

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

-against-

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

Defendants. :

- - - - - x

Continued deposition of Defendant The  
Babcock & Wilcox Company, by BRUCE ADOLPH  
KARRASCH, taken by Plaintiffs pursuant to  
adjournment, at the offices of Kaye, Scholer,  
Fierman, Hays & Handler, Esqs., 425 Park  
Avenue, New York, New York, on Wednesday,  
September 30, 1981, commencing at 10:05  
o'clock in the forenoon, before Joseph R.  
Danyo, a Shorthand Reporter and Notary Public  
within and for the State of New York.



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By: PATRICIA VAUGHN, ESQ.

-and-

ROBERT B. FISKE, JR., ESQ.,

of Counsel

## Also Present:

DAVID TAYLOR

-oOo-

1  
2 BRUCE ADOLPH KARRASCH ,

3 having been previously duly sworn, resumed and  
4 testified further as follows:

5 EXAMINATION (continued)

6 BY MR. SELTZER:

7 Q You are aware, aren't you, that your  
8 testimony today is under oath the way it has been  
9 every previous day of your testimony in this case?

10 A Yes, I am.

11 MR. SELTZER: I would like to mark as GPU  
12 381 a document produced from your personal files,  
13 according to the identification that was given  
14 to us. It is headed "Implications of TMI-2  
15 Incident."

16 (Document above described so marked as  
17 Plaintiffs' Exhibit GPU 381 for identification,  
18 as of this date.)

19 Q Is that your printing on the last page?

20 A The printing on the last page does look like my  
21 printing.

22 Q Could you please identify GPU Exhibit 381?

23 A I cannot identify GPU Exhibit 381. I don't recall  
24 either preparing it or ever seeing it.

25 Q What were the circumstances under which you

1  
2 wrote the chart or graph that is the last page of this  
3 exhibit?

4 MS. VAUGHN: I am not sure he said he wrote  
5 it. He said it looks like his handwriting.

6 MR. SELTZER: I will take that as he wrote  
7 it.

8 Q Do you know anybody else who has a  
9 handwriting style that looks like that on the last page  
10 of GPU Exhibit 381?

11 MS. VAUGHN: If you know.

12 MR. SELTZER: I just asked him, "Do you know."

13 A No, I do not.

14 Q What were the circumstances under which you  
15 wrote the chart or graph which appears as the last page  
16 of this exhibit?

17 A I really do not recall preparing this chart, nor  
18 do I recall the circumstances leading up to its  
19 preparation.

20 Q Do you think it would help refresh your  
21 recollection about the circumstances under which you  
22 prepared it if I showed you the box of your personal  
23 files in which this was produced to us?

24 A That may help.

25 Q Did Allen Womack ever ask you for anything

1  
2 along the lines reflected in GPU Exhibit 381?

3 A I really do not recall.

4 Q Does it refresh your recollection if I tell  
5 you that we found another copy of all three pages of  
6 GPU Exhibit 381 in another file that was identified as  
7 having come from Dr. Womack?

8 A No, that does not help refresh my memory.

9 Q Have you had a chance to read through the  
10 text of GPU 381 line by line?

11 A No, I just scanned it a few moments ago.

12 Q Why don't you take a chance to read it more  
13 thoroughly and see if that refreshes your recollection  
14 about having authored this.

15 A I have read it.

16 Q Is it beginning to come back to you now that  
17 this is something that you prepared?

18 A No, it is not.

19 Q Do you have any reason to believe anyone  
20 else prepared this?

21 A I don't recall at all preparing the outline which  
22 is typed on the first two pages. I do believe that the  
23 graph is my printing, and therefore I believe I did  
24 prepare it. I still don't recall preparing either the  
25 outline or the chart.

1

2

Q In 1979, did the phrase "PORV qualification" have any meaning to you, and if so, what?

3

4

A The phrase "PORV qualification" did have meaning to me in 1979. I believe that meaning was that the PORV in its original design was not qualified to safety grade standards. It was a non-safety grade piece of hardware. The word "PORV qualification" implied to me that -- let me start that sentence over.

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Qualification of the PORV would mean to me to upgrade it to safety grade standards.

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Q What is the significance of a component such as the pilot operated relief valve being safety grade?

13

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MS. VAUGHN: You are talking about today?

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Q What would be the advantages, to state it differently, of upgrading the PORV to safety grade?

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A There are several requirements outlined in various standards which define what safety grade means. Such things as qualification to seismic levels, assuring that the valve would work under a seismic event, assuring that the valve would work in an adverse environment caused by an accident, assuring that power supplies to the valve were redundant, such that if there were a single failure, you would still have power

1  
2 supplies that would allow the valve to operate, and  
3 possibly some amount of qualification testing to  
4 assure that the valve would operate as designed.

5 Q In other words, testing to assure that  
6 the valve as built conformed with the designs for the  
7 valve?

8 A Yes.

9 Q Is that sometimes called as-built  
10 verification?

11 A I don't know if it is referred to as as-built  
12 verification. I refer to it as qualification testing.

13 Q We will get to a document in a minute in  
14 which you talked about verification as built.

15 Prior to the Three Mile Island accident,  
16 are you aware that the pilot operated relief valves for  
17 the type 177 plant had not been qualified for passage  
18 of water?

19 A Yes, I am aware of that.

20 Q What does that mean, not qualified for  
21 passage of water?

22 A It would mean to me that the service conditions  
23 specified for the valve would have included steam as  
24 the liquid that the valve would relieve.

25 Q You mean the liquid or the fluid?

1  
2 A Excuse me. I meant the fluid that the valve  
3 would relieve and that water would not have been  
4 specified as the fluid for the valve to relieve.

5 Q You say that water would not have been  
6 specified. You mean water in its liquid phase?

7 A Yes. I mean water in its liquid phase.

8 Q Subsequent to the Three Mile Island  
9 accident, has B & W, to your knowledge, considered  
10 changing the qualifications for the pilot operated  
11 relief valve to include qualification for passing  
12 liquid water?

13 A I don't know.

14 Q Have you ever considered what qualification  
15 of the valve for liquid water service should be  
16 undertaken?

17 MR. FISKE: Could I ask a clarifying  
18 question. When you are asking Mr. Karrasch  
19 whether B & W considered qualifying the valve to  
20 pass liquid water, are you asking him whether he  
21 considered whether the valve would allow water  
22 to pass through it. Is that what you mean by  
23 "qualification"?

24 MR. SELTZER: No, I don't mean just could  
25 water escape through it, but whether the valve

1  
2 would still function as designed and pass liquid  
3 water through it.

4 Q Did you ever consider after the accident  
5 the issue of whether the pilot operated relief valve  
6 should be qualified for releasing liquid water?

7 A I don't believe I ever personally made that  
8 consideration.

9 Q Now that we have clarified exactly what I  
10 meant by "qualified for passing liquid water," do you  
11 know since the Three Mile Island accident whether  
12 anybody at B & W has ever considered the desirability  
13 of qualifying the pilot operated relief valve for  
14 permitting the escape of liquid water?

15 A No, I really don't know.

16 Q In 1979, did the phrase "auxiliary feedwater  
17 requirements" have meaning for you?

18 A Yes, they did.

19 Q What was the meaning?

20 A In order to adequately remove core decay heat  
21 following a loss of main feedwater with a subsequent  
22 reactor trip, the auxiliary feedwater must come on  
23 within a certain time and provide water to the steam  
24 generators. The minimum flow rate and minimum  
25 requirement for starting emergency feedwater are what

I consider requirements for emergency feedwater system.

Q In addition to minimum flow, what was the other thing that you said?

A In addition to minimum flow rate, I also consider the delay time between the loss of main feedwater and the start of emergency feedwater as an important variable.

Q And that was something that would be included within the auxiliary feedwater requirements?

A Yes, to the best of my knowledge.

Q Are auxiliary feedwater requirements a document prepared at B & W or a series of documents?

A For the backlog plants under construction, Integration prepared balance of plant criteria which communicated the requirements for auxiliary feedwater to our utility customers. Those are the only requirements for auxiliary feedwater that I am aware of.

Q It is a fact, is it not, that prior to the Three Mile Island accident, the auxiliary feedwater system was not a safety grade system on the lowered loop plants?

A I really don't know the answer to that question.

Q Do you know whether the integrated control system for auxiliary feedwater was safety grade or not

1  
2 safety grade?

3 A It is my understanding that the integrated control  
4 system is not a safety grade system.

5 Q After the Three Mile Island accident, are  
6 you aware of any consideration at B & W to require  
7 that the control and actuation mechanism for the  
8 auxiliary feedwater be upgraded to safety grade?

9 A Yes, I do recall that.

10 Q What, if anything, were the advantages of  
11 upgrading the actuation and control systems for  
12 auxiliary feedwater from non-safety grade to safety  
13 grade?

14 A It is my understanding that the advantages of  
15 upgrading the control system for emergency feedwater  
16 to safety grade were that it would increase the  
17 reliability of the system and provide a greater  
18 assurance that emergency feedwater would be supplied to  
19 the steam generators in the event of a loss of main  
20 feedwater.

21 Q In what way would it increase the  
22 reliability?

23 A As I mentioned earlier, the safety grade  
24 requirements address such things as seismic qualification,  
25 assurance of performance in an adverse environment

1  
2 caused by an accident, redundancy in the power supplies  
3 and the number of pumps and the number of valves such  
4 that a single failure would not preclude getting water  
5 to the steam generators.

6 Q Was the fact that the auxiliary feedwater  
7 was valved out in the control room at Three Mile Island  
8 on March 28, 1979 a single failure?

9 A No, not in the context of designing a system to  
10 safety grade requirements.

11 Q Would designing a system to safety grade  
12 requirements in any way affect whether the system could  
13 be operated with all of the auxiliary feedwater valves  
14 blocked?

