

ORIGINAL

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

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

Plaintiffs,

-against-

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

Defendants.

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: 80 CIV. 1683
: (R.O.)
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Continued deposition of THE BABCOCK
& WILCOX COMPANY, by BERT M. DUNN, taken
by Plaintiffs, pursuant to adjournment, at
the offices of Kaye, Scholer, Fierman, Hays
& Handler, Esqs., 415 Park Avenue, New York,
New York, on Tuesday, March 24, 1981, at
9:50 o'clock in the forenoon, before Charles
Shapiro, a Certified Shorthand Reporter and
Notary Public within and for the State of
New York.



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* * *

B E R T M. D U N N, resumed, having
been previously duly sworn, was examined
and testified further as follows:

EXAMINATION (Cont'd.)

BY MR. SELTZER:

Q Mr. Dunn, you understand that
everything you say today is going to be testimony
given under oath?

A Yes.

Q Have you ever been employed by any
company other than B&W that manufactures nuclear
steam supply systems?

A No.

Q Who was the individual at Westinghouse
whom you testified yesterday held a position at
Westinghouse that was analagous to yours?

A Vince Esposito.

Q How frequently do you see Esposito?

A It's irregular.

Q When did you first meet him?

A My first contact with him was on a telephone
call approximately three, four years ago.

Q Have you since met him face to face?

A Yes.

2 Q Approximately how many times would
3 you say you have met him in the flesh as it were?

4 A Five or six.

5 Q Do you serve on any committees with
6 Vince Esposito?

7 A No.

8 Q Have you served on any trade
9 association committees?

10 A Two.

11 Q Which ones?

12 A An ad hoc committee on containment
13 evaluation sponsored by the AIF and an ANS
14 committee, also on containment evaluation.

15 Q Does that refer to primary
16 containment or secondary containment?

17 A Primary. It refers to the reactor
18 building.

19 Q The wall between the world and the
20 nuclear plant?

21 A I suppose that's one way to phrase it.
22 It is the final containing mechanism.

23 Q Is that usually called the
24 secondary containment?

25 A I don't believe so.

2

Q I may be using BWR terminology then.

3

When did you serve on the Atomic

4

Industrial Forum committee?

5

A I'm not sure. I believe I would put it in
the '76 time frame.

7

Q When did you serve on the ANS

8

committee?

9

A '77, '78 time frame. I could be wrong.

10

Q ECCS Analysis does not generally

11

deal with evaluating the containment building,

12

does it?

13

A Well, I used the term "containment studies"
and I was probably too global.

15

The "we" in ECCS and people in the

16

field of ECCS who would understand the words

17

"containment studies," what the committees were

18

actually dealing with were the forcing functions

19

caused by a LOCA to which the containment would

20

be designed, pressure and temperature in the

21

building as a whole and within the subcompartments.

22

Q Is it correct that the building is

23

designed to experience under normal operating

24

conditions a negative pressure?

25

A In some cases; not generally.

2

Q In the 177 plants, is there a

3

negative pressure maintained in the containment

4

under normal operating conditions?

5

A There is an allowable pressure range under

6

normal operations. I have never heard of our 177

7

plants referred to as subatmospheric.

8

Q Does your ECCS Unit study the

9

ability of the containment building to withstand

10

forces that are released in a loss of coolant

11

accident?

12

A No. We compute the forces and pass those

13

on to structural personnel.

14

Q Had any of your computations

15

anticipated the possible hydrogen explosion that

16

occurred in the TMI-2 containment building?

17

A No.

18

Q Have you analyzed the phenomenon

19

of that possible hydrogen explosion since the

20

TMI-2 accident?

21

A I recall the subject being raised with

22

attention to the apparant hydrogen bubble that was

23

within the upper head of the reactor vessel and

24

perhaps in one of the hot legs.

25

Q You and I may be talking about two

2 different things.

3 I am referring to something that
4 occurred on the day of the accident when there was
5 a reported sound of an explosion within the
6 containment building.

7 Are you familiar with what I am
8 talking about?

9 A Yes.

10 Q I didn't mean to interrupt you if
11 that was what you were focusing on.

12 A As I was saying, relative to the
13 possibility of a detonation of the bubble in the
14 upper head of the reactor vessel and possibly
15 located additionally in the hot leg, B&W made
16 some efforts. I don't know of efforts to -- within
17 B&W to reduce or analyze the apparent detonation
18 which occurred in the first day of the accident.

19 Q Have you seen any study or analysis
20 of that apparent detonation?

21 A I haven't seen one. I have heard of one.

22 Q Whom did you hear did it or what
23 unit did you hear did it?

24 A Well, I wasn't speaking inside of B&W
25 necessarily.

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What I have heard is that one of the contentions relative to how much oxidation occurred during the accident is how much hydrogen would have to be produced to cause that amount of explosion if, in fact, it was caused by hydrogen and that relates back to the expectation for core uncovery.

As a result, the information has been fed to me loosely by an individual I have had doing some studies in the area of core uncovery.

Q Is the source of the hydrogen oxidation the zircalloy cladding and, if not, what is the source?

A It is my understanding that the primary source of oxidation is the oxidation of zircalloy cladding.

Q You were aware during the days immediately following the March 28th rumpus that there was a concern over a hydrogen bubble within the reactor, right?

A Yes.

Q You knew that there was a concern being aired in some circles that the bubble might explode, right?

2 A Yes.

3 Q At the time that that was first
4 being floated, did it occur to you that there was
5 no free oxygen present in the reactor?

6 A No.

7 Q At the time you heard about the
8 formation of the hydrogen bubble in the reactor,
9 did you believe that it could explode?

10 A At the very first hearing of such a
11 bubble -- I think my reaction was yes, however,
12 I also realized that I was not very well informed
13 on detonation processes. I didn't know about
14 them. I didn't know what might happen or might
15 not happen.

16 Q Did you subsequently learn from
17 others in B&W that the possibility of explosion
18 was very low?

19 A Yes.

20 Q How quickly after the hydrogen
21 bubble was known to exist did you learn that there
22 was very little likelihood of it exploding?

23 A I'm not sure at what time during the course
24 of the recovery process the hydrogen bubble was
25 identified.

1
2 My first information that it was
3 unlikely to explode was passed to me about
4 four or five hours after I had heard about the
5 existence of the bubble..

6 I don't know that at that time I
7 learned that information definitively, I think
8 definitive learning on the subject occurs after
9 the whole story is put together because other
10 people were primarily working on that, not me.

11 Q What did you ultimately learn made
12 it highly unlikely that the hydrogen bubble could
13 explode?

14 MR. FISKE: Mr. Seltzer, I assume
15 that sooner or later this is going to get
16 connected up to something that is relevant
17 to our case?

18 MR. SELTZER: I won't take very
19 long.

20 MR. FISKE: O.K. That's why I
21 haven't objected so far.

22 A Well, I don't think I really learned the
23 process of why it was very unlikely. I heard
24 some stories relative to oxygen content and
25 recombinations and the detonation concentrations

2 were not possible, people were talking about the
3 difference between explosion, detonation and one
4 other mechanism that can combine hydrogen with
5 oxygen, I suppose, and I think that's the state of
6 my knowledge.

7 I recognized these people were being
8 responsible in the field and I accepted their
9 say-so.

10 Q Other than Vince Esposito, have you
11 had any other contact with people at Westinghouse
12 engaged in nuclear plant design or nuclear plant
13 analysis?

14 A Yes.

15 Q Who?

16 A I have met Jim Cermac at one time. There
17 was a Westinghouse representative on the ad hoc
18 committee -- excuse me, that was not the ad hoc
19 committee, that was the ANS committee. I don't
20 remember his name. And there is another fellow
21 at Westinghouse that I have talked to occasionally
22 on experiments and his name is reasonably well-known
23 but I will be doggoned if I can remember it doay.

24 Larry Hockwriter.

25 Q From your conversations with any of

2 the people at Westinghouse, do you believe that
3 Westinghouse has chosen cost over performance in
4 its nuclear plant safety hardware?

5 A In the conversations I have had with the
6 individuals involved, there has been no basis
7 for a belief one way or the other.

8 Q From your conversations with them,
9 did you have any basis for a belief as to whether
10 Westinghouse had adopted proper attitudes towards
11 safety and design philosophy conducive to handling
12 emergency situations?

13 A From the conversations I have had with
14 those people, I couldn't deduce that again one way
15 or the other.

16 Q Have you had conversations with
17 people at Combustion Engineering from which you
18 could deduce what Combustion's attitudes were
19 towards safety and design philosophy?

20 A No.

21 Q Have you had conversations with
22 people from General Electric from which you could
23 deduce General Electric's attitudes toward safety
24 and design philosophy?

25 A No.

1
2 MR. SELTZER: I would like to mark
3 for identification as GPU Exhibit 105 for
4 identification. a memo from Dr. Roy and
5 Mr. Kosiba to Distribution, subject
6 "Preparation of Operating Guidelines for
7 Small Breaks in Reactor Coolant Pressure
8 Boundaries," April 28, 1979.

9 (Memorandum dated April 28, 1979
10 from D. H. Roy and R. E. Kosiba to
11 Distribution, subject "Preparation of
12 Operating Guidelines for Small Breaks in
13 RC Pressure Boundaries" marked GPU Exhibit
14 No. 105 for identification, as of this
15 date.)

16 Q Your name appears on the Task
17 Force in Attachment 1 to GPU Exhibit 105 and
18 the Task Force members are marked for a copy of
19 GPU 105.

20 Is this a copy of a memorandum which
21 you received in the regular course of business in
22 or about late April 1979?

23 A I don't recall receiving it but I don't
24 doubt that I did.

25 Q Is Attachment 1 a correct

2

description of the organization of the Task Force that developed small break guidelines?

3

4

A Yes.

5

Q Did the group that was working

6

on this Task Force get together for meetings?

7

A Yes.

8

Q Was there any office space set

9

aside temporarily for the Task Force?

10

A Yes.

11

Q Was Kane the head of the Task Force?

12

A Yes.

13

Q What role did he play?

14

A He had provided services to the Task Force in arranging for typing and other things. He was responsible for the assembly of the drafts and the final product. During the meetings of the Task Force, he functioned as a coordinator and administrator for the members.

15

16

17

18

19

20

Q Kane had been on the distribution

21

list of both of your February 1978 memoranda.

22

After the Three Mile Island

23

accident, either in connection with any meetings

24

of the Task Force or otherwise, did you talk with

25

Kane about the fact that your instructions for

2 operation of high pressure injection had apparently
3 not been sent out by B&W?

4 A I do not recall doing such.

5 Q Did Kane ever say anything to you
6 after the accident about the fact that you had
7 created instructions regarding dealing with the
8 small break such as the one that had occurred at
9 Three Mile Island?

10 A Again I do not recall such. ,

11 Q Do you have any belief that you
12 and Kane discussed your instructions after the
13 Three Mile Island accident?

14 MR. FISKE: Well, I am going to
15 object to that, Mr. Seltzer, unless it is
16 based on a recollection.

17 A I couldn't base it on a recollection.

18 Q Do you have any other basis for
19 a belief that you and Kane discussed your
20 February 1978 instructions after the Three Mile
21 Island accident?

22 MR. FISKE: I don't know what basis
23 there can properly be when he has no
24 recollection.

25 MR. SELTZER: I don't know what

2

code words you have given this witness to
associate with the word "recollection," but
he frequently --

4

5

MR. FISKE: None.

6

7

8

9

10

11

12

MR. SELTZER: -- testifies to his
beliefs about what has happened. If he has
a belief now that he and Kane discussed
his February 1978 prescription after the
Three Mile Island accident, I would like
him to testify to the best of his
knowledge.

13

14

15

16

17

18

19

20

21

22

23

24

25

MR. FISKE: Well, let's get a couple
of things straight. First of all, there
are no code words or any other instructions
given to Mr. Dunn with respect to what
recollection means. Everybody understands
what recollection means and I assume
Mr. Dunn is testifying when he says he
recalls or doesn't recall based on what
everybody understands a recollection is
and I never objected to the question
asking Mr. Dunn for his beliefs so long
as it is clear that the belief is based
on a recollection so that we are including

2 a recollected belief within the concept
3 of recollection, but beyond that, it seems
4 to me it is just speculation.

5 Q What does "recollection" mean to you?

6 A That I have a distinct memory that an
7 exchange took place and I can recall at least some
8 of the circumstances around the exchange.

