

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backup mechanisms that were designed to deal with the

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problem if it occurred. I am simply asking you isn't

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it a fact that you understood that you were supposed

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to run the plant so that kind of thing didn't occur?

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MR. SELTZER: He just said he understood

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it would occur in normal operation.

18

Q Did you understand that you were supposed

19

to run the plant in such a way that you would not cause

20

the kind of core damage that you have just described in

21

your answer to Mr. Seltzer?

22

A The plant was to be operated so as not to

23

cause any more damage of that nature that was present

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during normal operations.

25

Q Was it your understanding before the

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accident that that was the only kind of core damage that could possibly occur to the core under any circumstances?

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A I was not made aware during my training at B&W or the refresher training at Met Ed what types of damage could occur to the core or the system as a whole as a result of the accidents that they described in the safety analysis.

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Q That isn't my question. My question was did you have an understanding before the accident that there was no other kind of core damage that could occur regardless of the circumstances other than the type that you just described to Mr. Seltzer?

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A Yes.

Q Were you familiar before the accident with

something called a heatup/cooldown curve?

A Yes.

19

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Q Were there several different heatup/cooldown

curves that had to be found?

21

22

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A There were several curves that had to be referred to when doing a heatup or cooldown, but they weren't all called the heatup and cooldown curve.

24

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Q Were these curves a reflection of various pressure/temperature relationships?

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A The one that I am thinking of is a pressure versus temperature plot, yes.

3

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Q Were you familiar with a phrase before the accident called the pressure/temperature envelope?

5

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A I know that we use that phrase now in training quite a bit. I can't remember whether that is a pre-accident phrase or not.

7

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Q Whether the phrase itself came into existence before or after the accident, is the concept referred to in that phrase one that was known before the accident?

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A Known to me?

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Q Yes.

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A I understood the pressure/temperature envelope and I understand it now to be the normal operating range of the pressure and temperature in the plant at full power.

17

18

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Q So is your understanding of the pressure/temperature envelope one fixed pressure and one fixed temperature?

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A No, it is a range.

23

Q What is at the bottom end of that range?

24

25

A What I would refer to as the bottom end of the range would be the lowest pressure that would be

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obtained in normal pressurizer operation.

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Q Let me show you a document which has been marked as Exhibit 572. Do you recognize that?

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A This is a portion of the license document for Unit 2. The revision date isn't noted on here, but it is one of the revisions of the license attachment.

8

9

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Q Do you recognize this as the section of the technical specifications dealing with safety limits and limiting safety system settings?

11

12

13

A Yes.

Q You were trained on this, were you not,

before the accident at Met Ed?

14

A Yes.

15

16

17

Q Directing your attention to page 2-1, the very first item in this technical specification, do you see where it says "2.1 Safety Limits"?

18

A Yes.

19

Q Right under that, it says "Reactor Core."

20

A Yes.

21

22

23

24

Q Then it reads, "2.1.1 The combination of the reactor coolant core outlet pressure and outlet temperature shall not exceed the safety limits shown in Figure 2.1-1."

25

Do you see that?

1

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A Yes.

3

Q Then do you see Figure 2.1-1?

4

A Yes.

5

6

Q Does that figure set forth this pressure/
temperature envelope that you just described?

7

A No.

8

9

Q What do you understand this figure does
set forth?

10

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A These are the limiting safety system set
points for the reactor protection system.

12

13

Q This Figure 2.1-1 sets forth various
pressure and temperature criteria, does it not?

14

A Yes.

15

16

Q And do you see the words "Acceptable
operation" in the middle of that chart?

17

A Yes.

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Q Did you understand that the reactor had
to be operated within the limits, pressure/temperature
limits, covered by the acceptable operations part of
this figure?

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A No. More specifically, my understanding
was that the operation of the reactor could not continue
out of the bounds of these limits shown on this figure.
The normal operating parameters were much more

2 restrictive than this.

3 Q What did you understand would happen if
4 the reactor was operated outside the limits?

5 MR. SELTZER: Objection. No foundation.

6 A The operator or the reactor cannot operate
7 outside these limits.

8 Q What would happen if it was operating and
9 either the pressure fell or the temperature rose beyond
10 these limits?

11 A In the case where pressure fell or
12 temperature rose or pressure rose or you met the
13 variable pressure and temperature trip, in each one
14 of those cases the reactor protection system would
15 insert the control rods in what was termed the reactor
16 trip.