15 A My understanding of safety grade in this context  
16 is that the system is designed to still perform in the  
17 event of a single failure of one of the design features  
18 of the safety grade system. It is not designed to  
19 perform adequately for any and all occurrences, such  
20 as operator error or operator closing valves or turning  
21 off pumps.

22 Q In 1979, did B & W have something which you  
23 knew by the phrase "containment isolation requirements"?

24 First let me ask you, did you have an  
25 understanding in 1979 of what the phrase "containment

1  
2 isolation requirements" meant?

3 A Yes, I did have an understanding of what that  
4 phrase meant.

5 Q What did it mean?

6 A My understanding of "containment isolation  
7 requirements" is that the plant is designed such that  
8 the containment can be totally isolated from the outside  
9 world in the event of certain conditions which could  
10 possibly release radioactivity from the fuel.

11 Q You have referred to the containment. In  
12 the sense that you have used it in your answer, is that  
13 the same as the reactor building?

14 A Yes.

15 Q In the aftermath of the Three Mile Island  
16 accident, was there any consideration given at B & W  
17 to changing containment isolation requirements?

18 A I am really not familiar with the containment  
19 isolation requirements. I vaguely recall B & W  
20 suggesting requirements to the utility customers, but  
21 I believe the containment isolation requirements are  
22 the responsibility of the utility, and I really have not  
23 been involved in setting them.

24 Q In 1979, did you understand that "reactor  
25 coolant system high point venting" was a phrase that

referred to possible devices for venting gas out of the top of the loops and out of the top of the reactor vessel?

A Yes, that was my understanding in 1979.

Q What, if any, consideration was given at B & W to modifying the design of its plants to include high point venting in the aftermath of the Three Mile Island accident?

Let me ask you first, was there consideration given to modifying the design of B & W plants after the Three Mile Island accident to include high point venting?

A Yes, to the best of my knowledge.

Q It is a fact, is it not, that you recognized after the Three Mile Island accident that the inability to achieve high point venting could interfere with achieving natural circulation?

MS. VAUGHN: By "you," do you mean Mr. Karrasch himself?

MR. SELTZER: Yes.

A Again, I was not directly involved in the issue of high point venting, but it is my understanding that the requirements for high point vents were mandated by the NRC to the utility customers, and B & W's role

1  
2 in the issue of high point venting was that of responding  
3 to the needs of the utility customers.

4 Q That is not unhelpful, what you have said.  
5 I just don't think it responds directly to what my  
6 question was. Would you like to have the question  
7 reread?

8 A Yes.

9 (Record read.)

10 MS. VAUGHN: I think that is a responsive  
11 answer.

12 MR. SELTZER: I don't think he said a thing  
13 about the ability to achieve natural circulation.

14 MS. VAUGHN: He said he wasn't involved  
15 with it. It was just his understanding of what  
16 was going on.

17 MR. SELTZER: I said it wasn't unhelpful.  
18 I don't think it responds directly.

19 MS. VAUGHN: Do you have another question?

20 MR. SELTZER: No, I want to find out  
21 whether after the Three Mile Island accident he  
22 gained an understanding that if you can't get the  
23 gas out of the top of the candy canes, that it  
24 can interfere with natural circulation. Diminishes  
25 the capability for reactor coolant system natural

circulation. Karrasch to Fahland June 13, 1979.

MS. VAUGHN: Is that an exhibit already marked?

MR. SELTZER: No.

MS. VAUGHN: Will you mark it?

MR. SELTZER: I will in a minute.

THE WITNESS: Would you please reread the original question?

(Record read.)

A I vaguely recall that B & W did not believe the high point vents were necessary to achieve natural circulation in the event of a small break LOCA. I do recall that the NRC mandated that high point vents be installed and that our utility customers then asked B & W for assistance in setting the design requirements for a high point venting system.

That is the best of my recollection.

Q Do you agree or disagree with this statement?: "During a small break transient, the top of the hot leg and the head of the reactor vessel will fill with a steam/water mixture which diminishes the capability for reactor coolant system natural circulation."

I would like you to respond based on your

understanding as of June 1979.

MS. VAUGHN: If you are reading from a document, it might be very helpful for him to see it, because it might be in the context of the document he can answer your question much better than pulling it out of nowhere. It seems to me any answer he gives now is not necessarily a good one without having the document in front of him.

MR. SELTZER: If I had written this on a separate sheet of paper and just asked the question, since I used no funny words, it is all straight English, you wouldn't ask me to show him the document.

MS. VAUGHN: It seems you are asking him reading from a document.

MR. SELTZER: It is.

MS. VAUGHN: I think he should have that document in front of him.

MR. SELTZER: He will get it. Just not now. It is a perfectly proper way to proceed, to ask the witness a question, and then if he can't answer it, I will refresh his recollection by showing it to him.

A You want to try the original question again?

1  
2 Q The question is based on what you knew in  
3 1979. Do you agree or disagree with the following  
4 statement?: "During a small break transient, the top  
5 of the hot leg and the head of the reactor vessel will  
6 fill with a steam/water mixture which diminishes the  
7 capability for reactor coolant system natural  
8 circulation."

9 MS. VAUGHN: I still think if you are  
10 trying to get his understanding of what that  
11 means or what he would have understood that to  
12 mean, it is better to have a document in front of  
13 him. You can go on with the deposition that way.

14 Q You can answer the question.

15 A I am having trouble interpreting your question  
16 because there are different meanings to the words  
17 "natural circulation." When I refer to natural  
18 circulation, I think of solid water natural circulation  
19 where the loops are completely filled with water.

20 Q Let me suggest a different definition and  
21 see if you can answer the question using that. I mean  
22 effective cooling of the core without the reactor  
23 coolant pumps operating.

24 A Again, there are different meanings to the words  
25 "natural circulation."

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Q I just gave you the meaning that I would like you to apply.

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A I can achieve effective cooling of the core without the reactor coolant pumps running if I have either solid water natural circulation in the loops or if I have a condition where there is voiding in a steam/water mixture in the loops. Natural circulation will be achieved in both of those conditions and effective core cooling will occur if I have water on the secondary side of the steam generators to remove the heat being generated.

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Q Are you saying that based on the knowledge that you had in 1979, it is not your understanding that an air block or steam block would rise to the top of the candy canes and impede the further passage of coolant?

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MR. FISKE: By "1979," you mean June?

MR. SELTZER: Right.

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A It was my understanding in June 1979 and it is my understanding today that the core can be effectively cooled by natural circulation during a small break LOCA if there is a steam/water mixture present in the reactor coolant system.

25

Q Are you envisioning as you say that a

homogeneous steam/water mixture? Do you understand what the word "homogeneous" means? That the proportion of steam and water is everywhere the same throughout the entire reactor coolant system. Are you envisioning that the proportion of steam and water is going to be the same at the top of the candy cane as it is at the bottom of the core region or the reactor vessel?

A No, I am not envisioning that. The situation I am alluding to is a condition where the bottom of the loops and the reactor vessel is solid water, and the top of the loops is a homogeneous mixture of steam and water. It is my understanding that in that condition adequate core cooling can be maintained by natural circulation.

Q Do you know what a loop seal is?

MS. VAUGHN: Are you still talking about his knowledge in June 1979?

MR. SELTZER: Yes. I want to know if the head of Plant Integration at B & W knew at the time of the Three Mile Island accident what a loop seal is.

MS. VAUGHN: That is different from June 1979.

MR. SELTZER: I will take either period.

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A I believe I know what a loop seal is, yes.

3

Q What is it?

4

5

A A loop seal is a situation in a piping system where the piping contains trapped gas which will not allow the passage of fluid through the piping.

6

7

Q Is it a "U" bend?

8

A That is my understanding, yes.

9

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Q The tops of the hot and cold legs form "U" bends, don't they?

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A The top of the hot leg is a "U" bend.

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Q During the Three Mile Island accident, have you come to know that the "U" bends at the top of the hot legs became filled with steam?

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A It is my understanding that the "U" bend at the top of the hot legs became filled with steam.

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Q You said that it was your understanding of a loop seal that it was a device which could, by trapping gas, prevent the passage of fluid.

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Was it your understanding in June 1979 that the "U" bend at the top of the hot leg could become filled with a gas known as steam and thereby impede the flow of a fluid known as liquid water?

24

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A No, that was not my understanding in 1979, nor is it my understanding today.

1  
2 Q What is the mechanism by which the liquid  
3 water could pass through the hot legs if they were  
4 containing trapped gas at the top?

5 A It is my understanding that the steam/water  
6 mixture at the top of the loops will be condensed in  
7 the upper portion of the steam generator and return to  
8 the fluid state and thereby continually add liquid  
9 water to the reactor vessel which can then be boiled  
10 off to remove the heat in the core.

11 Q You said that steam would be condensed in  
12 the top of the candy canes; is that right?

13 A I think I said steam would be condensed in the  
14 steam generator.

15 MR. SELTZER: Let me mark as GPU 382 your  
16 memo to Fahland on June 13, 1979, subject:  
17 Responding to TMI-2 Concerns - Verification of  
18 As-Built Data and High Point Venting.

19 (Document above described so marked as  
20 Plaintiffs' Exhibit GPU 382 for identification,  
21 as of this date.)

22 Q Is GPU Exhibit 382 a copy of a memorandum,  
23 together with attachments, that you sent to Mr. Fahland  
24 on or about June 13, 1979?

25 A Yes.

1  
2 Q Do you see the attachment dealing with high  
3 point vent?

4 A Yes, I do.

5 Q At the time that you sent GPU Exhibit 382 to  
6 Mr. Fahland, did you indicate to him in any way that  
7 you disagreed with the statement that appears at the  
8 start of the page on high point vent?