9 Q Earlier in your deposition, I had
10 asked you whether you could recall people with
11 whom you discussed your February memoranda and
12 you had a memory about some conversations and
13 then I asked you do you have a belief that you
14 discussed it with anybody else and you added
15 "Yes, I believe I discussed it with Jim Taylor,"
16 and then you described what you believed was a
17 conversation that you had had with Taylor about
18 your February 9, 1978 memorandum, so I think the
19 record so far as it is clear is that you do have
20 a memory of some conversations which you do not
21 elevate to the level of a distinct recollection,
22 is that right?

23 A I believe that's true.

24 Q If you have a memory of a
25 conversation with Kane after the Three Mile Island

2 accident in which you and he discussed or you
3 believe you discussed your February 1978
4 instructions, I would like you to tell me about
5 that.

6 A I have tried to be consistent on that
7 point throughout the deposition and if I had such
8 a memory, I would have used the term either belief
9 or recollection.

10 Past that, I could only interpret
11 the circumstantial evidence or information that
12 was obviously occurring at that time.

13 MR. FISKE: Just so we are all
14 clear here, I don't have any objection to
15 questions based on Mr. Dunn's memory
16 if that is distinct from a recollection.

17 MR. SELTZER: O.K.

18 MR. FISKE: I consider the same
19 synonymous but if there is any difference,
20 you can use them both.

21 Q So, in other words, if you have any
22 memory of a conversation or communication or a
23 belief that a conversation or communication took
24 place, if that belief is based on any memory that
25 you have of it, I think your attorney is saying he

2 would understand that you should testify to it.

3 MR. FISKE: And that is, of course,
4 distinguished from reconstructing something
5 based on circumstantial evidence.

6 MR. SELTZER: I don't know any
7 court in the land that says circumstantial
8 evidence isn't admissible and I think people
9 do have memories based on evidence of the
10 circumstance. I think it is only laymen
11 who think that circumstantial evidence
12 is not good evidence.

13 MR. FISKE: Again it is a question
14 of whether it is a memory or whether it
15 is a reconstruction.

16 MR. SELTZER: All right.

17 MR. FISKE: That is the difference.

18 Q What is your belief about any
19 conversation with Kane following the Three Mile
20 Island accident?

21 MR. FISKE: Well, not to run this
22 into the ground --

23 Q Let me just ask you this. Do you
24 believe you had a conversation with Kane after
25 the Three Mile Island accident in which you and

2 he discussed your February 1978 prescriptions?

3 MR. FISKE: And, again, I have no
4 objection if that is based on a memory or
5 recollection.

6 A Not that I could put into the category of
7 memory or recollection.

8 Q What category would you put it into?

9 A Circumstance. It seems impossible to have
10 issued the small break operating guidelines and
11 the instructions that are contained in there
12 without having had a discussion of the content
13 of either the April 7th instructions we put out
14 or the February 16th memorandum.

15 MR. FISKE: I will move to strike
16 that answer.

17 Q You don't have a recollection as
18 you sit here today of any actual conversation
19 with Kane discussing your pre-accident
20 prescriptions?

21 A No.

22 Q Have you ever asked Kane what he
23 did with the copies of your memo? I am referring
24 to your February 1978 memoranda.

25 A I don't recall asking him that.

2

Q Did you ever ask him whether he had

3

taken any steps to get your instructions issued

4

to operators?

5

A I don't recall asking him that.

6

Q Don Hallman is listed as a member

7

of the Task Force. Under Hallman, Walters and

8

Veenstra are listed.

9

Who is this fellow Veenstra?

10

A This would be Jim Veenstra and as I recall,

11

he was a supervisor or principal engineer reporting

12

to Don Hallman.

13

Q What role did Hallman, Walters and

14

Veenstra play on the Task Force?

15

A They reviewed and provided comment on the

16

operational guidance that I was suggesting,

17

they participated placing the final guidance

18

into the language that is used to communicate

19

operational guidance to customers and this served

20

as a check and balance to be sure that what

21

guidance was provided would not cause problems

22

to the reactor facility.

23

Q What role did Norm Elliott, whose

24

name is spelled wrong, play in the work of the Task

25

Force?

2 A Norm provided review guidance on language
3 with particular attention to whether or not the
4 words we were utilizing would be understood in the
5 fashion that we wanted by operators. And, of
6 course, everybody reviewed the whole procedure.

7 Q Attachment 1 lists consultants.

8 Were there consultants who worked
9 with the Task Force?

10 A Yes.

11 Q Who?

12 A I do not recall. We did have people from
13 the operational staff of the utilities. At this
14 time, I don't recall whether the NRC ever
15 participated directly in the guidelines. Members
16 of the NRC were in Lynchburg at that time, however.

17 Q What role did you and the people
18 working with you have in the work of the Task
19 Force?

20 A The first task we had was to illustrate
21 and make understandable the range of possibilities
22 in terms of the condition that the reactor system
23 might be in following stabilization of loss of
24 coolant accident.

25 We then had to provide suggestions

1
2 for management of that condition to cold shutdown
3 which is what we were trying to -- that was the
4 end point for the instructions, and further, we
5 had to explain why certain operations might or
6 might not accomplish such a task and where
7 certain other operations might or might not be
8 dangerous.

9 Q How long did it take to complete
10 the work of the Task Force?

11 A I believe approximately three weeks.

12 Q During those three weeks, did you
13 talk to any operators?

14 A I don't recall. We had representatives
15 from the operational staffs available to us. I
16 don't know whether they were actual operators,
17 had previously been operators or were just members
18 of the staff.

19 Q Representatives of what operational
20 staffs?

21 A There were two or three individuals who met
22 with us from time to time who fit that category.
23 I believe one of them was from the Duke Power
24 Company. I'm not sure where the other one was
25 from.

1
2 In answer to a previous question, I
3 should answer that we also prepared a physical
4 description of the small break transients
5 explaining how the course of various variables
6 observable to the operator could proceed depending
7 on the boundary conditions for the accident and
8 that appears in the guidelines as a chapter, a
9 chapter on background.

10 Q What is your understanding as to
11 why you were preparing small break guidelines?

12 A Originally it was a request from the NRC
13 that guidelines for the safe management of a small
14 break loss of coolant accident following the
15 initial stabilization and proceeding to cold
16 shutdown be prepared.

17 Q Did anybody say to you, in words
18 or substance, that B&W had already prepared,
19 before the Three Mile Island accident, guidelines
20 or procedures that were substantially what the
21 NRC was asking for?

22 A No.

23 Q In preparing this small break
24 operating guidelines, did the Task Force work from
25 anything that had been written by B&W before the

Three Mile Island accident?

A Yes.

Q What?

A Within the immediate response section of the small break operating guidelines, the instructions for high pressure injection management are the same in essence as those issued in April.

Q April of what year?

A That year.

Q 1979?

A Yes. The instructions issued shortly following the Three Mile Island accident.

The chapter on the physical basis for the instructions which explains the course of the variables, the possible course of the various variables within the reactor coolant system and how they would proceed during the early phase of the loss of coolant accident was based on ECCS personnel's cumulative understanding of small break loss of coolant accidents and in that fashion relied, to some extent, on our earlier documented work.

Q That is, other documents within

2 the ECCS Unit? Is that what you are referring to?

3 A Yes, yes, SAR material.

4 MR. SELTZER: I would like to mark
5 as GPU Exhibit 106 for identification, a
6 handwritten memorandum by Mr. Dunn entitled
7 "Small Break Indications" bearing no date.

8 (Handwritten memorandum by Mr. Dunn
9 entitled "Small Break Indications" marked
10 GPU Exhibit No. 106 for identification, as
11 of this date.)

12 Q Are the first few pages of GPU
13 Exhibit 106 marked for identification pages which
14 you wrote?

15 A It appears to be my handwriting.

16 Q Would you identify, please, what
17 GPU Exhibit 106 is?

18 MR. FISKE: You mean the whole thing?

19 MR. SELTZER: Yes.

20 A It's written in the form of an initial
21 set of notes on what a small break procedure
22 might be and that refers to the first four pages
23 of 106 which are then repeated in the document
24 with two copies of the first four pages. I'm not
25 sure what the remaining section of the report is.

2

Q After the repetition of the first
3 four pages, there is an attendance list.

4

Do you see that?

5

A Yes.

6

Q Do you see your fine hand on the
7 attendance list?

8

A Yes.

9

Q And you signed in right above Zoltan
10 Rosztoczy, right?

11

A Yes.

12

Q It looks like R. C. Jones signed in
13 also.

14

Do you recognize that as being
15 Jones' penmanship?

16

A Yes. I believe that's the way he signs
17 his name or prints it, rather.

18

Q Do you recall attending a meeting
19 at or about the time you were developing small
20 break guidelines at which some or all of the people
21 on this attendance list were present?

22

A Yes.

23

Q Were you sitting next to Zoltan
24 Rosztoczy?

25

A Maybe.

1

2

Q What, if anything, do you call him
for short?

3

4

A I generally refer to him as Zoltan.

5

6

Q What was the subject of the meeting
with these gentlemen?

7

8

9

10

11

12

A The subject of the meeting I am recalling
was the review of the work which would be performed
for submittal to the NRC by May 7th in support of
the restart at that time for our operating plants
following the negotiated and scheduled shutdown
following reaction to Three Mile Island.

13

14

15

16

Q Is it your belief that these notes,
GPU Exhibit 106, were drafted sometime after the
creation of the small break guideline Task Force
and prior to May 7, 1979?

17

18

A I believe I would be close to speculation
in agreeing with your statement.

19

20

21

Q Is there any other time when you
think these notes were written? I am focusing on
the first four pages, your handwritten notes.

22

23

24

A From reading these notes, I think it would
be unlikely that they were generated at another
time.

25

Q On the first page of GPU Exhibit 106,

1
2 you have listed "Possible Alarms." These are alarms
3 which would indicate the occurrence of a small
4 break loss of coolant accident. Is that correct?

5 A They are alarms which may indicate the
6 possible existence of a small break loss of
7 coolant accident.

8 Q Who developed this list of the
9 eleven possible alarms?

10 A I do not recall.

11 Q You have both low pressurizer level
12 and high pressurizer level on the list of alarms.
13 Do you see that?

14 A Yes.

15 Q Low is opposite high, right?

16 A Yes.

17 Q How is it possible to have both
18 low pressurizer level and high pressurizer level
19 as possible alarms for the same accident?

20 MR. FISKE: Well, I think you are
21 misstating the exhibit, Mr. Seltzer.

22 MR. SELTZER: Well, I am not really
23 trying to pose it as an enigma. I just
24 want to get the explanation.

25 What do you think I have misstated?

2

MR. FISKE: You are assuming that

3

the document indicates both low pressurizer

4

level and high pressurizer level as an alarm

5

for the same accident.

6

MR. SELTZER: All right. For the

7

same class of accidents.

8

MR. FISKE: We can save a lot of

9

time --

10

MR. SELTZER: I will rephrase it and

11

try and do it more coherently.

12

Q How is it that you could list both

13

low pressurizer level and its opposite, high

14

pressurizer level as possible alarms for the same

15

class of accidents, namely, small break loss of

16

coolant accidents?

17

MR. FISKE: I think if you can

18

answer the question, it will become clear.

19

Go ahead and answer it.

20

A The intent of such a procedure would

21

probably have been to cover all loss of coolant

22

accidents which form a continuum in both break

23

sizes and in position for the rupture of the

24

primary system. If the rupture occurs in the

25

reactor coolant system piping, the low pressurizer

1
2 alarm is likely. If the rupture occurs in the
3 pressurizer, particularly high in the pressurizer,
4 the high pressurizer level alarm is likely.

5 Q Could you read your note that appears
6 beginning in the text just above the middle of
7 the page?

8 A With the asterisk?

9 Q No, just after that.

10 A "The nonstarred alarms will be indicated
11 for all except very small LOCA's."

12 Q Fine. That's all I want.

13 Did that mean that the possible
14 alarms that have stars next to them would not
15 always occur during a small break loss of coolant
16 accident?

17 THE WITNESS: Excuse me, would you
18 read that back.

19 (Record was read back.)

20 A You used the term "Did not mean" -- "Did
21 that mean," excuse me, and I would have to
22 interpret the meaning of that sentence today
23 because I do not recall putting this paper together.

24 Q Since you are undoubtedly the author
25 of the paper, why don't you go ahead and explain

1
2 it.

3 MR. FISKE: Mr. Seltzer, I think if
4 Mr. Dunn says he doesn't remember writing
5 this paper and doesn't remember what he
6 had in his mind at the time, I don't think
7 there is anything else to ask him.