17 Q In other words, the reactor would trip if
18 you went outside these boundaries?

19 A Yes.

20 Q Why did you understand that these boundaries
21 were referred to as a safety limit?

22 MR. SELTZER: Objection. No foundation.

23 Q I will put another question. Going back
24 to paragraph 2.1.1, under "Safety Limits," the "Reactor
25 Core," it says, "The combination of the reactor coolant

1
2 core outlet pressure and outlet temperature shall not
3 exceed the safety limits shown in Figure 2.1-1."

4 Why do you understand that was referred to
5 as a safety limit?

6 A The clarification I gave before referred
7 to all these lines here that are labeled high pressure
8 trip, and temperature, and all those others. The
9 safety limits on this curve is the line that is to the
10 right of all those numbers, to the right of that box,
11 and it has an arrow pointing to it that says "Safety
12 limit." We were discussing the other box and the
13 operator's envelope.

14 Q Let's talk of the safety limits on the
15 Figure 2.1-1, on the line that is drawn and designated
16 specifically "Safety limit." You understood, did you
17 not, from the tech specs that the operator was not --
18 the reactor was not to be operated outside those
19 safety limits?

20 MR. SELTZER: Now we are talking about a
21 technical specification?

22 MR. FISKE: We are talking about the same
23 sentence. "The combination of the reactor coolant
24 outlet pressure and outlet temperature shall not
25 exceed the safety limits shown in Figure 2.1-1."

1
2 Mr. Frederick pointed out the safety limit on
3 Figure 2.1-1 is a line that proceeds upwards on
4 the right-hand side of the graph.

5 I am asking him why did he understand that
6 was referred to as a safety limit.

7 MR. SELTZER: No foundation. Objection.

8 A I understood that line to be a safety
9 limit because it is referred to under the technical
10 specification heading of "Safety Limits" and has an
11 arrow pointing to it that says "Safety limit."

12 Q Other than the fact that it is in the
13 section of the technical specifications referred to as
14 "Safety Limits" and the fact that the line itself is
15 designated "Safety limit" line, did anybody at Met Ed
16 in the course of your training tell you why that line
17 represented a safety limit? Why was it called a safety
18 limit?

19 MR. SELTZER: Which question are you
20 putting?

21 MR. FISKE: The same question.

22 MR. SELTZER: The last one, why was it
23 called a safety limit?

24 Q Did anybody tell you in the course of your
25 training at Met Ed why this was a safety limit?

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A I believe the first time that I was taught about safety limits was at the cold license training in Lynchburg, and the things on the four pages called the "Safety Limits" were designated as safety limits because they related directly to the safety of the plant.

Q Why did you understand it to be unsafe for the plant if you went on the wrong side of the safety limit line?

A Before the accident, I understood that that line, the "Safety limit" line, represented the point at which DNBR would occur.

Q Does that stand for departure from nucleate boiling ratio?

A Yes.

Q What did you understand would happen to the plant if that occurred?

A If the plant reached the point of DNB, then some partial film boiling would occur.

Q What was unsafe about having film boiling occur?

A The fact that film boiling would occur in and of itself would not be unsafe in that occasionally during transients film boiling does occur, but it would

1
2 be undesirable because the type of fuel clad damage
3 that I described is likely to occur under partial film
4 boiling or film boiling.

5 Q Did you understand there was no safety
6 problem if DNB was reached?

7 A It was my understanding that simply
8 exceeding that limit would not necessarily cause the
9 type of damage that I described and that the actions
10 that had to be taken were outlined in the paragraph
11 below the one that we were just talking about.

12 Q Before we get to the actions, I would like
13 to stick with your understanding of the significance of
14 adhering to this limit. At any time when you were in
15 any of your training programs at either Met Ed or B&W,
16 did you ever ask anyone why is this line referred to
17 as a safety limit?

18 A As I remember, it was described--the answer
19 to the question is no. As I remember, it was described
20 quite thoroughly in B&W initial training.