9 A No, I did not indicate to him that I disagreed  
10 with that statement.

11 Q Have you ever told him that you disagreed  
12 with that statement?

13 A To the best of my knowledge, no.

14 Q Do you know what the basis for that statement  
15 was at the time that you sent it to Mr. Fahland?

16 A I do not recall preparing this paper on high point  
17 vent. However, I believe that the basis for the  
18 statement would have been that a comparison was being  
19 made between solid water natural circulation in the  
20 reactor coolant system and natural circulation with a  
21 steam/water mixture. I believe the statement is  
22 implying that solid water natural circulation is  
23 somewhat better than a condition where you have steam  
24 and water natural circulation. However, I believe they  
25 are both adequate for adequate core decay heat removal.

1  
2 Q Let me show you a diagram that I just  
3 sketched depicting the top of the hot legs in a B & W  
4 177 plant. Can you picture where that is in the hot  
5 legs, where there is that "U" bend configuration?

6 MS. VAUGHN: If you can.

7 A Yes, I can.

8 MS. VAUGHN: Can we mark this? I don't  
9 know that it is going to be much --

10 MR. SELTZER: Fine. We will mark it 383.

11 (Sketch above referred to so marked as  
12 Plaintiffs' Exhibit GPU 383 for identification,  
13 as of this date.)

14 Q One side of that "U" bend is the reactor,  
15 and on the other side is the steam generator, right?

16 A Yes, that's correct.

17 Q Did you understand in 1979 that there could  
18 be a situation in which steam would be formed in the  
19 reactor coolant system such that steam would fill up  
20 that area at the top of the hot legs that is depicted  
21 in GPU Exhibit 383?

22 A Yes.

23 Q Don't you recall that Carlyle Michelson and  
24 Bert Dunn had both concluded that if you had a steam  
25 formation occupying that much of the bend at the top

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of the hot leg, that it would interfere with natural circulation under either of the definitions that you have suggested?

MS. VAUGHN: "That much" is a funny term, and this is just your drawing. Do you want to qualify it?

MR. SELTZER: It means below the bottom of the bend.

A I am really unaware of any information from either Mr. Michelson or Bert Dunn on this subject.

Q Let me probe --

A I haven't read anything.

Q Let me probe your understanding, then.

Focusing on this configuration where the steam fills the top of the "U" bend to points that are below this point. What would you call this point that I am pointing to? David Taylor suggested it could be called the inside of the bend.

A That is O.K.

Q Let me label this.

Was it your understanding as of June 1979 that effective core cooling by natural circulation could be achieved when the area above the inside of the bend was filled with steam and in fact it was filled with

1  
2 steam to a little bit below that point and then there  
3 was water on both sides of the hot leg?

4 A Yes, that was my understanding.

5 Q What is the heat transport mechanism that  
6 you understood could give effective core cooling?

7 A As long as the core is covered with water,  
8 adequate core cooling will continue by a natural  
9 circulation process which occurs within the core itself  
10 where the water is merely heated up. As that water  
11 heats, it rises and eventually will form more of a  
12 steam/water mixture in the top of the hot leg as you  
13 have depicted here. As more and more of a steam/water  
14 mixture is formed in the top of the hot leg, eventually  
15 that steam/water mixture will reach the top of the  
16 steam generator. During this entire process, there is  
17 still adequate decay heat removal in the core by  
18 natural circulation.

19 Q Is that because the core is covered with  
20 water?

21 A Yes. It is my understanding that when the  
22 steam/water mixture reaches the top of the steam  
23 generator, that it will be condensed in the steam  
24 generator and return to the solid water state in the  
25 steam generator. At that time, a positive pressure

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2 differential will be established in the loop such that  
3 natural circulation will occur and more water will be  
4 admitted to the reactor vessel to continue the process  
5 of heating water in the core. It is my understanding  
6 that that natural circulation will continue as long as  
7 you remove the decay heat in the steam generators.

8 Q What will remove the decay heat in the steam  
9 generator?

10 A It is my understanding that maintaining a high  
11 water level on the secondary side of the steam generator  
12 will condense the steam and remove the energy from the  
13 primary water through the condensation process.

14 Q So your analysis and understanding was that  
15 eventually the water level in the hot legs gets lower  
16 and lower until eventually the water level drops into the  
17 steam generator; is that right?

18 A Yes.

19 Q And when the water level drops into the  
20 steam generator, then the steam generator begins to see  
21 steam from the primary side, right?

22 A I believe it is a steam/water mixture.

23 Q Your understanding that the steam generator  
24 would contribute effective core cooling is linked to  
25 your understanding that at the time that the water

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level has dropped down to within the steam generator, the core is still completely covered with water; is that right?

A Yes, I believe that is my understanding.

Q After the Three Mile Island accident, are you aware of considerations at B & W that there ought to be increased attention to realistic analysis of expected moderate frequency events? That is item II-A-1 of GPU Exhibit 381.

A Yes, I am generally aware of that.

Q Was that a shift in focus compared to prior to the accident?

A Yes, I believe that was a shift in focus throughout the entire industry.

Q What had the analyses been focused on before the Three Mile Island accident?

A It is my understanding that the analysis prior to the Three Mile Island accident focused on bounding safety analysis, accidents and transients.

Q Were the bounding events events that were not likely to occur or expected to occur with a very low frequency?

A I would say that the bounding events I referred to were expected to occur with a very low frequency.

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Q What, if anything, was the perceived desirability at B & W for shifting the focus to analysis of events that were expected to occur with moderate frequency?

A Please repeat that question.

(Question read.)

Q In other words, what is your understanding of what benefits, if any, would flow from shifting the focus in analysis from events which were highly unlikely to happen to events which were expected with a moderate frequency?

A I need it read back again.

(Record read.)

Q In other words, what was your understanding of the benefits, if any, from focusing transient analysis on events of moderate frequency instead of on events that were highly unlikely to occur?

A I think the focus -- excuse me. I believe the change in focus was primarily due to the operating experience that we had obtained since the start-up of the 177 fuel assembly plants. The change in focus in no way lessened the need to do the bounding safety analysis and show that the plant would be safe and that the safety systems would perform their intended function.

1  
2 Once that was done, and once many years of operating  
3 experience on the plants was obtained, B & W and the  
4 whole industry thought it would now be prudent to begin  
5 to focus our attention on the kinds of events that  
6 really happened on a nuclear power plant.

7 Q Why was that something that was seen as  
8 prudent? Why did you think that was prudent?

9 A I think our experience had shown that things  
10 happened at these plants which we were unable to predict  
11 and that by now taking that experience, we could improve  
12 both the operation and design of the plants to prevent  
13 recurrence of abnormal events.

14 Q Since the Three Mile Island accident, has  
15 B & W begun doing more transient analysis on events  
16 of expected moderate frequency?

17 A Yes, we have.

18 Q You are not saying, are you, that prior to  
19 the Three Mile Island accident B & W was unable to  
20 predict that a valve such as a pilot operated relief  
21 valve would fail to close, are you?

22 A No, I don't believe I am saying that we were  
23 unable to predict that.

24 Q Let me show you the file that was produced  
25 for us from your personal files in which GPU Exhibit 381

1  
2 appears, and I ask you if seeing it in the context of  
3 your files refreshes your recollection about the  
4 circumstances under which it was prepared. It was  
5 produced among these files. It was the file between  
6 6567, 6569. It is TMI-2 natural circulation, TMI-2  
7 owners, TMI sequence of events, and the one you have  
8 is B & W TMI-2 concerns.

9 Is that your handwriting on the file label?

10 A Yes, I believe it is. I recall starting a series  
11 of files shortly after the TMI-2 accident to accumulate  
12 correspondence which had crossed my desk.

13 Q Do you see GPU Exhibit 381 in the file that  
14 is in front of you?

15 A Yes, I see it.

16 Q Does it all come back to you now, the  
17 circumstances under which that was prepared?

18 A No.

19 Q Does any of it come back to you?

20 A I still do not recall preparing GPU Exhibit 381.  
21 I only recall starting the files and accumulating the  
22 documentation which is in them.

23 Q Is that one of your personal files?

24 MS. VAUGHN: What do you mean by "personal"?

25 MR. SELTZER: That this is Mr. Karrasch's

1  
2 files, and to the best of his knowledge, if  
3 something is in there, he put in in or his  
4 secretary put it in at his direction.

5 A To the best of my knowledge, that is true. It  
6 was a long time ago, and I don't recall reading or  
7 filing a lot of this documentation.

8 MR. SELTZER: I would like to mark as  
9 GPU Exhibit 384 a memorandum that begins with  
10 the same first two pages on "Implications of TMI-2  
11 Incident," but contains something fetchingly  
12 listed as "The TMI-2 Message" and concluding  
13 with the same chart that you had at the back of  
14 GPU 381.

15 (Document above described so marked as  
16 Plaintiffs' Exhibit GPU 384 for identification,  
17 as of this date.)

18 Q This copy was produced from Allen Womack's  
19 file. If this doesn't refresh your recollection, I am  
20 going to bring Dr. Womack in a second to tell you all  
21 about it.

22 Just for openers, that is your handwriting  
23 on the side of the first page of GPU Exhibit 384, isn't  
24 it?

25 A Yes, it does look like my handwriting.

1

2

Q Did you read the TMI-2 Message?

3

MR. FISKE: You mean just now?

4

MR. SELTZER: Right.

5

A Yes, I just finished reading it.

6

Q Within the TMI-2 Message, there is a

7

reference at the beginning of the second paragraph to

8

"the attached figure," and it says, "The attached figure

9

depicts the necessary elements which must be strengthened

10

to assure proper operator training and an optimum plant

11

design/operator interface."

12

You prepared the attached figure, right?

13

A To the best of my knowledge, yes.

14

Q And you headed the attached figure in your

15

handwriting "The TMI-2 Message," right?

16

A Yes, to the best of my knowledge.

17

Q And do you recall that you wrote the

18

preceding three pages, which are also entitled "The TMI-2

19

Message"?

20

A I honestly cannot recall preparing any of the

21

pages in this exhibit.