8 MR. SELTZER: Well, I think the
9 world would agree that he is probably the
10 best interpreter of words that he has
11 previously written. Even if Beethoven
12 couldn't remember what he had in mind when
13 he first wrote Eroica, if he sat down
14 at the piano he could probably do a pretty
15 good job of interpreting it at a subsequent
16 date.

17 MR. FISKE: I don't know if that
18 analogy is proper or not. If Mr. Dunn
19 does not recall what he had in mind when
20 he wrote this, then I don't think it is
21 proper to ask him to just look at it now
22 and tell us what he thinks it means now.

23 I have absolutely no objection if
24 he remembers what he had in his mind when
25 he wrote it but that is the only proper

2

question.

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MR. SELTZER: I thought I remembered from a law school evidence course that a witness could be asked to look at something which he has previously written and after you have exhausted his past recollection refreshed, you could then ask him what it means to him today.

MR. FISKE: Well, you must have taken a different law school course at a different law school because I am not aware of such thing.

Why don't we take a break. It is 11:15.

MR. SELTZER: All right.

(Recess taken.)

MR. FISKE: Where we were was, you had a question pending where Mr. Dunn had said he did not recall writing this memo.

MR. SELTZER: Right.

MR. FISKE: And you were asking him to now read it and construe it and I was taking the position that that was not

2

proper.

3

MR. SELTZER: Have you thought

4

better about that proscription?

5

MR. FISKE: I haven't changed my

6

mind. I thought the instruction was

7

appropriate.

8

MR. SELTZER: That brings us to

9

this important crossroads.

10

Are you going to instruct him not

11

to answer the question?

12

MR. FISKE: Yes, I think so.

13

MR. SELTZER: You are going to

14

throw down the gauntlet?

15

MR. FISKE: I don't know if it's

16

throwing down the gauntlet. I am taking

17

the position on this document, as to others,

18

as a matter of procedure it is not proper

19

to ask a witness today to read something

20

and ask him what is his construction of it.

21

MR. SELTZER: Fine.

22

MR. FISKE: I think the fact that

23

he wrote it as opposed to somebody else

24

really doesn't make any difference if he

25

has no recollection of having written it.

1
2 In other words, the fact that this
3 document happens to be in his handwriting
4 as opposed to being typed by someone else
5 really doesn't change that.

6 MR. SELTZER: I assume you abide
7 by the notion that what is sauce for the
8 goose is sauce for the gander?

9 MR. FISKE: I think at least as a
10 general proposition.

11 MR. SELTZER: All right, because
12 I think that this is no more nor less
13 applicable to one side than the other.
14 If that is what you think ought to be the
15 law of this case, so be it.

16 MR. FISKE: That is the law of the
17 case for this document.

18 MR. SELTZER: Come on now, let's
19 not -- I am sure you don't want to be that
20 small about it.

21 MR. FISKE: We don't have any other
22 situation in front of us at the moment.

23 MR. SELTZER: You weren't blocking
24 testimony just based on the nature of this
25 particular document. I thought you were

1
2 enunciating what you thought was the
3 applicable rule of evidence.

4 MR. FISKE: That is the rule of
5 evidence applicable to this document, yes.
6 And it may or may not apply to other
7 documents as well.

8 MR. SELTZER: We will certainly
9 cite Fiske on GPU Exhibit 106 when the
10 issue comes up and you are asking us to
11 construe documents.

12 MR. FISKE: If it's a valid
13 citation, fine.

14 MR. SELTZER: I can just see one
15 of your people saying, "Wait a minute,
16 this isn't GPU 106 anymore."

17 I would like to mark as GPU Exhibit
18 107, a memo from Kane to Roy, the subject,
19 "Small Break Procedures," dated April 30,
20 1979 with a copy to Mr. Dunn.

21 (Memorandum dated April 30, 1979
22 from E. R. Kane to D. H. Roy, subject
23 "Small Break Procedures" with copy to
24 Mr. Dunn marked GPU Exhibit No. 107 for
25 identification, as of this date.)

2

Q Is GPU Exhibit 107 a copy of a

3

memorandum which you received in the regular course

4

of business on or shortly after April 30, 1979?

5

A It's a copy of a memorandum I received

6

on or about April 30, 1979.

7

Q In the box at the top of the page,

8

there is something called file number or reference.

9

Do you see that?

10

A Yes.

11

Q What is 20A3.0?

12

A It's an alpha-numeric character which

13

indicates the location within the filing system

14

at which this particular memo could be retrieved.

15

Q Do you know what the description of

16

that file was?

17

A No, I do not.

18

Q Item 3 in the memorandum says,

19

"ECCS (B. M. Dunn) will put together in words and

20

figures the various small break scenarios (see

21

attachment) from which the adequacy of the procedure

22

can be verified."

23

Did you do that?

24

A We put together such a text including

25

words and figures of the various scenarios for

2

small break loss of coolant accident, yes.

3

Q Where is the work that you and Jones

4

and others in ECCS did for the small break Task

5

Force?

6

A This particular work?

7

Q This and all the work you did on the

8

small break Task Force.

9

Where did you file it?

10

A I don't recall filing anything except the

11

final product.

12

Q What did you do with the rest of the

13

materials that you had drafted?

14

A Relative to all of them, I'm not sure.

15

I think some may have been contained

16

in a packet of information which I had stored

17

beside my desk in Manila folders.

18

Q Was that turned over to attorneys

19

for consideration for production in this lawsuit?

20

A The packet was segregated on the basis of

21

was it connected to Three Mile Island and I believe

22

it was turned over for possible production.

23

Q Who made the segregation?

24

A I made the segregation.

25

Q Did you believe that this stuff was

1

2

related to Three Mile Island?

3

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A Well, that was the basis. I put everything that I had done for probably the first one or two months--I'm not actually sure when I cut off filing it in this fashion and started filing in the normal fashion--into those packets when I was basically through with them for on-line responsibility. I just kept them there.

Q Had you put together, in words and figures, various small break scenarios similar to these small break scenarios prior to the Three Mile Island accident?

A Not in the fashion that these were put together and not as extensively as these were put together.

Q How was the way in which you put these together different from the way in which you had put any previous materials together?

A Previous material was put together for licensing purposes and organized in a fashion which would demonstrate the capability of the ECCS systems.

These materials were put together in a caricature fashion to illustrate the possible

2 conditions that the operators might find present
3 in a -- in the reactor coolant system following a
4 small break loss of coolant accident with
5 particular stress to the continuum of the possible
6 conditions.

7 Q What does that mean, "the continuum"?

8 A Well, where a curve was illustrated, we
9 did not intend that the operator or the people
10 reading the material should believe that that
11 curve was the exact result to be expected but
12 rather a curve similar to that which could vary
13 on either side of it was possible. .

14 Q Were these graphic materials
15 included in the small break guidelines that were
16 subsequently issued?

17 A Yes.

18 MR. SELTZER: Let me mark those
19 and then maybe you can show me more
20 specifically what you mean by this
21 continuum.

22 I would like to mark as GPU Exhibit
23 108, the Babcock & Wilcox Operating Procedure
24 Guidelines for Small Breaks of May 5, 1979
25 which have a cover sheet from Don Hallman

to Ellison of May 7, 1979.

(Covering memorandum dated May 7, 1979 to K. R. Ellison from D. F. Hallman with attached Operating Procedure Guidelines for Small Breaks dated May 5, 1979 marked GPU Exhibit No. 108 for identification, as of this date.)

Q Do you recognize GPU Exhibit 108 as the small break operating guidelines on which you had been working and which B&W issued to its plants on or about May 5, 1979?

A Yes.

Q Can you explain by reference to the charts that are included in this exhibit what you mean by showing the continuum?

A Yes.

Q Which figure would you like to --

A Figure 1 I think does a reasonable job.

Q -- start with?

A Within Figure 1 there are several possible pressur scenarios indicated. The differentiation between the possible scenarios is primarily break sizes and the intent of such a figure was to communicate that almost any pressure course for

2

the transient would be possible.

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We see an indication in item 1 of

a very large small break; in item 2 of a smaller

break which takes longer to depressurize; 3 is a

smaller yet; 4 is an illustration of the accident

we termed a .01 to a .02 square foot break with

possible interruption of natural circulation; and

5 would most likely be characterized as a leak

instead of a break.

The function of 5 is that it

stabilizes mass in and mass out and does not lose

natural circulation.

Q Is 5 a break that is within the

capability of one makeup pump?

A Not necessarily. The same thing could be

had with the high pressure injection system.

Q The curve for 4 shows the reactor

coolant system repressurizing within less than

10 minutes, is that right?

A Yes, the curve does.

Q Figure 2 is a companion to Figure 1

depicting the performance of the pressurizer water

level, is that right?

A Yes.

2

Q It depicts the performance of

3

pressurizer level for the same breaks that are

4

enumerated in Figure 1?

5

A Yes.

6

Q So that for the break that is

7

numbered 4 as the reactor coolant system

8

repressurizes, pressurizer level recovers, is

9

that right?

10

A In 4, yes.

11

Q What is the break that is numbered

12

6 on Figure 2?

13

A I would have to go into the text to find

14

out.

15

Q When you find it, could you let me

16

know what page of the text it is on, please?

17

MR. SELTZER: Off the record.

18

(Discussion off the record.)

19

Q How about page 5 where there is

20

a reference to Curve 6, it shows refilling by

21

the high pressure injection.

22

A Unless it is mentioned elsewhere in here,

23

the information on page 5 does not appear to be

24

sufficient to characterize what that accident is.

25

Q So you can't figure out from the

2

B&W small break guidelines what type of break would produce Curve 6 in Figure 2?

3

4

A Well, I said the information on page 5 was not that clear.

5

6

I would be put in a position of interpreting the result and interpreting what was meant.

7

8

9

Q In other words, you don't find anything in GPU Exhibit 108 that clearly explains what produces Curve 6 on Figure 2?

10

11

12

A Well, it clearly explains that it is a refilling by the high pressure injection system. It does not clearly identify what accident sequence went along with that but a refill by the high pressure injection system could have that response.

13

14

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18

Q Have you ever discussed the small break operating guidelines with any B&W plant operators since the guidelines were sent out?

19

20

21

A Not that I recall. Not in detail.

22

23

24

Q Has any operator ever indicated to you, either directly or indirectly, whether he found these guidelines comprehensible?

25

MR. FISKE: I am going to object to

2

the form of that question. If you are asking about a conversation with an operator, that's fine.

3

4

5

MR. SELTZER: That is what I am asking.

6

7

MR. FISKE: You mean did an operator tell him that he found these guidelines comprehensible?

8

9

10

MR. SELTZER: Right.

11

Q In words or substance.

12

A No.

13

Q Did any operator tell you he found these guidelines incomprehensible?

14

15

A Not that I recall.

16

Q What conversation did you have with an operator regarding these guidelines?

17

18

A I had from time to time made myself

19

available to operators during a lecture I have been in the habit of giving on modes of natural circulation possible during a small break LOCA.

20

21

A latter portion of that discussion is a question and answer series on any issues that they might want to raise with me.

22

23

24

25

One time I recall asking how they

2 felt about the guidelines or something to that
3 extent, and I did just recall that a minute ago,
4 and the operator responded that they did not have
5 the guidelines.

6 Q What plant were these fellows from?

7 A I could give candidates but I could not
8 be specific.

9 Q Were these operators from a plant
10 that was already in operation?

11 A Yes.

12 Q Did you ask them whether they had
13 received your April 4th or April 17th instructions?

14 A No, I did not.

15 Q Did you ask them whether they had
16 received any other communication which conveyed
17 the substance of your small break operating
18 guidelines?

19 A No.

20 Q How soon after May 5, 1979 was the
21 meeting with these operators to which you have
22 just adverted?

23 A This was within the last year.

24 Q Did you take any steps after the
25 meeting to confirm whether B&W had sent the small

2 break operating guidelines to that particular
3 utility?

4 A No.

5 Q So with respect to that particular
6 utility, you have not verified that there was
7 closure on the small break operating guidelines?

8 A Yes, I believe I have.

9 Q What did you do?

10 A Well, I had verified that there was closure
11 on that issue before that time.

12 Q What had you done to verify that
13 this particular utility had received a copy of
14 the small break operating guidelines?

15 A The small break operating guidelines are
16 released to all operating utilities with B&W
17 plants and I have seen the release. I generally
18 sign the final release.

19 Q The release goes to the B&W
20 site representative at the operating plant,
21 right?

22 A I'm not sure of the actual transmittal
23 mechanism.

24 Q Do you see the stamp that has been
25 affixed in the upper right-hand corner of GPU

2

Exhibit 108?

3

A Yes.