21 Q Why did they tell you it was a safety
22 limit?

23 A Because exceeding that limit and the other
24 safety limits was the first step in beginning to
25 challenge the design of the plants, and I felt that

1
2 these were safety limits that the operators might not
3 necessarily conclude that damage had occurred, simply
4 because they gave you quite a bit of time to respond
5 to them.

6 Q Directing your attention to Section 2.1 at
7 page B2-1 of the technical specifications, following
8 the word "Note," do you see that?

9 A Yes.

10 Q You see the note on the preceding page,
11 it says, "The summary statements contained in this
12 section provide the bases for the specifications of
13 Section 2.0 and are not considered a part of these
14 technical specifications as provided in 10 CFR 50.36"?

15 A Yes, I see that note.

16 Q We are talking now about a Met Ed
17 document, are we not, this technical specification?
18 That refers to Unit 2 of Three Mile Island?

19 A What is a Met Ed document?

20 Q This is a document governing Three Mile
21 Island Unit 2 which is operated by Metropolitan Edison,
22 the basis upon which the NRC gave a license to Met Ed
23 to operate this plant. That is what I mean by Met Ed
24 document.

25 A This is a document that we use to govern

1
2 our actions in control of the plant as opposed to a
3 document that was originated by Met Ed.

4 Q You were trained on this document, were you
5 not, at Met Ed, these technical specifications?

6 (Discussion off the record between the
7 witness and his counsel.)

8 Q Did you understand from your training at
9 Met Ed that the technical specifications for Three Mile
10 Island Unit 2 were the basis upon which the Nuclear
11 Regulatory Commission had granted a license to Met Ed
12 to operate the plant?

13 MR. SELTZER: Objection.

14 A Yes.

15 Q And this document referring to 2.1.1 on
16 page B2.1 that you have in front of you reads, under
17 "Safety Limits," referring back to the section I read
18 to you several times already, referring back to Section
19 2.1.1, this says, "The restriction of this safety
20 limit prevents overheating of the fuel cladding and
21 possible cladding perforation which would result in
22 the release of fission products to the reactor core."

23 Do you see that?

24 A Yes.

25 Q Did you understand before the accident that

1
2 this safety limit as it has been described by Met Ed
3 in its NRC document was designed to prevent overheating
4 of the fuel cladding and possible cladding perforation
5 which would result in the release of fission products
6 in the reactor core?

7 (Discussion off the record between the
8 witness and his counsel.)

9 A I think I lost the question. Can I have it
10 read back?

11 (Record was read back.)

12 A No. I understood what you just read there
13 to refer to, as it says there, both of those
14 specifications, No. 1 and No. 2. The paragraphs written
15 in this part of the bases cover the combination of
16 those two safety limits.

17 Q I think you already said that you understood
18 before the accident that if pressure/temperature ratio
19 was allowed to fall to the right side of the line that
20 is designated as the "Safety limit" on the figure,
21 that that could cause a departure from nucleate boiling?

22 A Yes.

23 Q And you knew, did you not, that a departure
24 from nucleate boiling could produce a potential safety
25 problem?

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A Yes.

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Q Let me show you a document which has been marked previously as B&W Exhibit 540. Do you have that in front of you?

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A Yes.

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Q You said earlier, I believe, that the technical specification figure that we have just referred to a moment ago was designed to set forth the limits within which the reactor should be kept while it was operating and that if it went outside those limits, the reactor would trip. Is that correct?

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A No, I said -- the second part of your question is right. If we went outside the limits, the reactor would trip, but the operator's intention is to keep the operating parameters of the system in a much more restricted envelope than that.

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Q I believe that was implicit in my question, but in any event, the figure that is in the tech specs was designed to cover the limits that should apply during normal power operations?

22

(Record was read back.)

23

24

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A No, the limits that apply during normal operations are more restrictive than those shown in the technical specifications.

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Q You weren't supposed to go outside the limits in the figure during normal power operations?

3

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A In fact, it was impossible to operate outside those limits.

5

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Q Did you also have procedures whereby after a reactor trip and you were no longer in normal power operations, that it was important to maintain certain pressure/temperature ratios within the reactor coolant system?