22

Q Do any of these pages bring back even a

23

faint blush of recognition that you have seen them before?

24

A I recall very vaguely during the summer of 1979

25

that I was involved in the initial definition of the

1  
2 ATOG program. I worked with Dr. Womack and people  
3 like Joe Kelly to try and define a program which we  
4 could then offer to our utility customers called  
5 abnormal transient operating guidelines. The work that  
6 I did here, if indeed I even did it, may have been  
7 tied to the initial definition of the ATOG program.

8 Q When you said, "the work that I did here,"  
9 you were referring to GPU Exhibit 384; is that right?

10 MS. VAUGHN: I think he said may have  
11 done it.

12 Q When you said "here," you were looking down  
13 at something in front of you. You were looking at  
14 GPU Exhibit 384, weren't you?

15 A Yes, I was looking at Exhibit 384.

16 Q Did you have a personal secretary in June  
17 and July of 1979?

18 A There was a secretary for the entire Plant  
19 Integration Unit.

20 Q What was her name?

21 A She reported to me. I don't remember her name.

22 Q Is she still with the company?

23 A I had three or four different secretaries in  
24 Plant Integration during the time from 1978 to 1980,  
25 and I don't recall which one was in place during the

summer of 1979.

Q Is Art McBride still with B & W?

A No, he is not.

Q Where is he now?

A I don't know.

Q Where did he go after B & W?

A I don't remember for sure, but I believe he went to a consulting firm called S.A.I.

Q Is Eric Swanson still with B & W?

A Yes, he is.

Q When you wrote on the side of GPU Exhibit 384, page 1, "See Attachment 'TMI-2 Message,'" which were you referring to, the diagram that you wrote or the narrative "TMI-2 Message"?

A I don't recall.

MR. SELTZER: I would like to mark as GPU Exhibit 385 a memo from Mr. Karrasch to Mr. Fortune, subject: Proposed TMI-2 Impact Study, June 21, 1979.

(Document above described so marked as Plaintiffs' Exhibit GPU 385 for identification, as of this date.)

MR. SELTZER: I would like to mark as GPU Exhibit 386 a memorandum from C. W. Litchford to

1  
2 Distribution, subject: TMI-2 Related Work Tasks,  
3 June 6, 1979.

4 (Document above described so marked as  
5 Plaintiffs' Exhibit GPU 386 for identification,  
6 as of this date.)

7 Q Is GPU 385 a copy of a memo which you sent  
8 to Mr. Fortune on or about June 21, 1979?

9 A Yes, it is.

10 Q You outline a series of projects, and you  
11 give the names of people and dates. Was work done on  
12 those projects?

13 A Yes, I recall the work was done on those projects.

14 Q Was it done in the Plant Integration Unit?

15 A It was done by several units at B & W, including  
16 Plant Integration.

17 Q Was any centralized file set up for  
18 organizing materials done on these tasks?

19 A I don't recall.

20 Q Am I correct that GPU Exhibit 386 contains  
21 the owners group list of TMI-2 concerns that you  
22 referred to in GPU Exhibit 385?

23 A I don't recall for sure what I was referring to  
24 on the first page under item 1 as the owners group list  
25 of TMI-2 concerns.

1  
2 Q Do you recall receiving GPU Exhibit 386?

3 A Yes, I do recall seeing regular publications of  
4 TMI-2 related work tasks.

5 Q In June 1979, were Fairbrother, Brooks, and  
6 Brazill members of Plant Integration?

7 A Yes.

8 Q Is Fairbrother still with B & W?

9 A Yes, he is.

10 Q Is Brooks?

11 A Yes, he is.

12 Q Is Brazill?

13 A Yes, he is.

14 Q Is Brockman?

15 A I believe Mr. Brockman took a leave of absence  
16 to return to school several years ago. I don't know  
17 where he is today.

18 Q Is Mr. Leinhart still with B & W?

19 A No, he is not.

20 Q Where did he go?

21 A I don't remember.

22 Q How long ago did he leave?

23 A To the best of my recollection, it was sometime  
24 shortly after the summer of 1979.

25 Q Turn to item 46 in GPU Exhibit 386, please.

1  
2 Do you see where it says, "Evaluation of  
3 interrupted natural circulation as an acceptable cooling  
4 mode"?

5 A Yes, I see that.

6 Q Are you aware whether work was done to  
7 study that item after the Three Mile Island accident?

8 A No, I am not.

9 Q If someone wanted to find the results of  
10 studies on any one of these subjects, is there any  
11 index or source that someone could go to for the papers  
12 that were generated as a result of work on these  
13 subjects?

14 A I really don't know if there is a file that  
15 contains the work related to these tasks.

16 Q Was Litchford coordinating the work on these  
17 tasks?

18 A To the best of my knowledge, Mr. Litchford was a  
19 scheduler who prepared this list. I would not say  
20 that he was coordinating the work.

21 Q Is there anyone who was coordinating the  
22 work?

23 A The people listed under the headings "Task Leader,"  
24 "Integrator," and "Product Manager" would all have some  
25 responsibility with respect to preparing and issuing

the results of the work.

MR. SELTZER: I would like to mark as GPU Exhibit 387 a memo which you sent to Mr. Pryor, subject: Impact of TMI-2 Related Changes on Hardware Design Evaluation, November 9, 1979.

(Document above described so marked as Plaintiffs' Exhibit GPU 387 for identification, as of this date.)

Q You wrote this in early November, 1979, right?

A Yes.

Q You told Pryor that Plant Integration has made an evaluation of studies being conducted in Plant Design which had the potential to change the operating plant or backlog contract reactor coolant system design basis.

Who worked on that evaluation?

A I believe I personally did that evaluation.

Q Did you do it in your head or did you write something down?

A I believe that the evaluation that I performed was a review of those work tasks under way in Plant Design to determine which ones would have an effect on work which was being performed in Dr. Pryor's Component

1  
2 Engineering Section. My review indicated that there  
3 was a potential impact, and as I best recall, the  
4 purpose of this letter was to just make members of the  
5 Plant Design Section aware that they should be  
6 communicating such changes to the people in Charlie  
7 Pryor's Component Engineering Section.

8 Q You say that the purpose of this memo is  
9 to let people in Plant Design know that they should  
10 be communicating with Charlie Pryor?

11 MS. VAUGHN: Are you reading or are you  
12 just asking the question?

13 Q Is that what you just said to me?

14 A Yes, I believe that was the intent of the  
15 memorandum.

16 Q Did you write down anything as part of your  
17 evaluation of the studies that you say you conducted?

18 A I don't recall for sure, but I don't think I did.  
19 I was performing a review of paper which already  
20 existed.

21 Q Do you recall that in the spring of 1979  
22 after the Three Mile Island accident Allen Womack  
23 or Carlton or somebody asked you to review the history  
24 of failures on pilot-operated relief valves and  
25 establish a B & W position on what should be the failure

mode for the electrical circuitry associated with the pilot operated relief valve?

A I don't recall a request like that.

Q Let me show you the request and see if it refreshes your recollection. I show you GPU 33, which is a Womack to Carlton, c.c. to Karrasch, memo, May 15, 1979.

Does that refresh your recollection that you were asked to develop or establish a position for the Plant Design Section on what should be the failure mode for the pilot operated relief valve circuitry?

A I do not recall seeing this request, nor do I recall discussing it with Ray Carlton.

Q You see where Womack says at the bottom of his memo, "Prompt Action is Needed," capitalizing Prompt Action Needed?

A Yes, I see that.

Q He also underlined it. Do you see that, too?

A Yes.

Q Do you remember taking any action?

A No, I do not.

MR. SELTZER: I would like to mark as GPU Exhibit 388 a Preliminary Report of Safety Concerns from Mr. Brockman, PSC 35-79, dated August 10,

1979.

(Document above described so marked as Plaintiffs' Exhibit GPU 388 for identification, as of this date.)

Q Have you had a chance to look at GPU Exhibit 388?

A Yes, I have just reviewed it.

Q Plant Integration is supposed to be the lead unit on this PSC and the manager of Plant Integration is supposed to review all PSC's.

Is GPU Exhibit 388 a copy of a page which you have seen and previously reviewed?

A Yes, I recall seeing this PSC when it was issued.

Q Do you recall the concern that is being described here, namely, the relatively high probability that the steam generators will be flooded during a number of transients?

A Yes, I do recall the concern.

Q Do you recall that sometime in November 1978 or earlier B & W management directed the Plant Integration Unit to spearhead the job of resolving this problem?

A I recall that there was an effort under way in Integration prior to TMI-2 to resolve a concern on the

1  
2 BSAR 205 plant with respect to the potential for steam  
3 generator overfill.

4 Q In the nine months between November 1978  
5 and August 1979, when GPU Exhibit 388 was written, had  
6 Plant Integration made any progress on providing a  
7 fix for this problem?

8 A To the best of my knowledge, some amount of work  
9 went on between November of 1978 and the Three Mile  
10 Island accident.

11 Q Who was doing that work?

12 A I believe that it was being led by Eric Swanson.  
13 I don't recall exactly, but I don't believe we finished  
14 our evaluation prior to the TMI-2 accident, and I do  
15 recall that the overfill concern was of a lower  
16 priority than addressing the new concerns that had  
17 arisen from the TMI-2 accident.

18 Q Let me switch to another subject.

19 On the 177 plants other than Davis-Besse,  
20 what is the maximum head on the HPI pumps, give or take  
21 a pound or two?

22 A I don't know for sure. I believe that it is  
23 several hundred pounds greater than the design pressure  
24 of the reactor coolant system. That design pressure is  
25 2500 pounds per square inch.

1  
2 Q So something in or around 3000 pounds per  
3 square inch would be your best recollection of what the  
4 maximum discharge pressure for the high pressure  
5 injection system was?