4

Q Do you see the distribution marked to 3, 4, 5, 6, et cetera?

5

6

A Yes.

7

Q Do you see the indication of response requested from or required from 3, 4, 5, 6, 7, et cetera?

9

10

A Yes.

11

Q Do you have an understanding that that means that GPU Exhibit 108 was distributed to B&W site representatives at plants numbered 3, 4, 5, 6, 7, et cetera and that a response indicating transmittal to the plants was required from those site representatives?

16

17

A No.

18

Q Have you ever verified that the plants which were intended to receive the small break operating guidelines actually got the small break operating guidelines?

21

22

A In terms of direct contact with the customer, I have not. I considered it adequate that once an instruction got to this stage, that the process would be followed through.

23

24

25

2

Q Did you ever take any steps to find

3

out why the operators that you were talking to

4

believed they had not received the May 5th small

5

break operating guidelines?

6

A Well, at the time I was talking to these

7

operators--we really shouldn't be talking about

8

May 5th, the document has undergone revision--

9

but, no, I did not take any steps.

10

Q At the meeting that you had with

11

these operators, did you volunteer to give them

12

a copy of the current version of the small break

13

operating guidelines?

14

A I don't recall whether I did that or not.

15

Q Is there any company policy that

16

would have made it improper for you to offer them

17

a copy of the small break operating guidelines

18

at that time?

19

A I don't believe so.

20

Q Did you say anything to Hallman or

21

Kosiba or anybody in Customer Service about the

22

fact that some operators had apparently not

23

received the small break operating guidelines?

24

A I don't believe I did.

25

Q Do the lecturers from ECCS who

2 participate in the training program at B&W include
3 the small break operating guidelines as part of
4 their presentation to operators?

5 A They would not include the detail that is
6 contained in Part II to an exhaustive extent,
7 rather they would lecture around the possibilities
8 contained in Part I with providing information
9 on the general character of Part II and how it
10 accomplishes its task.

11 It is not the function of these
12 lectures to provide detailed training on any given
13 procedure.

14 Q In GPU 107, item 3, it says that
15 you were going to put in words and figures the
16 small break scenarios "from which the adequacy
17 of the procedure can be verified."

18 What does that mean, "the adequacy
19 of the procedure could be verified"?

20 A I would have to interpret that.

21 Q What did you understand it meant?

22 A Well, at the time that this memo was
23 issued, things were moving very rapidly and there
24 was a great deal going on. I don't believe that
25 I made an effort to criticize that particular

2

phrase.

3

Q Do you have any notion how at that

4

time it was intended that the adequacy of the

5

procedures for management of small break loss of

6

coolant accident would be verified?

7

MR. FISKE: Can I hear that question

8

again, please.

9

(Record was read back.)

10

A No, not at that particular time.

11

Q Returning to March 28, 1979, the

12

day of the accident, you attended a meeting in

13

Allen Womack's office or it was Allen Womack's

14

meeting about 11 o'clock in the morning, then you

15

went to lunch, played cards, and then you came

16

to a meeting in the war room sometime in the

17

afternoon.

18

When did you first realize that

19

there was or had been a loss of coolant accident

20

at Three Mile Island?

21

MR. FISKE: May I hear the question

22

again, please.

23

(Record was read back.)

24

A I'm not sure.

25

MR. FISKE: Are you, just so it is

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clear, are you asking him when did he make that determination or are you asking him when did it first appear to him that it was a possibility? In other words, you say "realize," do you mean when did he actually conclude that there was a loss of coolant accident?

MR. SELTZER: That is a good way to say it.

Q When did you first conclude that there had been a loss of coolant accident or that there was in progress a loss of coolant accident?

A As I indicated, I am not sure.

Q Do you believe that you had concluded that there was a loss of coolant accident before you went to lunch on March 28th?

A I believe that there was or I had indicated that there was a possibility that we knew prior to lunch that the core had been involved. In that case, the extent that that in its limited sense is a loss of coolant accident, I may have known it then. To the extent that it later turned out and to the serious nature of it, I don't believe I had become aware of that until after lunch.

2

Q It is part of the design of the plant, prior to the Three Mile Island accident, to lift or open the pilot operated relief valve in response to certain anticipated transients, right?

3

4

5

6

A Yes.

7

8

9

Q When the pilot operated relief valve opens in response to certain anticipated transients, do you call that a loss of coolant accident?

10

A No.

11

12

13

Q When do you believe you first knew or concluded that there had been saturation in the primary coolant system at Three Mile Island?

14

A Again, I'm not sure.

15

16

17

Q Do you believe that you knew or concluded that there had been saturation in the primary coolant system before you went to lunch?

18

19

MR. FISKE: You are again asking him about his recollection, right?

20

21

MR. SELTZER: Right. Or memory or belief.

22

23

MR. FISKE: Well, no, it's memory or recollection.

24

25

MR. SELTZER: I am including belief because he uses belief to encompass things

2

that he can remember, also.

3

MR. FISKE: As long as it is memory

4

or recollection.

5

MR. SELTZER: For me, belief is good

6

enough.

7

MR. FISKE: Well, the question for

8

Mr. Dunn is what he remembers or recalls.

9

A Yes. I'm trying to use the word "belief"

10

to indicate a positive memory to some extent and

11

I'm not sure.

12

Q You are not sure whether you knew

13

that there was saturation before you went out to

14

lunch?

15

A That's correct.

16

Q When is the first time that you

17

recall you were concerned about whether there had

18

been or was proper use of high pressure injection?

19

A In the afternoon when we found out about

20

the super heat.

21

Q So before lunch, you were not

22

concerned about whether there had been adequate

23

use of high pressure injection, is that right?

24

MR. FISKE: Well, I will object

25

to the form of that question.

2

You can answer it.

3

A I left the 11 o'clock meeting with the understanding that the plant was in a stable condition.

5

6

Q Did you have --

7

A Or rather an acceptable condition.

8

Q Do you recall having any concern

9

before lunch on March 18, 1979 regarding whether

10

high pressure injection had been properly

11

employed at Three Mile Island?

12

A No, I do not recall having the concern one way or the other.

13

14

Q Do you recall anyone at the morning

15

meeting on March 28, 1979 raising any question

16

about the employment of high pressure injection

17

at Three Mile Island that day?

18

A I do not recall it.

19

Q On March 28, 1979, who, to your

20

knowledge, would be the person most expert at

21

B&W on when high pressure injection should be

22

used in response to a loss of coolant accident?

23

A I think there would be two equally capable candidates.

24

25

Q Who?

2 A Myself and Mr. Bob Jones. Definitely
3 using your word "most."

4 Q As of March 28, 1979, do you believe
5 that Allen Womack was to any extent expert in the
6 use of high pressure injection in response to a
7 small break loss of coolant accident?

8 MR. FISKE: Well, I think we are
9 going to have a little trouble here with
10 what you mean by "expert."

11 MR. SELTZER: Knowledgeable.

12 MR. FISKE: Was he to any extent
13 knowledgeable?

14 MR. SELTZER: Yes.

15 MR. FISKE: Well, I guess you can
16 answer that question yes or no.

17 THE WITNESS: Let me have the question
18 one more time, please.

19 (Record was read back.)

20 MR. SELTZER: I will rephrase the
21 question so that with respect to Allen
22 Womack it is.

23 Q On March 28, 1979, do you believe
24 that Dr. Allen Womack was to any extent
25 knowledgeable about the proper use of high pressure

2 injection in response to a small break loss of
3 coolant accident?

4 MR. FISKE: You can answer that yes
5 or no. Just yes or no. Was he to any
6 extent knowledgeable.

7 A Yes.

8 Q On March 28, 1979, was Bruce
9 Karrasch to some extent knowledgeable about when
10 it was appropriate to use high pressure injection
11 response to a small break loss of coolant
12 accident?

13 A I don't know.

14 Q On March 28, 1979, was Mr. Labelle
15 to some extent knowledgeable about when it was
16 appropriate to use high pressure injection in
17 response to a loss of coolant accident?

18 A I don't know.

19 Q On what were you basing your
20 affirmative answer to the question about whether
21 Allen Womack was to some extent knowledgeable about
22 the appropriate use of high pressure injection?

23 A I'm not sure the word "appropriate" was
24 utilized in the question.

25 Allen, it was my understanding, had

2 been involved with nuclear power for some period
3 of time. He had been in a project management
4 position associated with the M-K project at BBR
5 during the times that I interfaced with him and
6 it was my belief at the time that he would have
7 picked up some knowledge about the intended
8 operation and role of the ECCS system.

9 Q What created the conclusion in your
10 mind before you went to lunch and played cards
11 on March 28th that the Three Mile Island plant was
12 in a stable condition, if you can recall?

13 A I don't recall the specific thing that
14 created it. It was as a result of the meeting.

15 Q Was Allen Womack on the phone to
16 anybody in Pennsylvania during the course of the
17 morning meeting?

18 A I don't recall whether he was or wasn't.

19 Q You weren't there for the entire
20 meeting, were you?

21 A No, I was there for the second half.

22 Q At any other time, have you ever
23 been consulted for advice while a loss of coolant
24 accident was in progress?

25 A Yes.

1

2

Q When?

3

MR. FISKE: Mr. Seltzer, I don't

4

really see the relevance of whether

5

Mr. Dunn was consulted on some other

6

occasion or not. The last half hour I have

7

been sitting here very patiently wondering

8

what this has to do with anything.

9

MR. SELTZER: You're kidding?

10

MR. FISKE: I certainly don't see

11

what the relevance whether Mr. Dunn was

12

consulted on another accident has to do

13

with this. It is marginal relevance what

14

conclusions he may have drawn from

15

fragmentary information that he may or may

16

not have received at various intervals

17

during the day of March 28th but if you

18

want to ask him about that, I don't object,

19

but this, now if we are going to do the

20

same thing for some other accident that

21

isn't even the accident in this case, it

22

seems to me we are way, way afield.

23

MR. SELTZER: We are at the time

24

for lunch. Why don't you let me find out

25

what the other accidents were and then over

2

lunch, I can consider whether I want to

3

fly into the teeth of the gale and persist

4

in trying to ask questions.

5

MR. FISKE: All right.

6

Q What were the other accident or

7

accidents where you were asked for advice while

8

the LOCA was in progress?

9

A Well, I mentioned earlier that I wasn't sure

10

that the LOCA was still in progress during this

11

event. It is the Crystal River event and I was

12

certainly consulted and involved from the time

13

that I was able to get to the communication center

14

which was actually just an office in Customer

15

Service that placed us in communication with the

16

control room and the time at which we felt the

17

important phase of the accident had been resolved.

18

Q Other than Crystal River, were you

19

ever consulted for advice while a loss of coolant

20

accident was in progress or while the plant was

21

dealing with the aftermath of such an accident?

22

A No.

23

MR. SELTZER: A quarter of 2?

24

MR. FISKE: Fine.

25

(Luncheon recess - 12:35 p.m.)

AFTERNOON SESSION

1:52 P.M.

B E R T M. D U N N, Resumed.

EXAMINATION (CONTINUED)

BY MR. SELTZER:

Q Mr. Dunn, in your resume which is part of GPU Exhibit 75 you describe as one of your major accomplishments during the period you have been Unit Manager the specification of operational procedures for handling of loss-of-coolant accidents.

Is that a reference to your role in the development of the small break guidelines?

A Yes.

Q You also wrote that "These procedures may have prevented a second incident similar to TMI-2."

A Yes.

Q That second incident you have previously said is the Crystal River event; right?

A That is correct.

Q The small break guidelines had been distributed to operating utilities prior to the Crystal River event?

1
2 A To be sure I would want to check the dates
3 again, but when I wrote this, I was under the
4 impression that they were.

5 Q O.K.

6 A I would also have included the April
7 instructions in the general phraseology here
8 (indicating).

9 Q Is it your understanding that the
10 actions taken by the operators at Crystal River
11 were consistent with the April 1979 operating
12 instructions and the small break guidelines?

13 Let me make it easier for you.

14 All I'm referring to is the actions
15 which you heard or which were reported to you
16 to have been taken by the operators.

17 MR. FISKE: In other words, the
18 question is based on what he was told
19 about the actions taken by the operators,
20 did he draw a conclusion one way or the
21 other as to whether they were consistent with
22 the April guidelines, April instructions?

23 MR. SELTZER: The April instructions
24 and the subsequently issued small break
25 guidelines.

1
2 MR. FISKE: Can you answer that?