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A Upon establishing the prerequisites for technical specification mode 3, after a reactor trip or plant transient, then there are procedures which cover what the plant parameters should be.

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Q Is Exhibit 540 that I just showed you one such procedure?

16

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A Yes.

18

Q That is called Unit Cooldown, is it not?

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A Yes.

20

Q Can you turn to the, I believe it is called Figure 1. It is page 16.

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22

(Discussion off the record between the witness and his counsel.)

23

24

Q Do you have the figure in front of you, page 16?

25

1

2

A Yes.

3

Q Figure 1?

4

A Yes.

5

Q That is called a heatup/cooldown curve.

6

Do you see that at the top?

7

A Yes.

8

Q Did you understand that during the course

9

of a cooldown, following a reactor trip, that it was

10

necessary to maintain pressure/temperature relationships

11

as defined by various of the curves on this figure?

12

A The time to use this procedure is stipulated

13

in the prerequisites. When to use this figure is

14

stipulated in the prerequisites of this procedure, and

15

that is when you would refer to this figure.

16

That I understood, yes.

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(Continued on the following page.)

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Q Did you understand that within the prerequisites specified in the procedure, that it was necessary to be sure that as the plant cooled down, you maintained pressure and temperature in certain ratios as prescribed by this curve?

A Yes.

Q Take, for example, curve No. 5. Do you see curve No. 5 at the bottom?

A Yes.

Q What does that curve designate?

A The legend on the diagram shows it as being the minimum RC pressure for single pump in a loop NPSH or 1/0, 1/1, 2/1 instrument error plus 50 pounds and 12 degrees Fahrenheit.

Q Is that sometimes referred to as the net positive suction head?

A It is the net positive suction head curve for a particular pump configuration.

Q And No. 6 is the net positive suction head curve also?

A Again it is a net positive suction head curve for other pump configurations.

Q During the course of a cooldown being conducted pursuant to this procedure, did you

1
2 understand which side of the curve you were supposed
3 to keep the pressure temperature ratio on?

4 A Yes.

5 Q Which side?

6 A Which side of the curve No. 5 and curve
7 No. 6?

8 Q Yes.

9 A The area of the curve which is to the left
10 and above the curve.

11 Q Were you trained on how, during the course
12 of a transient where you were following this cooldown
13 procedure, you would be able to tell which side of
14 the curve you were on?

15 A Yes.

16 Q How were you trained to do that?

17 A I recall that the procedure stipulates the
18 instruments to be used to read the parameters on this
19 graph.

20 Q What other parameters on the graph that
21 you have to read?

22 A Reactor coolant pressure and temperature
23 in degrees Fahrenheit.

24 Q Temperature of what?

25 A I don't recall now whether it was average

1
2 temperature or cold loop temperature. It would say so
3 in the body of the procedure. I could look it up.

4 Q What instrumentation was there in the
5 control room that showed what the T-AV and T-C were?

6 A Average temperature and cold leg
7 temperature are displayed several places on the panel.

8 Q And reactor coolant system pressure is also
9 displayed on the panel?

10 A Yes.

11 Q So do I understand that in the course of
12 conducting a cooldown pursuant to this procedure, that
13 the operators were trained to watch the instrumentation
14 for pressure and temperature to be sure that pressure
15 and temperature were maintained to the left and above
16 these curves as the curves became applicable?

17 A The net positive suction head curves?

18 Q Yes.

19 A Yes, those are the only ones or those are
20 the only two that you would have to stay to the left
21 of. Some of these you have to stay to the right of.

22 Q Which ones did you have to stay to the
23 left of and which ones did you have to stay to the
24 right of?

25 A The curve which is labeled A, B, C, D, E

1
2 is a line which the operator had to remain to the
3 right of. Since the rest of them are curved lines,
4 they are all to stay to the left of, including lines
5 2 and 3, you stay to the left of also.