6 A All I really know for sure is that it is greater  
7 than 2500 pounds.

8 Q And you say a few hundred greater, right?  
9 Is that what you just said?

10 MS. VAUGHN: I think he said he just doesn't  
11 really know. He just knows it is greater.

12 MR. SELTZER: That is great for you to say  
13 that. All I am trying to do is capture his  
14 recollection. I think he said just a moment ago  
15 that his best recollection was that it was a few  
16 hundred pounds greater.

17 Why don't you read it back?

18 (Record read.)

19 Q At the time you were head of Plant Integration,  
20 would it have been extremely easy for you to find out  
21 exactly what the maximum discharge pressure was on the  
22 high pressure injection pumps on B & W plants?

23 MS. VAUGHN: Extremely easy? What do you  
24 mean?

25 MR. SELTZER: Like as easy as picking up a

2

telephone and dialing any of five or six people

3

who were in the Pumps Section.

4

A I would say that I could have obtained that

5

information via a phone call or by obtaining a document

6

like a safety analysis report to look it up.

7

Q Did you keep SAR's in your office?

8

A No, I did not.

9

Q Were they available in the Plant Integration

10

Section?

11

A Some of them were, not all of them.

12

Q How many people were working on the ATWS

13

questions in Plant Integration in 1978?

14

A To the best of my recollection, there were between

15

three and five people in Plant Integration who had work

16

assignments related to the ATWS concern.

17

Q Was it a full-time assignment for those

18

people or were they working on other things

19

concurrently?

20

A They were working on other things in addition to

21

the ATWS assignment.

22

Q Was there one person who was supervising

23

all of the ATWS assignments?

24

A Yes, Art McBride was that person.

25

Q Are the files on the ATWS work located

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pretty much in one place?

A I believe that Mr. McBride kept a central file of ATWS documentation in 1978. That is to the best of my recollection.

Q In the course of the ATWS work, was a question raised as to whether continued operation of high pressure injection could result in a pressure spike that would damage the reactor internals?

A I don't recall any such questions.

Q In the course of the ATWS work, was there any question raised about the possibility of a pressure spike created by the operation of high pressure injection?

A I recall that analysis was performed to determine what the transient pressure response of the entire reactor coolant system was during an ATWS event. If a pressure spike were to have occurred, it would have been part of the analysis to determine pressure versus time.

Q Based on the understanding that you had in 1978 of the reactor coolant system, was it your understanding that the high pressure injection pumps could create a pressure in the reactor coolant system greater than the maximum discharge pressure of the high pressure injection pumps? In other words, without any

2 preamble, can an HPI pump create a pressure in the  
3 reactor coolant system that exceeds the head of the  
4 HPI pumps?

5 MS. VAUGHN: As far as he understood in '78.

6 A I don't believe I knew the answer to that question  
7 in 1978.

8 Q Do you know the answer today?

9 A I need to understand more about the specific  
10 conditions you are referring to before I can answer  
11 such a question.

12 Q Like what? What conditions would you need  
13 to know?

14 MS. VAUGHN: I don't think Mr. Karrasch is  
15 here as an expert to answer on that.

16 MR. SELTZER: I will tie this back. It  
17 relates to his knowledge before the accident.

18 Q What are the conditions that you would need  
19 to know?

20 A What kind of a transient are you imposing on the  
21 reactor coolant system? What assumptions are you  
22 making about the performance of relief valves? What  
23 is the initial condition of the temperature and pressure  
24 in the pressurizer? I think there are many variables  
25 that would have a direct influence on the answer to

1  
2 that question. And it would require some analysis to  
3 answer it.

4 Q Have you ever done that analysis or had it  
5 performed for you?

6 A What analysis? You have to be specific.

7 Q Whether a high pressure injection pump can  
8 create a pressure in the reactor coolant system that  
9 exceeds the maximum discharge pressure of the pump.

10 A I don't recall such an analysis being performed.

11 Q Before you responded casually in the hallway  
12 to Don Hallman regarding his August 3 memo, what  
13 analysis had you seen about the response of pressure in  
14 the reactor coolant system to high pressure injection  
15 pumps staying on?

16 MS. VAUGHN: I object to the form of the  
17 question.

18 A The analysis that I had seen, which could be  
19 helpful in answering that question, was the analysis  
20 that had been performed for ATWS.

21 Q I am trying to find out what particular  
22 part of that analysis you are referring to. Who did  
23 it, what did he do, what was concluded, what did he  
24 study. Any of those.

25 A The ATWS analysis includes a very rapid heat-up

1  
2 of the reactor coolant system, which causes a very  
3 rapid expansion of the fluid in the reactor coolant  
4 system. That expansion causes the pressurizer level  
5 to increase, the pressurizer to go solid, and  
6 subsequently end up in water relief out the pressurizer  
7 safety valves.

8 A similar transient in the pressurizer  
9 would occur if one were to leave the high pressure  
10 injection pumps running long enough for the system to  
11 go solid.

12 It is my understanding that the transient  
13 would not be nearly as severe or as rapid as the ATWS  
14 transient.

15 Q With your last sentence, you answered what  
16 I was going to ask you. Why would the transient not  
17 be as rapid or severe as an ATWS transient? What is  
18 the crucial difference?

19 A The ATWS transient causes the reactor coolant  
20 to expand due to a rapid increase in temperature. That  
21 expansion, to the best of my knowledge, is at a greater  
22 rate than the expansion that would result if the high  
23 pressure injection pumps merely injected fluid into the  
24 system.

25 Q Hallman's question hadn't included this

1  
2 part of its hypothesized state of facts that the  
3 reactor remained critical without scram, did it?

4 A I don't think Don Hallman's question said one  
5 way or the other.

6 Q When you said that the HPI situation  
7 wouldn't progress as rapidly as the ATWS situation,  
8 weren't you assuming that in the high pressure injection  
9 situation posited by Hallman that there was a scram of  
10 the reactor?

11 A No, I don't believe that the scram of the reactor  
12 was an important distinction in the questions that Don  
13 Hallman was asking me. Maybe if I could see the  
14 memorandum, it would help.

15 Q Let me take you back a step. You said you  
16 didn't believe that an HPI situation would progress as  
17 rapidly as an ATWS situation. When you said that, I  
18 asked you what did you mean, and you said the heat-up  
19 that causes the transient to progress rapidly, an ATWS,  
20 wouldn't be there in a high pressure injection situation.

21 Isn't it a fact that the heat-up is caused  
22 by the fact that the reactor has not been scrambled in  
23 an ATWS situation?

24 A Yes. The reason the reactor coolant fluid  
25 expands so rapidly in an ATWS situation is that the

reactor is still producing power.

(Luncheon recess taken at 1:00 o'clock p.m.)

-oOo-

AFTERNOON SESSION

(2:15 p.m.)

BRUCE ADOLPH KARRASCH ,

having been previously duly sworn, resumed and  
testified further as follows:

EXAMINATION (continued)

BY MR. SELTZER:

Q You understand that you are still under  
oath to tell the truth?

A Yes.

Q Did you rely on analysis that was generated  
as part of the ATWS project in answering Don Hallman's  
first question as set forth by Hallman in GPU Exhibit  
80?

A Yes, I did.

Q Did you rely on any ATWS analysis to answer  
Don Hallman's second question, what damage would the

1  
2 water surge through the relief valve discharge piping  
3 and quench tank cause?

4 A I think with regard to the second question, I don't  
5 recall looking at any specific analysis. I do recall  
6 that water surge through the relief valve discharge  
7 piping was an issue that had been addressed in ATWS  
8 and that it had been concluded that the valves were  
9 capable of handling a water discharge.

10 Q But you don't recall relying upon that  
11 information or analysis when you responded to Don  
12 Hallman; is that right?

13 A No, I had that information when I did respond to  
14 Don.

15 Q What did you mean when you said you don't  
16 recall relying on any specific information?

17 A I think I am distinguishing between the use of  
18 actual analysis, which is what I used in formulating an  
19 answer to question No. 1, versus what I would consider  
20 just general information that I had received during the  
21 course of the ATWS analysis in the fall of 1978.

22 Q If one were to look at all of the ATWS  
23 analysis material that was generated in the fall of '78,  
24 are you saying that someone would be able to find  
25 information in there relating to whether water surge

1  
2 through the relief valve discharge piping and quench  
3 tank would cause damage?

4 A I don't know that.

5 Q If somebody looked through the ATWS material  
6 that was generated during the fall of 1978, would  
7 someone be able to find information on the surge of  
8 Hallman's first question?

9 A Yes.

10 Q Do you know what form that information is  
11 in?

12 A To the best of my recollection, that information  
13 is in the form of transient pressure traces of the  
14 reactor coolant system during the entire ATWS event.

15 Q Had work been done on transient pressure  
16 responses for the ATWS program before the fall of 1978?

17 A I don't know for sure. I know that work had been  
18 ongoing earlier than the fall of 1978. I don't recall  
19 the specific nature of it.

20 Q How do the transient analysis pressure  
21 tracings that you referred to give any indication that  
22 would respond to Hallman's first question?

23 MS. VAUGHN: I will let him answer, but I  
24 thought we went over this essentially before  
25 lunch.

MR. SELTZER: If you want to tell me what the answer is, please do.

MS. VAUGHN: No, I don't want to.

Q Hallman's first question was if the pressurizer goes solid with one or more high pressure injection pumps continuing to operate, would there be a pressure spike before the reliefs open which could cause damage to the reactor coolant system.

A Would you please now repeat the question?

Q The question is, how did the transient analysis pressure tracings, which you say were generated in the ATWS work during the fall of 1978, lead you to an answer to Don Hallman's first question?

A Those pressure traces, again to the best of my knowledge, show that there is no pressure spike before the relief valves open.

Q Do you recall that there are one or more pressure traces that describe a transient during which the high pressure injection pumps continue to operate? And I mean pressure trace done in the fall of 1978.

A I don't recall looking at any pressure traces where the conditions were such that one or more HPI pumps were operating.