3 A I did not conduct an in-depth review, point
4 for point, looking for consistency.

5 MR. FISKE: It seems to me, Mr.

6 Seltzer, the question of whether the operators'
7 actions at Crystal River, assuming for
8 the moment that they may be relevant to this
9 case, are facts that can be established; and
10 whether they are consistent with the
11 guidelines or not is also something that can
12 be determined at an appropriate time as a
13 conclusion, but I don't know that it helps
14 very much to ask Mr. Dunn based on what
15 somebody else may have told him, which is
16 certainly not going to be admissible under
17 any circumstances.

18 MR. SELTZER: I am asking subject to
19 later connection. If it turns out he heard
20 correctly what the operators' actions were,
21 then his view as somebody who lists as one
22 of his major accomplishments the drafting of
23 these procedures is very significant, whether
24 he believes that these actions were
25 consistent with the guidelines.

1
2 MR. FISKE: I don't -- if that is
3 what you are trying to do, then I think you
4 then have to establish specifically what
5 Mr. Dunn was told the operators did, so that
6 you have those --

7 MR. SELTZER: O.K., fine.

8 MR. FISKE: If he can answer that.

9 BY MR. SELTZER:

10 Q What were you told the operators did?

11 A Well, I participated --

12 Q Let's start this way: On the day of
13 the Crystal River accident, how soon after the
14 start of that transient were you first contacted
15 with respect to that transient?

16 A I am not sure in that I have not recorded
17 the actual time the event started in my memory.
18 I think it is within an hour.

19 Q O.K. Where were you when you were
20 first contacted with respect to the Crystal River
21 event?

22 MR. FISKE: Mr. Seltzer, this is where
23 we were before lunch in terms of the contacts
24 that they had with him during the Crystal
25 River accident.

1
2 MR. SELTZER: Mr. Fiske, I have to
3 beg you not to interrupt this way. I am
4 trying to proceed in the way that you have
5 suggested to get at the facts in a proper
6 way. I have changed my line of examination
7 since we came back from lunch to pick up
8 what you were suggesting would be the
9 proper way to proceed, and I think that it
10 is not proper for you now to be blocking
11 this avenue of inquiry, which is specifically
12 following up on what you have recommended
13 would be the proper way to proceed.

14 MR. FISKE: No. Let's get a couple
15 of things straight. I said if you are going
16 to at some point later try to establish a
17 predicate for asking Mr. Dunn about
18 conclusions based on the small break
19 operating guidelines you need to establish
20 specifically what he was told the operators
21 did, that's got nothing -- and you can ask
22 him that; but I don't see what that has to
23 do with the point in time at which he was
24 contacted, going through some sort of a
25 chronology. However, I am not sure that

1
2 in the end this is going to make very much
3 difference as long as it doesn't take very
4 long.

5 BY MR. SELTZER:

6 Q Go ahead with your answer.

7 A The question was, where was I at the time I
8 was informed of the incident at Crystal River?

9 MR. FISKE: I am also going to -- I
10 think I better make it clear, just so you
11 know where we are going on this, I am not
12 sure that -- I am not going to allow Mr.
13 Dunn to answer a question in any event as to
14 whether he believes today the operators'
15 actions at Crystal River were or were not
16 consistent with the guidelines. I mean, I
17 am not going to let him answer that question,
18 in any event. So, if you are --

19 MR. SELTZER: Let's just proceed. I
20 think that hearing you talk and hearing me
21 talk really doesn't advance the ball. If
22 there is one thing that is clearly in-
23 admissible, it is what you and I say.

24 MR. FISKE: The question is whether
25 this has any relevance at all. What he was

1
2 told at Crystal River is absolutely -- I
3 mean, if you want to ask him that for the
4 purpose of discovery, I suppose you are
5 entitled to do it; but it seems to me we
6 are wasting an awful lot of time in a
7 deposition that on occasion has been
8 characterized by that.

9 MR. SELTZER: Are you casting
10 aspersions on the way I have conducted this
11 deposition?

12 MR. FISKE: I have told you on several
13 occasions that I thought the particular line
14 of inquiry that you were engaged in was
15 one that was irrelevant and was not going to
16 lead to the discovery of admissible evidence,
17 and in words or substance that we were
18 wasting time. I believe I have made that
19 point on several occasions, and I am making
20 it again now.

21 MR. SELTZER: I will just have to
22 suffer that accusation as manfully as I can.

23 MR. FISKE: Well --

24 BY MR. SELTZER:

25 Q Go ahead, Mr. Dunn.

2

A I was in one of the training rooms giving a lecture on the modes of natural circulation within the reactor coolant system during small break loss-of-coolant accident.

3

4

5

6

Q Were you called out of that teaching responsibility to participate in a --

7

8

A I was informed of the incident and told of the location of the telephone communication with the site, and I proceeded to that location.

9

10

11

Q Where was that?

12

A In an office in the Customer Service Section towards the front wall just down the right-hand side of the east entrance to that section.

13

14

15

Q Was this in the morning or the afternoon?

16

17

A As I recall, it was just before lunch. I am not sure of that.

18

19

Q Who was assembled in the room when you arrived there?

20

21

MR. FISKE: Mr. Seltzer, I would just point out that in reviewing my notes of the examination on March 19th, there was an extensive line of questions, on this whole situation, including virtually

22

23

24

25

1
2 everybody he talked to about this at the
3 time, the question as to whether he had
4 spoken to people in the Crystal River
5 control room at the time of the transient,
6 did he speak to the site representative,
7 has he spoken with Mr. Hallman, has he
8 spoken with Jones.

9 MR. SELTZER: Does it indicate who
10 was in the room in Customer Service that
11 morning receiving information from the site?

12 MR. FISKE: No, I am not sure -- I don't
13 know whether that specific question has been
14 asked.

15 MR. SELTZER: O.K. That is the
16 pending question.

17 MR. FISKE: Well --

18 MR. SELTZER: I appreciate your
19 pointing out we asked other questions about
20 Crystal River.

21 MR. FISKE: I am not sure how long I
22 will allow this to go; but you can answer
23 this question.

24 A Don Hallman was in charge. There were
25 several other people in the order of five or six

1
2 in or around the room.

3 I could not be positive other than
4 Don who was specifically in the room at that time.

5 Q What information did you get in the
6 room that morning about what had happened at
7 Crystal River?

8 A We had a blackboard representation of plant
9 parameters; our response at that time was in a
10 diagnostic sense, particularly with stress on
11 whether there remained or was -- I think maybe
12 better than "remained," was any opening in the
13 primary system, was concern that we might have
14 a hung open code safety involvement.

15 Q Did the parameters that were listed
16 on the blackboard indicate whether there was
17 saturation in the primary system?

18 MR. FISKE: Now I think I am going to
19 object to all of this, Mr. Seltzer. I just
20 don't think that the inquiry as to what
21 information they were getting from the
22 control room at Crystal River a year after
23 the Three Mile Island accident has any
24 relevance to this case at all.

25 So I am just going to instruct him

not to answer any more questions on this

or at least -- well, I should say at least

with respect to -- I will certainly object

to the pending question unless you can tell

me --

MR. SELTZER: Bob, I don't understand

how you think we can examine whether the

actions that the operators were taking were

consistent with the April 1978 prescription

if we don't know what conditions the operators

were reacting in response to.

Certainly the April prescription which

Mr. Dunn has testified is virtually the same

as his February 1978 prescription is very

relevant to this case.

MR. FISKE: Well, it may or may not

be relevant to find out what the operators

at Crystal River did, that may or may not be

relevant. But certainly what was reported

to B&W that they did is clearly not going

to be admissible in any event.

MR. SELTZER: I am not --

MR. FISKE: Well --

MR. SELTZER: -- going into it for the

2

truth as to what the conditions were at

3

Crystal River. I am going into Mr. Dunn's

4

understanding as to what was done at Crystal

5

River.

6

He is not an expert witness. I am

7

not going to be able, Mr. Fiske, to present

8

to him a state of facts and say assume this

9

is what happened at Crystal River, does this

10

conform to the small break guidelines?

11

So I believe the proper way for me to

12

proceed is to find out what his knowledge

13

is of what he understands happened at Crystal

14

River from his experience, and then ask him

15

whether his knowledge of what happened at

16

Crystal River is consistent with what he

17

believes the small break guidelines would

18

call for.

19

MR. FISKE: Well, I am not sure that

20

this whole line of inquiry is appropriate;

21

but go ahead. I will take it one question

22

at a time.

23

BY MR. SELTZER:

24

Q Mr. Dunn, did the parameters, as

25

engineers like to call it --

2

MR. FISKE: I would just say, bearing

3

in mind at the end whether what the

4

operators did a year after the Three Mile

5

Island is or is not in accordance with

6

instructions that were issued after the

7

Three Mile Island accident is of dubious

8

relevance in any event.

9

MR. SELTZER: I am not asking you to

10

waive an objection to relevance at trial.

11

MR. FISKE: I understand. I certainly

12

haven't done that.

13

Do you need to hear the question?

14

THE WITNESS: Yes, I don't think I

15

have any idea of it.

16

A The question was?

17

Q The question was: Did the parameters

18

which had been reported -- what are "parameters,"

19

just so the jury understands when they hear this?

20

MR. FISKE: Assuming --

21

A It is used in more than one sense. In this

22

sense it means the values of the particular

23

variables and their value that can describe the

24

state of the system, such things as pressure,

25

temperature.

1
2 Q Pressurizer level?

3 A Pressurizer level. Maybe valve position
4 might be considered a parameter.

5 Q From the conditions or parameters that
6 had been reported in the room where you were on
7 the morning of the Crystal River accident, did you
8 understand or believe that there had been
9 saturation in the primary system?

10 A I don't believe so.

11 Q At any time have you come to know that
12 there was saturation in the primary system of
13 Crystal River during that transient?

14 MR. FISKE: I object to the form.

15 A That question was asked earlier in the
16 deposition. I believe my answer was then, and
17 still is today, that whether or not there was
18 saturation at one time during the incident did
19 not appear remarkable to me. I would need to have
20 the specific data presented to me to respond to
21 the question.

22 Q Why did the question of whether there
23 was saturation not appear significant to you?

24 A It is my understanding there had not been
25 any interruption of high-pressure injection.

Further, from the data as I recall it, there is a time in the transient in which the values of the parameters approached saturation, they may for a short time cross into it, they may not quite have made it; but they recover very shortly thereafter to a solid subcooled condition.

Q You said you knew that the high-pressure injection had been on continuously.

When did you learn that?

A I believe it was after the accident, the incident.

Q When you were in the special command room at B&W the morning of the Crystal River incident did you take steps to determine that the high-pressure injection was on?

A No, I think I was informed of its status.

Q You mean you didn't have to ask? You were informed?

A Yes.

Q How long did you remain in the command center at Lynchberg?

MR. FISKE: I will object to the form of the question. Nobody has called this the command center. I think undoubtedly the

2

commanding was going on at Crystal River.

3

It was referred to as a controlling or

4

central center. I don't remember the

5

term, "command center," coming from Mr.

6

Dunn.

7

Q How long were you in the control center

8

command module?

9

A I was in that for a few hours. I made

10

contact with the -- maintained contact with them

11

for a period of time until late that evening, and

12

response coordination was at sometime during that

13

afternoon shifted to the room we have called the

14

War Room previously.

15

Q So, in other words, for a few hours

16

you remained in either the command center or in the

17

War Room, whichever was the focal point of

18

Lynchberg's contact with the Crystal River plant?

19

MR. FISKE: Well, I will object to

20

the form of the question.

21

A For the most part, let's say.

22

Q How many hours was that?

23

A I am not sure. I would place it on the

24

eight-hour time frame.

25

Q That day you didn't go to lunch and

2 play cards?

3 A If it occurred in the morning, that day I
4 did not go to lunch and play cards, no.

5 Q It is your recollection that at some
6 point in that transient the temperature and
7 pressure brought the plant to, or close to the
8 saturation curve; is that right?

9 A Yes.

10 Q The small break guidelines and the
11 April 1979 guidelines and the Bert Dunn February
12 14th, 1978 instructions called for having high
13 pressure injection on at such a time; right?

14 A Yes.

15 Q Did you believe that the actions by
16 the Crystal River operators in handling high
17 pressure injection on the day of the Crystal River
18 transient were consistent with those various
19 instructions on high pressure injection?

20 MR. FISKE: Well, are you referring,
21 Mr. Seltzer, to the question whether it was
22 consistent with the instructions to leave
23 HPI on at a time when temperature and
24 pressure indicated that they were close to
25 the saturation curve?

1
2 MR. SELTZER; That is a good first
3 question.