6 Q Could we talk about lines 2 and 3 for a
7 minute.

8 What are those referring to? What did you
9 understand prior to the accident that those referred
10 to?

11 A Those were minimum pressure guidelines.
12 You had to stay to the left of those. Left and above.

13 Q Are those referred to as fuel pin
14 compression curves?

15 A I seem to remember they were called fuel
16 clad compression curves, but it would be essentially
17 the same thing.

18 Q What did you understand before the accident
19 would happen if pressure and temperature was allowed
20 to fall to the right-hand side of the fuel clad
21 compression curves?

22 MR. SELTZER: Objection. No foundation
23 he had an understanding.

24 A That if you exceeded that temperature at
25 that pressure or exceeded to the rate of that curve,

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you would not have sufficient pressure on the clad surface to conform with the way it was designed.

Q And it was designed to maintain a certain pressure on the outside of the surface to balance the pressure from the inside of the surface; isn't that correct?

A Yes.

Q And what did you understand would happen or could happen if the pressure was allowed to drop to the point where the pressure on the outside was less than the pressure on the inside?

A I think that there would be some distortion of the clad surface.

Q And potential damage to the clad?

A Again, not the same type of damage we were speaking of earlier where you would get little fissures. We were talking about getting ripples along the edge of the clad. Unevenness.

Q But you understood if the pressure was allowed to drop to the right-hand side of these curves, you could create a situation where clad damage could occur as a result of an imbalance of pressure?

MR. SELTZER: By "clad damage," do you mean the ripples that the witness has just

described?

MR. FISKE: I mean any kind of damage.

MR. SELTZER: You mean any damage other than what he just described?

Q Did you understand that the further the pressure dropped to the right of this curve, the greater the imbalance there would be between the pressure pushing out from inside the clad and the pressure on the outside?

MR. SELTZER: Is that anything that you thought about before the accident? If so, answer his question.

MR. FISKE: I don't think you need to inject that. I think the question is perfectly clear as to what his understanding was before the accident.

MR. SELTZER: If he didn't think about it, then you are just going to be getting his conclusions today, and you repeatedly instructed your witnesses not to give me their analyses today and you told the witnesses on the record they should only give me analyses and conclusions they drew before the accident. I am merely making sure that Mr. Frederick understands that

1
2 the question calling for his understanding
3 pre-accident calls for things that he thought
4 about pre-accident and not for an independent
5 appraisal today.

6 MR. FISKE: Things that he understood
7 before the accident. That is all I asked him.
8 It is a fairly simple question.

9 A Can I hear it again?

10 Q Did you understand before the accident
11 that the further the pressure dropped to the right
12 of this curve, the greater the imbalance would be
13 between pressure from the inside of the clad and
14 pressure on the outside?

15 A My understanding -- my answer is no. My
16 understanding is that an item of importance in crossing
17 that line was that you get back as quickly as possible,
18 that the time spent on that side was more important
19 than the differential that you are speaking of. My
20 impression was that, and in fact it was the practice,
21 that we on occasion crossed that line, but as long
22 as we came back quickly, there was not expected to be
23 any damage.

24 Q Was it your understanding that was true
25 no matter how far below the line you went?

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A That if we recovered quickly, there would be no damage, yes.

Q Recognizing that the less time you are below the curve, the better, and I understand that, my question is, didn't you also understand as a matter of simple logic before the accident that the further you went, the further pressure dropped to the right of the curve, that is, the lower the pressure became, the greater the difference would be between that pressure on the outside and the pressure that was pushing from the inside?

A No, that which I gave you in my answer previously was the limit of my understanding prior to the accident.

Q Why did you understand that it was important to get back on the correct side of the curve quickly?

A I am only working on recollection here, but I remember that on several occasions a curve similar to this using Unit 1, it was passed into that region and quickly recovered. We asked B&W what do we do about that, and they said as long as you recovered quickly, there should be no problem.

Q What is "quickly"? A few minutes?

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A A few minutes.

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Q Did anybody at Met Ed in the training that you received there discuss with you either the question of how short a period of time you should stay on the right of the curve or how far below the curve you should avoid going?

A I think my answer indicates there was a discussion at some time.

Q But other than that, there were none, other than what you already referred to?

A I don't want to limit it to only one discussion on only one occasion. I am only giving you the best of my recollection.

Q What did you understand would happen if the pressure was allowed to fall to the right of the net positive suction head curve?