Q Then how did the pressure traces help you

1

2

answer his question, if they didn't show one or more

3

high pressure injection pumps continuing to operate?

4

A It was my understanding at that time that the

5

pressure transient that is imposed upon the reactor

6

coolant system during an ATWS event is more severe than

7

the pressure transient that would occur when one or

8

more HPI pumps continue to operate.

9

Q How can it be more severe? How do you know

10

it would be more severe? In the fall of 1978 and the

11

beginning of 1979, did you know that an ATWS transient

12

would be more severe than an event in which one or more

13

high pressure injection pumps continue to operate?

14

A That was the basis which I used to answer Don

15

Hallman's question.

16

Q Why did you assume that basis?

17

A I don't recall exactly how I came to that

18

conclusion. I may have discussed it with someone in

19

Engineering, but the general phenomenon which is

20

occurring here is that the ATWS event causes the

21

reactor coolant pressure and pressurizer level to

22

increase from the normal value up to the set point of

23

the safety valves within seconds. It is very rapid.

24

My understanding of the capability of the

25

high pressure injection system is that it would cause

1  
2 the pressurizer level and reactor coolant pressure to  
3 increase up to the safety valve set points on the  
4 order of minutes.

5 Q That was your understanding in the fall of  
6 1978 and early 1979?

7 A That was the basis upon which I could answer  
8 Don's first question.

9 Q That is the basis on which you answered it?

10 A To the best of my recollection, yes.

11 Q So you assumed when you answered Don  
12 Hallman's first question that whatever the pressure  
13 effects were that were created in the situation he was  
14 describing in his first question, that was a pressure  
15 situation that would develop over a matter of minutes,  
16 not seconds; is that right?

17 A Yes, to the best of my recollection.

18 Q So you were assuming that the high pressure  
19 injection pumps continuing to operate was a situation  
20 that was existing without a simultaneous transient  
21 without scram, right?

22 A I don't understand that question.

23 Q If you had a simultaneous transient without  
24 scram, you said you would progress to high pressure to  
25 the relief valve set point in a matter of seconds,

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right?

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MS. VAUGHN: What do you mean by

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"simultaneous"?

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MR. SELTZER: Concurrent. Happening at the

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same time.

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MR. FISKE: What happening at the same time?

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MR. SELTZER: High pressure injection pumps

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running and the reactor not scrambled.

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MR. FISKE: I think maybe we need some

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clarification. I think what Mr. Karrasch was

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testifying before, he was not testifying about

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a situation in which there was an ATWS and HPI

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at the same time.

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Q Do you agree with your counsel?

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A Yes, he is exactly right.

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MR. SELTZER: That is all I was trying to

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clear up.

19

Q And you understood that Don Hallman in his

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first question was just asking you about HPI pumps

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operating without their being ATWS at the same time;

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isn't that right?

23

A That was my understanding.

24

Q So if you understood that Hallman's first

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question was just asking you about HPI pumps continuing

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to operate without ATWS going on at the same time, that means that the reactor was scrammed at the time that the HPI pumps were continuing to operate, right?

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A Even though Don's memo states that the reactor was scrammed, I believe that was his intent.

6

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Q That is what you understood at the time,

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that you were responding?

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A To the best of my knowledge, yes.

10

Q If the reactor is scrammed at the time that

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the high pressure injection pumps are continuing to

12

operate, you said that it would take several minutes

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for the pressure to rise to the relief valve set point;

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is that right?

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A That is my understanding, yes.

16

Q And that was your understanding at the time

17

you were considering responding to Don Hallman's memo,

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right?

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A Yes, that's correct.

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Q The cause of the rise in pressure over

21

several minutes is the water being added to the system

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by the high pressure injection pumps; is that right?

23

A The cause of the pressure excursion is the water

24

being added to the system by the pumps, which causes

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the steam space in the pressurizer to contract, and that

1  
2 is what causes the pressure to increase.

3 Q The high pressure injection pumps can only  
4 cause the pressure to increase up to the maximum  
5 discharge pressure of the pumps themselves; isn't that  
6 right?

7 A As I testified this morning, I haven't done that  
8 analysis, but my guess would be that the pressure  
9 could not go above the shutoff head of the pumps.

10 Q Is that what your understanding would have  
11 been, as best you can reconstruct it, in the fall of  
12 1978 and early 1979?

13 MR. FISKE: I don't think he has to  
14 reconstruct it. It is a question of what he  
15 remembers.

16 Q From what you remember, do you recall  
17 anything inconsistent with that from late '78, early '79?

18 A I guess I don't really recall asking myself that  
19 question in late 1978 or early 1979.

20 Q With a reactor scrammed and high pressure  
21 injection pumps continuing to operate, are you aware of  
22 anything that you knew in late 1978, early '79, that  
23 would cause reactor coolant system pressure to rise  
24 above the head of the high pressure injection pumps?

25 A No, I was not aware of anything.

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MR. SELTZER: I have no further questions.

EXAMINATION BY MR. FISKE:

Q You have in front of you Mr. Hallman's memorandum, which is Exhibit GPU 80; is that correct?

A Yes.

Q What is the date of that memorandum?

MR. SELTZER: I think the document speaks for itself.

MR. FISKE: I think it would be useful -- I will read it into the record. The date of this memorandum is August 3, 1978.

Q Is that correct?

A Yes, that is the date of the memorandum.

Q Can you tell us what was going on in the Plant Integration Unit in August 1978?

A To the best of my recollection, in early August of 1978, I had just returned from a one-and-a-half-week vacation and was in the process of spending some amount of extra time working with Allen Womack, who at that time had just been named the new manager of the Plant Design Section.

Q When you refer to "extra time," what do you mean by that?

A As the new manager, Allen was looking to me to

1  
2 assist him in learning about the duties and  
3 responsibilities of both the Plant Integration Unit and  
4 the Plant Design Section, and I found myself spending  
5 considerable time with Allen in addition to my normal  
6 duties and responsibilities during the first two or  
7 three months of his tenure as the new manager.

8 Q I think you said that after you received  
9 Mr. Hallman's memo, you sent it to either Mr. Swanson  
10 or Mr. McBride with a note asking them to look into the  
11 questions raised. Do you remember that?

12 A Yes, that's correct.

13 Q Did you take that action shortly after you  
14 received Mr. Hallman's memorandum?

15 MR. SELTZER: Objection. Leading.

16 Q Can you tell us how soon after you received  
17 Mr. Hallman's memorandum you sent it to either Mr.  
18 Swanson or Mr. McBride?

19 MR. SELTZER: Objection. No foundation this  
20 witness has a recollection.

21 MR. FISKE: I am asking the question.

22 A I don't recall the exact time that I sent the  
23 memorandum to Mr. McBride or Mr. Swanson. I do recall  
24 upon returning from my vacation that I was reviewing a  
25 very large backlog of mail which I had received while on

1  
2 vacation, and I believe at that time that I quickly  
3 scanned this particular memorandum, GPU Exhibit 80,  
4 noted the two questions which were being asked of the  
5 Plant Integration Unit and delegated a response to the  
6 questions to either Mr. McBride or Mr. Swanson by  
7 writing a note at the top of the memorandum and sending  
8 it to one of them.

9 Q Were there any projects that were under way  
10 in the Plant Integration Unit in the late summer or  
11 early fall of 1978?

12 A Yes.

13 Q Can you describe some of the more  
14 significant projects?

15 A There were quite a number of what I considered  
16 very high priority projects under way in the Plant  
17 Integration Unit.

18 Q Would you describe some of the projects  
19 that you considered to be high priority?

20 A The anticipated transient without scram analysis  
21 which was under way was one of the most high priority  
22 efforts.

23 Q That is the program that has been referred  
24 to from time to time in your deposition earlier; is  
25 that correct?

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A Yes, that's correct.

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I recall a major effort to re-evaluate the small break analysis which had been performed on our 205 fuel assembly plants.

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I recall spending a considerable amount of personal time working on what was then called the asymmetric loading problem.

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There were several NRC issues which were taking a considerable amount of time. Some of these that come to mind are a fission gas release program, a program to requalify safety grade control room instrumentation equipment, a program to respond to a regulation guide which required the plants to be taken to a cold shutdown condition entirely through the use of safety grade equipment. And there was one other major project which was under way throughout the entire B & W -- excuse me -- the entire Nuclear Power Generation Division at Lynchburg, and that was a product standardization program, in which we were updating all of our documentation on the 205 fuel assembly plants to assure that the analysis and the system requirements and the equipment specifications for hardware were all consistent and accurate and up to date.

1  
2 Q Do those describe some of the projects that  
3 you considered to be high priority in the late summer  
4 and fall of 1978?

5 A Yes, those are a representative sample of some  
6 of the high priority projects.

7 Q You referred earlier to what we have been  
8 calling the ATWS analysis. I don't think yet in this  
9 deposition you have been asked exactly what you were  
10 analyzing in that program. What was the ATWS analysis?

11 A Anticipated transient without scram was a  
12 transient which was postulated by the NRC in which there  
13 was a loss of main feedwater and a subsequent increase  
14 in reactor coolant pressure to the trip set point  
15 which was supposed to trip the reactor.

16 The concern in ATWS and the postulated  
17 condition was that the reactor did not trip when the  
18 reactor protection system received the high pressure  
19 signal. This led then to a situation where there was  
20 no feedwater provided to the steam generators to  
21 remove the heat generated in the core, and the core  
22 was still producing essentially full reactor power.  
23 This is a very severe condition in which the reactor  
24 coolant system temperature and pressure increases to  
25 values much greater than those previously analyzed.

1  
2 The concern is that the high reactor  
3 coolant system pressures which are well in excess of  
4 3,000 p.s.i. could compromise the structural integrity  
5 of the components and welds in the reactor coolant  
6 system and possibly result in severe damage to the  
7 reactor coolant system.