4 MR. FISKE: Well, it is the only one
5 you have established a predicate for.

6 MR. SELTZER: O.K.

7 A When -- the time frame for my belief, please.

8 Q The day of the accident.

9 A I don't think I believed one way or the
10 other. I didn't ask the question.

11 Q Were you mentally comparing the status
12 of high pressure injection of Crystal River with
13 the small break guidelines?

14 A Yes.

15 Q For what purpose were you comparing
16 them?

17 A For determining what the present status of
18 the HPI should be.

19 Q From what you heard was the status of
20 the high-pressure injection, did you believe it
21 conformed to the small break guidelines?

22 A At the first time that I reviewed the data
23 we had available to us from the site, which was
24 information being relayed to us and updated
25 periodically at the time that it was related,

2 the plant was in a condition that was well
3 subcooled. They could have been doing anything
4 with the HPI as far as I was concerned in those
5 circumstances.

6 Q Did you either directly or indirectly
7 communicate any advice to the Crystal River
8 operators regarding operation of high-pressure
9 injection that day?

10 A We passed on the words to the B&W site
11 representative that we wanted to be sure the
12 plant maintain its 50 degrees subcooling margin.

13 Q Did you pass on the word that it would
14 be appropriate to terminate high-pressure
15 injection so long as the 50 degrees subcooling
16 margin existed?

17 A I don't recall whether we passed that on or
18 not.

19 Q Was Bob Jones at the B&W offices
20 in Lynchberg that day?

21 A I do not recall.

22 Q Do you recall whether you had any
23 communication with Bob Jones regarding the Crystal
24 River incident on the day of the Crystal River
25 event?

1
2 A No, I cannot recall whether I did or did not.

3 Q Would you look at the first page of
4 GPU Exhibit 108, please. Would you turn to
5 Part I.

6 Who, to the best of your recollection,
7 wrote the section, "Background Information for a
8 Spectrum of Loss-of-Coolant Accident"?

9 A It was a combined effort between Mr. Bob
10 Jones and Mr. Bob Salm.

11 Q Did you review the small break
12 guidelines before they were finalized?

13 A Yes.

14 Q Were you satisfied with the contents?

15 A I was satisfied that the contents were
16 sufficient for issuance at that time.

17 Q In other words, you believed that the
18 material contained in it was accurate?

19 A Sufficiently accurate for the purpose being
20 served and worthy of distribution.

21 Q At the end of the first paragraph of
22 the background information section there is a
23 sentence that begins, "The existence..." Do you
24 see that?

25 A Yes.

1
2 Q It states there, "The existence of
3 saturated conditions within the reactor system is
4 the principal longer-term indication of a
5 loss-of-coolant accident."

6 Let me ask you first, as background,
7 it is correct, is it not, that the principal
8 difference between your February 9, 1978 and
9 February 16, 1978 instructions were the addition
10 of the 50 degrees subcooling margin?

11 A No, I don't think I would phrase it that way.

12 Q How would you phrase it?

13 MR. FISKE: Why don't we get them
14 out and we can look at them.

15 A I think the principal difference was the
16 subcooling margin could exist and be appropriate
17 at a variety of pressures as opposed to the
18 specific pressure contained in the February 9th
19 memo.

20 Q The February 9th memo does not make
21 any specific reference to saturation, does it?

22 A No.

23 Q The February 16th memo specifically
24 refers to saturation, right?

25 A In the recipe or the instruction. It does

1
2 not specifically mention saturation.

3 Q In the February 9th memo, right?

4 A In the February 9th memo.

5 Q The recipe or prescription on February
6 16th does refer specifically to saturation, right?

7 A It refers to the saturation temperature
8 corresponding to the existing reactor coolant
9 system pressure.

10 Q It thereby refers specifically to
11 the occurrence of saturation or to a margin that
12 is necessary to be maintained below saturation;
13 is that right?

14 A It does refer to a margin to be maintained
15 below saturation; that is correct.

16 Q The April 4th and the April 17th
17 instructions on operation of high-pressure
18 injection both included specific references to
19 maintaining a margin below saturation; right?

20 A That is correct.

21 Q When did you first become aware of the
22 fact that the existence of saturated conditions
23 within the reactor system is the principal
24 longer-term indication of a loss-of-coolant
25 accident?

1
2 A The question of distinguishing between loss-
3 of-coolant accidents and other accidents which
4 could involve a depressurization of the reactor
5 coolant system was primarily raised for the first
6 time in my belief in constructing the operator
7 small -- the small-break operational guidelines,
8 that this occurrence was a principal indicator
9 of most -- excuse me, most small-break loss-of-
10 coolant accidents was known and established, I
11 think, as early as 1973.

12 Q Known and established by whom?

13 A The ECCS Group Unit, although we had a
14 different title then.

15 Q Is it something that you knew in 1973?

16 A Yes.

17 Q Did you have any discussions with
18 anyone after the Three Mile Island accident about
19 the appropriateness of hinging instructions for
20 high-pressure injection operation on the detection
21 of margin to saturation?

22 MR. FISKE: I am sorry; I would just
23 like to hear that question again, please.

24 (Question read.)

25 A Yes.

1
2 Q When is the first time that you had
3 such discussions?

4 A When Taylor and Elliott met in my office
5 to discuss what type of instructions we would issue.
6 I explained why these instructions were formed
7 the way they were, what they were intended to do
8 which was to assure a given physical amount of
9 water in the system by noting that the temperature
10 and pressure combination at a given location
11 within the plant could not be that of steam.

12 Q When you refer to maintaining a given
13 amount of water, you meant liquefied water?

14 A Yes.

15 Q Did either Taylor or Elliott at any
16 point indicate that they thought appropriate
17 instructions could be issued without reference to
18 the occurrence of saturation or the maintenance
19 of a margin below saturation?

20 A I don't recall them saying such. I recall
21 us agreeing that these would work.

22 Q Did anyone on the group that worked
23 on the small break guidelines say or suggest at
24 any point that the reference to saturation was
25 not appropriate?

2 A I don't believe so.

3 Q Was it your understanding when you
4 finally issued the April 4, 1979 instructions that
5 that was the first time that B&W had issued
6 instructions on operation of high-pressure
7 injection which were keyed to saturation or margin
8 below saturation?

9 A No, because I was not familiar with whatever
10 instructions we had previously issued or that we
11 had in fact even issued any differentiating between
12 preparation of draft material and actually
13 issuing instructions.

14 Q Did you have an understanding that B&W
15 had not previously prepared instructions or draft
16 procedures which tied the operation of
17 high-pressure injection to the specific recognition
18 of saturation or the specific recognition of a
19 margin below saturation?

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

21 Q At any time since the Three Mile Island
22 accident have you come to have that understanding?

23 MR. FISKE: Before you answer this,
24 can I hear the previous question and the
25 answer?

2

(Record read.)

3

A I don't think I have an understanding.

4

I have a belief.

5

Q What is your belief?

6

MR. FISKE: Well, I am going to

7

object to that unless it is based on

8

something that makes the question

9

worthwhile.

10

Q Go ahead and answer.

11

MR. FISKE: Why don't you start by

12

answering what your belief is based on

13

without saying what the belief is.

14

A My belief would be based on the many

15

interactions that I have had since the Three

16

Mile Island accident, the issuance of the

17

various small break operating guidelines and

18

other procedures, the interest in the use of

19

certain meters and/or scopes at our facilities

20

but I would say no real specific recollection.

21

Q If your belief is based on all of

22

those personal experiences, why don't you tell

23

me what it is.

24

MR. FISKE: I don't think this makes

25

very much difference.

2

MR. SELTZER: O.K.

3

A It is my belief we have not issued HPI management instructions relative to maintaining a subcooling margin following the accident previous to Three Mile Island.

4

5

6

7

MR. FISKE: I might say once again

8

that is a factor -- either it is a fact

9

either they did or didn't.

10

MR. SELTZER: Now, I will bet that

11

there is not going to be any one person who

12

is going to know for sure what was issued and

13

what was not issued, and we may go to

14

trial and this may go to the United States

15

Supreme Court without it ever being

16

established as a fact whether B&W issued it,

17

but there will be many people who will have

18

beliefs that they didn't issue it, and it

19

will probably be that that is how the

20

fact will be determined not based on you

21

coming in with something engraved in tablets

22

that were handed down at Mount Ararat saying

23

either the company did or didn't issue it.

24

I don't think that is how fact is determined.

25

MR. FISKE: I can guarantee it won't

1
2 be determined what Mr. Dunn is stating today,
3 what his belief is based on, is a series of
4 unrelated incidents.

5 MR. SELTZER: That is what makes it
6 interesting.

7 BY MR. SELTZER:

8 Q Whom do you believe would be most
9 knowledgeable at B&W about whether operating
10 instructions had been issued prior to Three Mile
11 Island that were tied to maintenance of a
12 subcooling margin?

13 A The filing system.

14 Q The filing assistant?

15 A The filing system.

16 Q Are there any individuals who have
17 their finger on the pulse of communication with
18 customers in this area who might know?

19 A Yes.

20 Q Who?

21 A I would first ask Don Hallman.

22 Q Do you have any second choices?

23 A The people that report immediately to Don
24 and the files of the project managers on the
25 operating plants.

2

Q In the instructions that were issued

3

since the Three Mile Island accident for proper

4

operation of high pressure injection, did you

5

believe that the instruction relating to

6

maintenance of a subcooling margin was an

7

important instruction?

8

A Yes.

9

Q What is there about that instruction

10

that you believed made it an important instruction?

11

A It is important because it guarantees us a

12

certain inventory of liquid coolant within the

13

reactor coolant system before any action should

14

be taken to retard or shut off the supply, the

15

additional supply of coolant to the system.

16

Q Once a plant hits saturation, steam

17

is formed in the primary system, right?

18

A Steam would start to be formed if it went

19

a little bit past saturation.

20

Q If the plant is then effectively

21

brought into the subcooling range through

22

high-pressure injection, what happens to the

23

steam that has been formed according to the

24

analyses that your unit has done?

25

A There are many possibilities.

1
2 Q What are the more probable?

3 A It would depend on the amount of steam that
4 was formed while the plant was at saturation.

5 MR. FISKE: You understand I will
6 object to this line of questioning unless
7 Mr. Dunn is testifying based on analyses
8 that have already been made.

9 MR. SELTZER: Right. That is what I
10 assumed I was asking him about.

11 MR. FISKE: Is that what you meant?

12 MR. SELTZER: Yes.

13 MR. FISKE: O.K.

14 Q Let us say the plant, if this is
15 something that you have studied, has been at
16 saturation for 10 minutes. Have you done analyses
17 that would show what would happen to the quantity
18 of steam that would be generated in the primary
19 system?

20 A To answer that question, I would have to
21 quote details from our analysis.

22 I am not prepared to answer that
23 question today.

24 Q Are those analyses which had been
25 done prior to the Three Mile Island accident?

1
2 A In general I could base my response on
3 analysis performed before Three Mile Island.

4 Q Are you able to say from what you can
5 recall from those analyses what the variety of
6 different things are that could happen to the
7 plant? Let me just ask this --

8 A Yes.

9 Q Go ahead; tell me what are the variety
10 of things.

11 A We would express the steam content in
12 terms of cubic feet or some volumetric measure,
13 expressing it in terms of time would require the
14 specification of a given break size or a given
15 break scenario.

16 If the amount of steam was small, then
17 there is the possibility that some steam would
18 remain collected in the upper head of the reactor
19 vessel, some steam would initially collect in the
20 upper regions of the 180-degree bend in the candy
21 cane, and that steam would eventually be condensed.

22 I am hypothesizing that there is a
23 finite time for steam formation, and at sometime
24 the high-pressure injection is either capable of
25 overcoming the break or we have secured the break

2

somehow.

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There is the possibility that steam

might only have been formed in the pressurizer,

in which case it would collect there. If a larger

amount of steam is formed within the primary system

itself, excluding the pressurizer, a significantly

sized steam bubble could appear in the upper head

of the reactor vessel, a significant size bubble

could appear in the top of the two hot legs, which

again would be gradually condensed, but that is

provided the bubble in the hot leg is not large

enough to totally stop natural circulation.

If the bubble is large enough to

totally stop natural circulation and the resultant

energy balances between the hot legs and the

steam generator and cold leg sections are not

sufficient during the remainder of transients

to induce circulation, the steam would stay in

those locations for an extended period of time,

gradually condensing as energy was lost to the

environment.

Q There are no windows built into the

primary coolant system, are there?

A Not other than the instruments.

1
2 Q So you can't send an operator over to
3 the reactor coolant system and tell him to look
4 through the glass and see whether there is steam
5 or water at different points in the system, can
6 you?