A If the operation fell to the right of the No. 6 curve, I think is the one that we normally used, then it would be violating the operating recommendations for the reactor coolant pumps.

Q In what respect?

A That is where curve No. 6 comes from, from the operating recommendations for the reactor coolant pumps, from the vendor.

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Q Did you understand why it was part of operating recommendations that they told you to maintain temperature and pressure within a certain relationship?

A Yes, that is why the curve was called the NPSH curve. If you go beyond that curve, then at some point beyond there you would violate the NPSH requirements for that pump.

Q In what way?

MR. SELTZER: What do you mean?

Q What would happen that would cause a violation of the NPSH requirements?

MR. SELTZER: I don't understand. This is a temperature/pressure curve, and going beyond the curve means the temperatures and pressures are in a relationship that is defined by the curve. So that is how you have gone beyond the NPSH.

Q Why did you understand pressure/temperature ratios had anything to do with operating pumps?

A Why did I understand that pressure and temperature had something to do with operating pumps?

Q Why did you understand it made any difference as to what the pressure/temperature ratios

1
2 were to the operation of the pumps?

3 MR. SELTZER: Do you mean why was there
4 an operating recommendation for the reactor
5 coolant pumps?

6 Q Why did you understand that the pressure/
7 temperature relationships had anything to do with
8 the operation of the pumps?

9 A The relationships shown on this curve are
10 extrapolations of limits given to the proper
11 operation of the pump so no damage could occur to the
12 pump and it could be expected to last the lifetime
13 of the plant.

14 Q Why did you understand that damage could
15 occur to the pumps if the pressure/temperature
16 relationships reflected on this curve were not
17 maintained?

18 A Damage would not occur at these
19 relationships. It would occur at some point to the
20 right of that where the actual limit existed.

21 Q Why did you understand that if you didn't
22 follow this curve damage would occur to the pumps?

23 A Because the pump would operate in a
24 cavitating state.

25 Q What does that mean?

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2

A It is a condition of the pump in which vibration and poor flow begin to develop.

3

4

Q What causes the development of the cavitation, vibration and poor flow?

5

6

A As the formation of vapor at the eye of the pump, which is a low pressure point of the pump, and then the subsequent collapse of those vapor bubbles at the tips of the impeller, that collapse causes erosion and vibration at the tip of the impeller.

11

12

Q Is vapor another word for steam?

13

A In this case, yes.

14

Q In other words, you understood if pressure was allowed to fall to the right of these curves, that that could cause the formation of steam and damage to the pumps in the way you have described?

17

18

MR. SELTZER: Steam at the eye of the

19

pump.

20

MR. FISKE: Yes, in the way he described

21

it.

22

A My understanding is if the pump were allowed to operate for some time in that condition, then damage would occur to the pump, yes.

23

24

25

Q As a result of steam caused at the eye

1
2 of the pump by the drop in pressure?

3 A No, as a result of the collapse of that
4 steam at the tip of the impeller.

5 Q After it had been formed at the eye by
6 the drop in pressure?

7 A Yes.

8
9 Edward R. Frederick

10 Subscribed and sworn to before me
11 this day of 1982.
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C E R T I F I C A T E

STATE OF NEW YORK)
: ss.:
COUNTY OF NEW YORK)

I, JOSEPH R. DANYO, a
Notary Public within and for the State of New York,
do hereby certify that the foregoing deposition
of EDWARD R. FREDERICK was taken before
me on Tuesday, May 5, 1982;

That the said witness was duly sworn
before the commencement of his testimony and
that the within transcript is a true record of said
testimony;

That I am not connected by blood or
marriage with any of the parties herein nor
interested directly or indirectly in the matter in
controversy, nor am I in the employ of any of the
counsel.

IN WITNESS WHEREOF, I have hereunto set
my hand this 5 day of MAY, 1982.

Joseph R. Danyo
Joseph R. Danyo

I N D E X

WITNESS

PAGE

Edward R. Frederick

4

E X H I B I T S

B&W FOR
IDENTIFICATION

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650	Memorandum from Mr. Zaggers to Mr. Lawyer, dated July 18, 1977, subject, "General Physics Audit Exam Results"	46
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