8 Q You said that this ATWS project had been  
9 postulated by the NRC. What did you mean by that?

10 A To the best of my knowledge, the NRC reviewers  
11 had some time ago begun asking questions about the  
12 reliability of the reactor protection system to scram  
13 the reactor when a demand signal occurred.

14 Q In other words, the work that you were  
15 doing on this ATWS project was being done in response  
16 to questions raised by the NRC?

17 A That's correct.

18 Q I think the next project you mentioned was  
19 the work on the small break analysis on 205 plants?

20 A Yes.

21 Q Can you describe that briefly?

22 A Sometime during the spring and summer of 1978, it  
23 was discovered that the small break analysis for the  
24 205 fuel assembly plants had assumed that there was a  
25 very high water level on the secondary side of the steam

1  
2 generators to enhance condensation heat transfer on  
3 the primary side and subsequently core cooling during  
4 the small break LOCA.

5 We also determined sometime during that  
6 time frame that there was no instrumentation installed  
7 on that 205 fuel assembly plant to measure such a high  
8 level in the steam generator, nor was there a system  
9 installed to automatically bring the water level to that  
10 point.

11 Integration was in the lead to resolve  
12 that generic problem and determine what the best  
13 solution would be. This was one of those situations  
14 where our role as an integrator resulted in us being  
15 asked to resolve an inconsistency between the analysis  
16 which had been performed on the plant and the hardware  
17 which had been designed and procured.

18 Q When you refer to the 205 plants in  
19 connection with this analysis, were those plants that  
20 were then still under construction?

21 A Yes. None of the 205 plants were operating at  
22 that time, nor are they yet operating today.

23 Q You referred earlier to an asymmetric  
24 loading problem that you were working on in the late  
25 summer and fall of 1978. Can you tell us what that was?

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A Yes. The asymmetric loading problem was another NRC concern in which they had discovered that for operating 177 fuel assembly plants that we had never taken into account the loads imposed on the reactor vessel due to a pipe rupture inside the reactor vessel cavity. As a result of this discovery, the NRC told our operating plant utilities to do an entire re-analysis of the supports and restraints and the loads on the reactor vessel for a postulated double-ended rupture of the hot or cold leg pipe where it is attached to the reactor vessel.

One of the people in my unit was asked to take the lead in resolving this problem and getting the analysis performed to the satisfaction of the NRC.

Q You referred -- and that work was also going on in the summer and fall of 1978?

A Yes. That work had been ongoing since 1977. It was a very big project.

Q You referred to a couple of other projects which you described as NRC issues, one of which was the fission gas release program?

A Yes.

Q Can you tell us about that?

A One of the people in my unit was asked to direct

1  
2 a program to determine exactly what the proper values  
3 were for the amount of fission gas which is released  
4 from the fuel during operation. The NRC has asked a  
5 question about our models and techniques for predicting  
6 the fission gas which is released from the fuel, and  
7 they questioned whether or not we were conservative.

8 The concern is that if you underpredict  
9 the amount of gas which is released, you would  
10 consequently underpredict the internal pressure which  
11 is generated inside the fuel rods.

12 As you remember my testifying earlier, the  
13 first barrier to the release of radioactivity is the  
14 fuel rod cladding, which therefore it is very important  
15 that you accurately predict how much fission gas is  
16 released from the fuel and how much pressure build-up  
17 there is inside the rods.

18 During the fall of '78, we had embarked on  
19 a program to re-analyze and recalculate the amount of  
20 fission gas released inside the fuel rod.

21 Q Then I think you referred to another project  
22 that you were working on involving requalifying  
23 instrumentation?

24 A Yes.

25 Q Could you describe that project?

1  
2 A Prior to the summer of 1978, the NRC had issued  
3 a new regulatory guide. I believe the number is  
4 Regulation Guide 1.89, which stipulates that all control  
5 and instrumentation hardware which is inside the  
6 reactor building must be able to withstand the  
7 environment which is imposed upon it during its service  
8 in the plant. They impose such stringent requirements as  
9 making sure that we addressed aging of the equipment,  
10 making sure that we addressed operability of the  
11 equipment in the environment caused by a LOCA or steam  
12 line break, and making sure that procedures were in place  
13 to check the calibration of this hardware so that it  
14 maintained its accuracy over the entire 40-year life  
15 of the plant during both accident and normal conditions.

16 This was a major project which is still  
17 under way today, and to the best of my recollection, it  
18 required a significant amount of time by several people  
19 within the Plant Integration Unit.

20 Q I believe you also referred to work that  
21 you were doing in response to a reg. guide having  
22 to do with being able to proceed to a cold shutdown  
23 condition?

24 A Yes. This was another reg. guide which the  
25 NRC had recently issued which required that the plants

1  
2 install safety grade equipment to allow the operator  
3 to cool the plant down to a stable condition on the  
4 decay heat removal system. The previous requirements  
5 had stated that the plant could be maintained in a  
6 stable hot shutdown condition by the use of safety  
7 grade equipment. This new requirement stated that in  
8 addition to maintaining the plant safe during hot  
9 conditions, that equipment be installed and qualified  
10 to cool the plant down and maintain it in a safe  
11 condition at cold conditions.

12 Here again, this is an issue which requires  
13 the utilities to re-analyze and redesign and reprocur a  
14 considerable amount of hardware to be back-fit to  
15 their plants which are currently under construction.

16 Q This again was going on in the late summer  
17 and fall of 1978?

18 A Yes, it was.

19 Q Then you referred also to a project  
20 spreading across the entire Nuclear Power Generation  
21 Division involving product standardization?

22 A Yes.

23 Q Could you describe that briefly?

24 A Sometime in the spring and summer of 1978, we  
25 discovered that the documentation which defines our 205

1  
2 fuel assembly product had a good number of  
3 inconsistencies and inaccuracies in it which really  
4 did not meet our quality standards for having good,  
5 sound documentation to back up our product.

6 As a result of such a situation, B & W  
7 could be very open to audit by either customers or the  
8 NRC and could find ourselves in the situation where  
9 the equipment which we had purchased for a 205 fuel  
10 assembly plant would not be good equipment, so a very  
11 high priority effort was undertaken in the fall of '78  
12 to make sure that all of the analysis and the system  
13 requirement specs prepared by Integration and the  
14 equipment specifications which were used to buy hardware  
15 were all consistent and right and up to date to the  
16 latest standards. That was a major effort which took  
17 up to 10 or 12 people out of the Plant Integration Unit  
18 on almost a full-time basis during the fall of 1978.

19 Q Again, was the project that you just  
20 described being conducted with respect to the 205 plants  
21 that were then under construction?

22 A Yes.

23 Q You testified in response to one of Mr.  
24 Seltzer's questions earlier that during this period of  
25 time in the late summer and fall of '78 you and others

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in the Plant Integration Unit were working nights and weekends. Do you recall that testimony?

A Yes.

Q Were you working nights and weekends on the projects you just described?

A Many of the projects which I just described were projects which came in which were in addition to our normal duties and responsibilities. It was an overload of work, so to speak. As a result, rather than staff up the unit with more people for what we perceived to be a short-term extra amount of work, a good number of the people in Integration were asked to work overtime to handle not only their normal duties and responsibilities, but also these additional work projects. To the best of my recollection, a good number of people did work nights and weekends, including myself.

Q Do I understand from your testimony that during this period of time in the summer and fall of 1978 there were many other projects going on in the Plant Integration Unit, other than the ones you have described?

A Yes.

Q Without taking the time here to go through every single one of those projects separately, do I

1  
2 understand from what you just said that the projects  
3 that you did describe in some detail a few minutes ago  
4 were projects that were putting this extra workload  
5 pressure on your unit during this period of time?

6 MR. SELTZER: Objection. Leading.

7 A Yes, those projects are the key ones that I can  
8 recall that were causing the extra workload in the  
9 Plant Integration.

10 Q Now, I think you told Mr. Seltzer in  
11 response to his questions that on two occasions, possibly  
12 three occasions, in the fall of 1978, early 1979, Mr.  
13 Hallman asked you in effect how you were coming on the  
14 questions that he had put in his memorandum and that you  
15 told him that someone was working on that and would be  
16 getting back to him with an answer.

17 Do you remember that testimony?

18 A Yes, I do.

19 Q When you told him that someone was working  
20 on it, whom were you referring to?

21 A I was referring to either Art McBride or Eric  
22 Swanson.

23 Q At page 45 of your deposition earlier in this  
24 case, Mr. Seltzer asked you the following question and  
25 you gave the following answer:

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"Question: It is a fact, isn't it, Mr.

3

Karrasch, that you know of no work that was done by

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anybody in the Plant Integration Section to resolve Don

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Hallman's questions between August 3, 1978 and New

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Year's 1979; isn't that right?

7

"Answer: There was work under way in the

8

Plant Integration group on other subjects which are

9

related to the questions which Don Hallman was asking.

10

As a result of being aware of that work, I was able

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sometime after the first of the year, to the best of

12

my recollection, to respond to Don Hallman's questions."

13

Do you remember being asked that question

14

by Mr. Seltzer and giving that answer?

15

A Yes, I do.

16

Q What work were you referring to in that

17

answer that was under way in the fall of 1978 in your

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unit which was related to the questions which Mr.

19

Hallman had asked you?

20

A The work that I was referring to was the

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anticipated transient without scram evaluation, which I

22

described earlier.

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Q Was there a particular person in your unit

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who had primary responsibility for that work?

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A Yes.

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Q Who was that?

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A It was Art McBride.

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Q I think you told Mr. Seltzer in response to his question that sometime after the first of the year you yourself reviewed Mr. Hallman's memorandum in order to try to come to a determination with respect to the questions that he had asked. Do you remember that?

10

A Yes.

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Q I take it you did that at that time after work had proceeded during the summer and fall on the ATWS project?

14

A Yes, that's correct.