7 A No.

8 Q In order to determine whether there is
9 a two-phase mixture in the reactor coolant system,
10 what types of instruments were available, to your
11 knowledge, in the Three Mile Island plant on March
12 28, 1979?

13 A Hot and cold leg pressure and temperature,
14 pump flow.

15 Q What pumps?

16 A Reactor coolant pumps.

17 I think pump flow is probably wrong.
18 Flow measurement. Those would be the direct ones.

19 Q Would you need to know pressure?

20 A I mentioned pressure, I thought.

21 THE WITNESS: Didn't I?

22 MR. FISKE: No.

23 A (Continuing) I would need to know pressure.

24 MR. FISKE: I didn't hear it, either.

25 MR. BENEDICT: In connection with hot

leg temperature and pressure and cold leg temperature and pressure.

THE WITNESS: That is what I thought.

MR. FISKE: For once we agree.

Q Where would you need to know the flow, the flow at what point?

A You asked what would indicate saturation in the primary system?

Q Right.

A If all the reactor coolant system pumps are running, the flow which would be measured would be a gradually reducing flow because of the nature of the measurement instrumentation as saturated conditions progressed to higher and higher void fractions.

Q If you had the temperature and pressure in the hot and cold legs that would show whether the reactor coolant system was at saturation or not; is that right?

A Well, there is an accuracy involved in instrumentation and that is the reason -- one of the reasons for the margin that is utilized in the calculation that would indicate it was at saturation. You could not determine the void

2

fraction from those measurements.

3

Q So, in other words, if the reactor

4

coolant pumps are on, you could know from the

5

flow whether you had steam in the primary system;

6

is that right?

7

A Well, you could not exclude the upper head

8

of the reactor vessel.

9

Q What does that mean?

10

A Well, it is possible to place the plant in

11

a configuration in which a two -- a solid water

12

liquid state, circulation exists around the loops,

13

through the generators, back into the vessel

14

through the core and back out the hot leg, and

15

at the same time have a steam bubble in the upper

16

head of the reactor vessel.

17

Q If that existed, you would not be

18

able to tell just from the flow through the

19

primary coolant pumps that there was steam in

20

the reactor coolant system; is that right?

21

A That's correct.

22

Q If the hot and cold leg temperatures

23

were 30 degrees below the saturation curve, that

24

would merely indicate that there was not

25

saturation occurring in the primary system at that

2

time, right?

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MR. FISKE: Mr. Seltzer, it seems to me you are just now engaging in a colloquy with Mr. Dunn concerning his present analysis of the questions that you are asking him. I don't think any of these questions are based on any analysis that Mr. Dunn made prior to the accident or even since.

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MR. SELTZER: Well, I am still basing it on what I thought I had established starting these questions, that is, I want to know what the instrumentation was to his knowledge in the Three Mile Island plant on March 28th, 1979 and what he would expect from those instruments, what he would have to -- what those instruments would have to be telling him in order to conclude there was saturation in the primary system.

22

23

24

25

MR. FISKE: Yes, I understand what you are asking him, and that is exactly my point. You are asking him to take the instrumentation that was available on

1
2 March 28th, 1979 and now you are asking him
3 a series of questions about what would have
4 to be shown by those instruments to determine
5 whether or not there was saturation.

6 It seems to me that is precisely the
7 question of asking Mr. Dunn for his present
8 analysis of that instrumentation, and I think
9 that is not proper.

10 MR. SELTZER: I am asking him what his
11 knowledge was of that instrumentation on
12 March 28th, 1979 and what he can recall of
13 his knowledge of that instrumentation on
14 that date would show, given history.

15 MR. FISKE: I think he has told you
16 what the instrumentation was. You have
17 asked him that question, and he has given
18 you the answer.

19 MR. SELTZER: I don't disagree.

20 MR. FISKE: Now you are starting to
21 ask him a series of hypothetical questions,
22 if it was this, if it was that.

23 MR. SELTZER: I am just trying to
24 understand his last answers. I am really
25 not trying to write a textbook of

thermodynamics.

MR. FISKE: I think we all know what you are trying to do. The question is whether it is proper or not.

I think he has answered the question. From this point on, I think it is a bunch of hypotheticals that Mr. Dunn is not required to answer.

While you are thinking about that, I have to just make one quick phone call.

(Recess taken.)

MR. SELTZER: I would like to mark for identification as GPU Exhibit 109 a blue book, Babcock & Wilcox' "Evaluation of Transient Behavior and Small Reactor Coolant System Breaks in the 177 Fuel Assembly Plant, May 7, 1979," Volumes I and II.

(Volumes I and II of the book "Evaluation of Transient Behavior and Small Reactor Coolant System Breaks in the 177 Fuel Assembly Plant, May 7, 1979," by Babcock & Wilcox was marked GPU Exhibit 109 for identification, as of this date.)

BY MR. SELTZER:

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Q When you were getting reports from Three Mile Island on March 28, 1979, have you already described the instrumentation which was in the plant which you believed could indicate the existence of saturated conditions?

A Yes.

Q You have identified the flow of the reactor coolant pumps and the instruments measuring temperature and pressure in the hot and cold legs; right?

A Yes.

Q It is a fact, is it not, that the instruments recording temperature and pressure in the hot and cold legs would only show whether the plant was currently at saturation; isn't that right?

A That's true.

Q Those instruments could not show whether saturation had previously occurred but was not now occurring; right?

A I don't know actually.

Q If the plant had previously been at saturation so that steam had formed and maybe it was sitting at the top of the reactor vessel but

1
2 the water in the hot and cold legs then came
3 down to a temperature and pressure that was
4 below the saturation curve, isn't it a fact
5 that it was your understanding on March 28th,
6 1979 that those instruments would then show
7 readings below the saturation curve?

8 A At that time they would show it. The
9 reason I said I was not sure was that some
10 of these instruments have attached strip
11 charts which would indicate history.

12 Q Did Three Mile Island Unit 2
13 have strip charts?

14 A I do not know. They did have a
15 reactimeter.

16 Q What is a reactimeter?

17 A A data logger of some fashion.

18 Q During March 28, 1979 did you
19 or others who were with you at B & W call for
20 data from the log of earlier plant parameters?
21 What I mean is, did you ever ask for data on
22 what had happened at some earlier time during
23 March 28th, 1979?

24 A During that day I did not. I don't
25 know what others did.

1

2

Q Can you identify, please, what

3

GPU Exhibit 109 is other than just reading

4

the title?

5

A GPU Exhibit 109 is a copy of a report

6

issued by Babcock & Wilcox in support of its

7

177 fuel assembly operating plants on May 7th

8

and the report was issued to the Nuclear Regulatory

9

Commission.

10

Q You have referred to GPU Exhibit

11

109 as the blue book; right?

12

(Continued on page 826.)

13

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A Yes.

3

Q Why?

4

A When it was originally issued, the front and back covers of it were blue.

6

Q Did you assist in the preparation of the blue book?

7

8

A Yes.

9

Q Was the blue book generated by the same task force that produced the small break operating guidelines?

10

11

12

A Some of the small break operating guidelines are contained within the blue book as an appendix, but a majority of the work documented in the report was produced by other personnel.

13

14

15

16

Q What other personnel worked on it?

17

A Personnel with ECCS Analysis and personnel with Safety Analysis.

18

19

Q That is Labelle's outfit?

20

A Yes.

21

Q Will you turn to Page 4521 way up near near front.

22

23

A 4521.

24

I was looking for another type of page number.

25

2

Q At the bottom of the page do you see

3

where it says, "The work documented in this

4

report..."?

5

A Yes.

6

Q It says, "The work documented in this

7

report leads to the following conclusions:

8

"1. Analytical codes are available

9

that accurately predict plant response to various

10

transients and small break scenarios. These codes

11

have been benchmarked against the TMI-1 data."

12

Do the analytical codes include CADDS

13

and CRAFT-2?

14

A Yes.

15

Q Was this a reference to any other

16

codes?

17

A I would have to review the document to

18

answer that question.

19

Q What is your belief?

20

MR. FISKE: Well, if he has to review

21

the document, he can review it.

22

MR. SELTZER: All right.

23

Q Is there anything that you could turn

24

to easily within the document to refresh your

25

recollection? If so, please do.

2

A Within the summary and conclusions, the only codes mentioned are CADDs and CRAFT.

3

4

Q When you say that these codes have been benchmarked, what does that mean?

5

6

A The appropriate boundary conditions from the incident at Three Mile Island were utilized in a simulation of the event with the codes. Following the simulation, the product of the codes was compared to the data judged to have a sufficient level of accuracy.

7

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Q Were these codes in use at Babcock & Wilcox at the time of the Davis-Besse transient?

13

14

A I can't testify to the use of the CADDs code.

15

16

Essentially the CRAFT code was in use at that time.

17

18

Q Did you benchmark the CRAFT code against the Davis-Besse September 24, 1977 transient?

19

20

21

A No.

22

Q Is benchmarking a way to test the accuracy of a computer code?

23

24

A It is one way.

25

Q Is that why you benchmarked CADDs

2

and CRAFT against TMI-2?

3

A No.

4

Q Why did you benchmark those codes

5

against TMI?

6

A There were two reasons. One was to

7

demonstrate that the codes would essentially

8

reproduce the Three Mile Island accident. The

9

second one, reason, was to gain some insight

10

over and above the data as to what had occurred

11

to the fluid volumes within the reactor coolant

12

system during the transient.

13

Q You said the first purpose was to

14

determine that the codes would reproduce the

15

Three Mile Island accident.

16

Why did you want to determine that?

17

A I wanted to demonstrate it. I didn't use

18

"determine."

19

Q Why did you want to demonstrate that?

20

A At the time I initiated the evaluation,

21

I thought there would be interest in that, and

22

I thought it would have usefulness in future

23

licensing arenas.

24

Q Would you look at Page 518, please.

25

A 4518?

2

Q Right. In the second paragraph of the

3

Introduction it says, "This report documents

4

recent analytical work performed by Babcock &

5

Wilcox in connection with small breaks. These

6

analyses were performed to develop further

7

understanding of plant response during various

8

small break scenarios."

9

The reference to analysis includes

10

work performed by ECCS Analysis; right?

11

A Yes.

12

Q It goes on to state, "The results of

13

these analyses were used as a basis for

14

developing operating procedure guidelines which in

15

turn will form the basis for the development of

16

further training and detailed operating procedures

17

where necessary."

18

Are the operating procedure guidelines

19

that are referred to there the small break

20

guidelines that were previously marked as GPU

21

Exhibit 108?

22

A Yes.

23

Q Was it your understanding at the time

24

that the blue book was issued, GPU Exhibit 109,

25

that the small break operating guidelines were

going to be used as the basis for the development of further training and operating procedures?

A Yes.

Q As a result of these analyses did B&W develop a further understanding of the plant response during various small break scenarios?

A I phrased my opinion on these analyses as being basically confirmatory of our previous positions. I certainly created a computerized set of data which is of use in extrapolation and in understanding things to a greater detail than is necessary to reach the conclusion of bounding analysis.

Further they specified or allowed us to specify certain points such as the minimum time for initiation of high-pressure injection for total loss of feedwater event.

Q Would you turn to Page B 4519.

Do you see the last paragraph on that page?

A Yes.

Q It states there, "This report also describes some equipment changes which will provide greater assurance that the most likely

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small leak (opening of the pilot operated relief valve - PORV and reactor trip on loss of feed water) will not occur and other changes that, should a leak occur at any point, will aid the operator in diagnosing plant status so that correct actions will be taken."

When did you first learn that the opening of the pilot operated relief valve was the most likely small leak in the reactor coolant system?

A About two minutes ago.

Q Do you understand the phrase, "small leak," to be used here in the same sense ECCS analysis sometimes uses the phrase, "small break," or commonly uses the phrase, "small break"?

MR. FISKE: I will object to that, Mr. Seltzer, unless Mr. Dunn reviewed this at the time and had some understanding then.

Q Did you review the blue book before it was issued?

A Not totally.

Q What parts did you review? Well, let me ask you first: Did you review the

2 introduction and summary and conclusions?

3 A I don't recall whether I did or not.

4 Q Did you receive a copy of the blue
5 book?

6 A Yes.

7 Q Did you receive a copy on or about
8 May 7, 1979?

9 A Yes.

10 Q Do you keep a copy in your office?

11 A No.

12 Q Has anybody ever called you up from
13 the operating plants and said, "Mr. Dunn, we have
14 got a problem; can you help us?" Or words to
15 that effect?

16 A Not usually. But I get those kind of
17 questions from the engineering staffs.

18 MR. FISKE: You mean at B&W?

19 MR. SELTZER: No, the customers.

20 Q Prior to the last ten minutes had
21 anybody at B&W ever told you that the sticking
22 open of the pilot-operated relief valve was a
23 highly probable small break?

24 MR. FISKE: I object to the form of
25 that question.

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You mean that it was -- are you asking him whether anybody from B&W told him that it was highly probable that the PORV would stick open? Is that what you are asking him?

MR. SELTZER: O.K., that's a good question.

MR. FISKE: Good.

THE WITNESS: Is that the question?

MR. FISKE: Yes.

Q Yes.

A No.

Q Do you believe that the statement on Page 4519 is incorrect in saying that the pilot operated relief valve is the most likely small leak?

A Yes.

Q Is that the first time you have ever told anyone that?

A I don't believe so.

Q Do you think you spotted this error in here before?

A You asked for my belief?

Q Right.

A I would not say that that is an error.

1
2 Q You don't think it is an error, I
3 don't want to push it.

4 What were the equipment changes that
5 were made to provide assurance that there would
6 not be a break caused by the opening of the pilot
7 operated relief valve?

8 MR. FISKE: Maybe he can direct
9 us to the page of the report.

10 MR. SELTZER: Fine. You mean where
11 am I reading from?

12 MR. FISKE: No. It says the report
13 also describes some equipment changes. I
14 assume that is what you are asking him,
15 what changes are described. I thought it
16 might save time if we can just find the page,
17 which I don't carry around in my head.

18 A Well, it might be difficult. I don't see
19 an indication of where it might be in the Table
20 of Contents.

21 Q Would you turn to Page 4534, please.

22 A 4534.

23 Q Is this section on CRAFT analysis the
24 section that was written by your section, your
25 unit?

1

2

A This is one of the sections.

3

4

Q Did you review this before it was finalized?

5

6

7

A I reviewed it for intended content. I did not have the opportunity to review in detail the actual words.

8

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11

Q The introduction describes the fact that the CRAFT-2 code was run in a simulation of the first hour of the Three Mile Island transient, right?

12

A Yes.

13

14

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Q In the middle of the second paragraph it states, "Actual HPI flow rates after ten minutes into the transient are not available. However, plant data indicate that the HPI was throttled and manually controlled by the operator. Therefore, an estimated value of 200 gpm was used for the remainder of the analysis to show that system voiding had occurred even though the indicated pressurizer level shows that it was full of liquid."

23

24

25

Does that mean that after some early point in the accident you assumed that high pressure injection had been manually throttled back

2 to a rate of 200 gallons per minute at Three Mile
3 Island?

4 A For the purposes of this specific analysis,
5 yes.

6 Q You then continued to run the code
7 simulation to see what the response of the reactor
8 coolant system was to the reduced emergency
9 injection and the continued loss of coolant
10 through the stuck open pilot operated relief valve;
11 is that right?

12 A Yes, I believe so.

13 Q When you did that simulation, the
14 analysis showed that system voiding occurred and
15 that refers to voiding in the reactor coolant
16 system; is that right?

17 A Yes.

18 Q "Voiding" is another word for
19 saturation?

20 A No.

21 Q In this sense does voiding refer to
22 the occurrence of saturation in the primary
23 coolant system, as used in this context? Does
24 the word "voiding" refer to the fact that
25 saturation occurred in the reactor coolant system?

1
2 MR. FISKE: In the context of the
3 third paragraph on Page 4534?

4 MR. SELTZER: No, the second
5 paragraph.

6 MR. FISKE: I'm sorry. Oh, yes, I'm
7 sorry, yes. The last sentence?

8 MR. SELTZER: Yes.

9 A The statement that voiding occurs indicates
10 that the system would have been at a saturated
11 state and expanding for a period of time, the
12 Three Mile Island and this analysis were at a
13 saturated state from, I think, approximately
14 ten minutes on. I would need to review the date
15 to give an exact time.

16 Q "Voiding" means that there was steam
17 being formed, right?

18 A Yes.

19 Q And your analysis showed that steam
20 was being formed even though the indicated
21 pressurizer level showed that the system was full
22 of liquid, right?

23 MR. FISKE: I am not sure that is
24 what that sentence means.

25 MR. SELTZER: That is why I am asking

2

the question.

3

A I am not sure of the author's implication
4 in that sentence, either. I can read it two ways.

5

Q What are the two ways you can read it?

6

MR. FISKE: Well, this is ridiculous.

7

MR. SELTZER: Everything you object
8 to is ridiculous. Why don't you just say
9 you object to the form of the question?

10

MR. FISKE: Well, I do; and I don't
11 see asking Mr. Dunn to read it now and tell
12 you what the two different options are meaning
13 anything. It seems we ought to ask the
14 person who wrote it.

15

MR. SELTZER: All right.

16

Q Who wrote it?

17

MR. SELTZER: Probably Mr. Dunn wrote
18 it.

19

A No, I did not write it.

20

Q Who wrote it?

21

A Either Bob Jones or Bill Bloomfield.

22

MR. FISKE: My real objection was
23 that I think you were misstating what the
24 language of the exhibit is.

25

MR. SELTZER: Well, the pronoun "it";

2

and the question is, what is the antecedent of "it" as it appears in the next-to-last line of the second paragraph.

3

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Q As you read this when it was being issued in or about early May 1979, what was your understanding as to what the "it" referred to?

8

9

10

A I indicated that I reviewed this for intended content. I did not review the words. That I recall I did not review the words.

11

12

Q What does the "it" refer to as you read it now?

13

14

MR. FISKE: I will not let him answer that.

15

16

MR. SELTZER: Are you going to direct him not to answer?

17

18

19

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MR. FISKE: Yes, I don't think there is much point in having him answer it because it's a worthless answer in terms of any meaning.

21

22

23

MR. SELTZER: Why don't you object; your objection is preserved, and I think that it is the proper way to proceed.

24

25

MR. FISKE: All right. This is your last question of the day. I will let him

1
2 answer this subject to the clear objection
3 that this is totally improper.

4 Go ahead, Mr. Dunn.

5 A I would expect it refers to the pressurizer.

6 Q You said earlier it could refer to
7 either of two things. What was the other thing
8 you were testifying about it could refer to?

9 MR. FISKE: I object to that. He
10 told you what he thinks it refers to. I
11 think that is going too far, and it is
12 certainly going too far to ask him what
13 all the other possible options are.

14 He does have to get his plane at
15 4:15. He does have to leave to get his
16 plane by 4:15, by my watch, if not by
17 Charlie's.

18 MR. SELTZER: Well, on that --

19 MR. FISKE: At that level?

20 MR. SELTZER: Yes, at that level let's
21 call it a day.

22 We will resume this deposition at
23 another time to be agreed on.

24 MR. FISKE: We will discuss that
25 subject.

MR. SELTZER: We have the deposition of Mr. Walters, which is scheduled for the week of April 13th, and we have the deposition of Mr. Kelly scheduled for the week of April 27th; is that right?

MR. FISKE: That's right. I will guarantee you that whatever resumption of Mr. Dunn's deposition, if any, will be before April 13th but I think at least we ought to proceed in an orderly fashion.

MR. SELTZER: Fine.

MR. FISKE: We will talk about it.

(Time noted: 4:16 o'clock p.m.)



BERT M. DUNN

Subscribed and sworn to before me
this 29 day of October 1982

Danita R. Kidd
Notary Public

Commissioned Notary as Danita D. Robertson
Commission Expires: July 1, 1983

CERTIFICATE

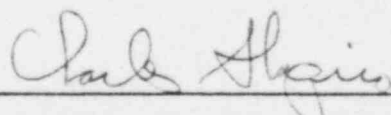
STATE OF NEW YORK)
 : ss.:
COUNTY OF NEW YORK)

I, CHARLES SHAPIRO, C.S.R., a Notary
Public of the State of New York, do hereby
certify that the continued deposition of
BERT M. DUNN was taken before
me on March 24, 1981 consisting
of pages 726 through 842 ;

I further certify that the witness had
been previously sworn 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 said parties 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 10th day of APRIL, 1981.



Charles Shapiro

I N D E X

WITNESS

PAGE

BERT M. DUNN, Resumed

728

E X H I B I T S

GPU FOR
IDENTIFICATION

- 105 Memorandum dated April 28,
1979 from D. H. Roy and R. E.
Kosiba to Distribution,
subject: "Preparation of
Operating Guidelines for Small
Breaks in RC Pressure
Boundaries" 732
- 106 Handwritten memorandum by
Mr. Dunn entitled "Small Break
Indications" 751
- 107 Memorandum dated April 30,
1979 from E. R. Kane to D. H.
Roy, subject: "Small Break
Procedures," copy to Mr. Dunn 761
- 108 Covering memorandum dated
May 7, 1979 to K. R. Ellison
from D. F. Hallman, with
attached Operating Procedure
Guidelines for Small Breaks
dated May 5, 1979 766
- 109 Volumes I and II of the book,
"Evaluation of Transient
Behavior and Small Reactor
Coolant System Breaks in the
177 Fuel Assembly Plant, May 7,
1979" 823

Dunn - Vol. 7

738-776 Small Break Operating Guidelines

- 738-39 - Task Force org'd to develop small break guidelines, headed by Ed Kane
- 739-40 - DNR discussing non-transmittal of instructions w/ Kane
- 745-46 - DNR asking Kane what he did w/ copies of 4/78 memos; DNR asking if he'd taken any steps to get the instructions issued -
- 748 - Task Force with Task 3 able to complete
- 749-50 - Task Force with from 4/78 instructions
- 754-55 - Dunn explains that both low & hi per level can be signs of LOCA & are so listed in SBOGs
- 763-65 - Dunn put together various SBLOCA scenarios after TM1 to show participants ops not find solve in
- 766-67 - curves for various SBLOCA, one of which shows depress in after 10 mins and 4p recovers
- 770-72 - at lecture, ops told Dunn they hadn't received SBOGs; Dunn made no follow-up, tho he had signed final release of SBOGs from B&W.
- 773 - never verified that wtl actually got SBOGs
- 774 - said nothing to Halloran or Kamesch about not getting SBOGs

776-782 Day of Accident

- 776-77 - not sure when first heard of LOCA at TM1-2; may have known core involved before lunch, but not aware of serious nature until after lunch
- 778 - not sure when first heard of sat'n
- 779 - first concerned over proper use of HPI when heard

about superheat

780- DNR anyone else having concern over HPI in on

781- Dunn & Jones met ^{expert} on 4/1 at B&E

782-804:
Crystal River →

782- Womack was knowledgeable about HPI

784-85 was consulted while Crystal River was in progress
793-95 - was called out of lecture into room with
several others in contact w/ Crystal River

800- was informed w/o asking that HPI was on at
Crystal River; if any sat in, only for a short time

803-841

More on Dunn's
Instructions

803-04- info was that Crystal River RCS was subcooled;

B&W passed the word to keep 50° subcooling

806- difference b/w 2/9 & 2/16 instructions is that subcooling
margin doesn't exist & be appropriate at a variety of pressures as
opposed to the specific pressure in 2/9 memo; 2/9 memo
doesn't refer to saturation, while 2/16 memo does.

808- knew in '73 that sat in was principal indicator of
most SBLOCAs

809- when Taylor & Elliott met in Dunn's office, Dunn
explained how his instructions were intended to assure
a given physical amt of water in system by assuring
subcooling at particular P/T

810- not familiar w/ previous instructions

813- Hallman wd know best if any prior instructions
based on subcooling

814- instruction important b/c it guarantees a certain
liquid coolant inventory w/in RCS before any action to
shut off supply of coolant to system

818 - pre-accident, to determine if 2-phase mixture in RCS,
use hot & cold leg P&T, flow measurement

819 - sat in and cause gradually reducing flow

820 - it is possible to place plant in a configuration
in which solid w/ circulates thru loops & there is
a steam bubble in upper head of vessel; if that happened,
cls' & tell just from flow that there was steam in RCS
824³⁵ - P/T & flow rate to tell you if had been sat in,
but no longer, or if liquid flow in loops & bubble in
upper head

825A - GPU109 - 'blue bks' - 5/7/79 B1W report ^{to NRC} on its
177-FA plants

829 - benchmarked CADD5 & CRAFT-2 against TMI data
to show they do reproduce accident and to get further
understanding about fluid volume behavior

830-31 - understood SBOGs w/ be used as basis for dev't of
further & of op'g proc's

834³⁵ - disagrees w/ blue bks statement that open ARV is
most likely small leak; but won't say it's an error