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Q Could you tell us, to the best of your recollection now, what your thought process was in analyzing that memorandum of Mr. Hallman's, attempting to answer his questions?

19

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MR. SELTZER: Are you asking him what was his thought process sometime in 1979?

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MR. FISKE: Yes, at the time he already testified he sat down with the memorandum, reviewed it in order to be able to answer Mr. Hallman's questions.

25

A To the best of my --

1  
2 MR. FISKE: What I am asking Mr. Karrasch  
3 is at the time he sat down with that memorandum,  
4 reviewed it in order to come to an answer with  
5 respect to Mr. Hallman's questions, what thought  
6 process did he go through in the course of  
7 answering those questions.

8 MR. SELTZER: You are focusing on his thought  
9 processes in 1979 sometime between January 1 and  
10 March 15, which is the period in which he says  
11 to the best of his recollection he responded to  
12 Don Hallman; is that right?

13 MR. FISKE: I am asking Mr. Karrasch about  
14 that point in time in early 1979, as he has  
15 previously testified, when he reviewed Mr.  
16 Hallman's memorandum for the purpose of analyzing  
17 the questions and responding to them.

18 A To the best of my recollection, I recall reading  
19 Don's memorandum sometime after the first of the year  
20 and recognizing that the real concern that was being  
21 addressed here was that of uncovering the core if there  
22 were an operator interruption of high pressure injection.

23 I recall thinking that that should be an  
24 unlikely event because the operator should not interrupt  
25 high pressure injection, and in fact, my perceived

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2 understanding of the procedures and my very good  
3 understanding of the way the plant was designed told  
4 me that once high pressure injection comes on at 1600  
5 p.s.i., that both the design and the procedure  
6 state that it should be left on until the pressure  
7 recovers above 1600 p.s.i. So it was --

8 Q What conclusion did you come to with respect  
9 to the questions that Mr. Hallman had raised in that  
10 memorandum?

11 A In addition to understanding the real concern as  
12 I just discussed, I also had obtained the benefit  
13 several months previous to January 1979 of the analysis  
14 that had been under way on ATWS, and as I testified to  
15 Mr. Seltzer earlier, that analysis of ATWS was useful  
16 in answering Don's first question about the presence  
17 of a pressure spike before the reliefs open.

18 Q And you have already explained your thought  
19 process with respect to that in response to Mr. Seltzer's  
20 questions; is that correct?

21 A Yes.

22 Q What conclusion did you come to with respect  
23 to the second question raised by Mr. Hallman in light  
24 of the concern expressed by Mr. Dunn?

25 A The ATWS analysis had addressed the issue of water

1  
2 surge through the relief valve and the relief valve  
3 discharge piping and had concluded that the valves would  
4 pass water. In addition, I determined that any damage  
5 that could occur to the surge line -- excuse me -- any  
6 damage that could occur to the relief valve discharge  
7 piping would really be insignificant to the concern  
8 that was expressed here, that being the potential for  
9 uncovering the core.

10 I was able then to conclude that there would  
11 be no pressure spike and that the concern that was  
12 being expressed, that being potential for uncovering  
13 the core, was a much more significant concern than any  
14 potential damage to the relief valve discharge piping,  
15 and I could then, with that analysis, answer Don's two  
16 questions.

17 Q So to conclude your thought process at that  
18 time, what was the conclusion that you reached with  
19 respect to the questions raised by Mr. Hallman in  
20 relation to Mr. Dunn's concern?

21 A I believe as a result of that analysis, I  
22 concluded that the potential for uncovering the core  
23 due to operator interruption of high pressure injection  
24 was a concern which was much more significant than the  
25 two concerns that Don had addressed in his two questions

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2 to me, and I thought that if Bert thought additional  
3 clarification to the operators on when to terminate  
4 HPI was a prudent thing to do, then I agreed that indeed  
5 we should go ahead and communicate that to the utilities.

6 Q Did you, after reaching that conclusion,  
7 communicate that conclusion to Mr. Hallman?

8 MR. SELTZER: Which conclusion? He has  
9 enunciated several now. He has his answer to  
10 Question 1, his answer to Question 2, and his  
11 thoughts on Bert Dunn's recommendation that  
12 additional advice should be given to the operators.

13 MR. FISKE: I will rephrase the question.

14 Q You testified, I believe, in response to  
15 questions by Mr. Seltzer that you had a conversation  
16 with Mr. Hallman on the subject of Mr. Hallman's  
17 memorandum sometime in early 1979; is that correct?

18 A Yes, that's correct. To the best of my  
19 recollection.

20 Q To the best of your recollection, how soon  
21 after you had reached the conclusions that you just  
22 described did you have that conversation with Mr.  
23 Hallman?

24 MR. SELTZER: If you can recall.

25 A I think, as I testified earlier, I don't know for

1  
2 sure, but I believe it was within a week or two after  
3 I went through this thought process following my  
4 reading of Don's memorandum.

5 Q And did you communicate to Mr. Hallman your  
6 conclusion that the additional clarification could be  
7 sent to the customers?

8 A I don't recall the exact nature of the  
9 conversation with Don except to say that I told him  
10 that I had the answers to his questions, and I believe  
11 I told him what those answers were and that I thought  
12 that in light of the fact that potential uncovering of  
13 the core is a valid concern, that I thought that was more  
14 significant than the concerns raised in the two questions.

15 Q After you had that conversation with Mr.  
16 Hallman, did you believe that you had answered the  
17 questions that he had raised in his memorandum to you?

18 A Yes, I believe I was satisfied that I had  
19 responded to Don's memorandum.

20 MR. FISKE: That is all I have.

21 FURTHER EXAMINATION

22 BY MR. SELTZER:

23 Q You said after you reached you conclusions  
24 about Don Hallman's questions, it was a week or two  
25 before you bumped into Don Hallman in the hall and gave

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him any response.

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Before coincidentally bumping into Don Hallman in the hall and giving him a response, had you developed any thought about how you were going to respond to him?

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MR. FISKE: I think you already asked that question in your direct examination. I will object.

10

Q You can answer.

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MR. FISKE: You may put an answer on the record that will be subject to a ruling thereon.

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A Again, to the best of my recollection, I do recall reading the memo, formulating in my mind the answer to Don's two questions just because I had been involved with the ATWS issue and could now answer those questions, but still I didn't feel the urgency of the potential possibility that was expressed of uncovering the core due to operator interruption of high pressure injection. So once I answered the two questions in my mind, I merely told myself that I would get to Don Hallman as soon as I could and answer his two questions.

23

24

Q Did you have any intention after you had formulated an answer to dictate a memo to Don Hallman?

25

MR. FISKE: Same objection.

1

2 A I don't recall that.

3 Q Did you formulate any intention to set up a  
4 meeting with Don Hallman or with Don Hallman and others  
5 to discuss your answer to his questions?

6 MR. FISKE: Same objection.

7 A No, I did not.

8 Q Did you plan to call Don Hallman up at a  
9 convenient time and tell him over the telephone what  
10 the answers were?

11 A I may have. I don't recall.

12 Q Do you have any recollection of at any point  
13 setting out to look for Don Hallman to give him the  
14 answers to these questions?

15 A Again, I may have.

16 Q The question is, do you have a recollection  
17 of doing so, not "I may have."

18 MR. FISKE: He is answering the question,  
19 and I believe on numerous other occasions you  
20 would have welcomed that kind of a response; any  
21 response, you have said many times, in whatever  
22 the words the witness wishes to put it, may be  
23 useful in constructing a glimmer of a recollection,  
24 is something you have always solicited. I don't  
25 see how you can object to his answer until you

1  
2 have heard it.

3 MR. SELTZER: It seems strange out of your  
4 mouth. You are usually saying, through a clenched  
5 fist, "How can you ask a witness that?"

6 Q Do you remember what the question is?

7 MR. FISKE: Read the question and answer  
8 as far as it got.

9 (Record read.)

10 A I may have. I don't recall. I do recall  
11 formulating the answer to those two questions in my  
12 mind, and my normal practice would be to do something  
13 when I had the time to do it.

14 Q Do what? What would it have been your  
15 normal practice to do in responding to questions in  
16 written form from Don Hallman such as GPU Exhibit 80?

17 A To communicate back to Don the answers to his  
18 questions, either verbally or in writing, possibly in  
19 a meeting. I make a judgment many times on what the  
20 best, most efficient means of making a communication is  
21 at B & W. On this particular instance, I did not elect  
22 to follow up with a written memorandum.

23 Q If you had not run into Don Hallman quite  
24 by chance in the hall and given him an answer on the  
25 fly, as it was, do you know when thereafter you would

1

2

have responded to him?

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MR. FISKE: I object to that question because of the form and also because it is hypothetical and also because it was already asked and answered.

7

Q What is the answer?

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MR. FISKE: I think he said by definition his response to Mr. Hallman would be to some degree later than it was by having met him in the hall and communicating with him, but he couldn't say how much later it would have been. I think that is almost a verbatim paraphrase of the answer he gave.

15

16

If that saves time, I am happy to make that contribution.

17

18

19

Q Is what Mr. Fiske said consistent with your recollection and would that be your testimony if you were asked today?

20

A Yes, it would.

21

22

23

Q During the fall of 1978 and early 1979, how many people were working in your Plant Integration Unit?

24

A Somewhere between 20 and 24 people.

25

Q Did the staffing increase during that time

1  
2 period?

3 A I don't recall exactly. I do recall that the  
4 staff level of Plant Integration stayed pretty constant  
5 during my entire tenure as manager of that group.  
6 Somewhere between 20 and 24 people.

7 Q To the best of your recollection, did you  
8 ask for any increase in staffing during the fall of '78  
9 and early 1979?

10 A I recall going through the budgeting process for  
11 the next year, which would be 1979, and putting in for  
12 something greater than 25 people.

13 MR. FISKE: Total?

14 THE WITNESS: Total.

15 A I don't recall if that was ever approved or not.

16 Q In response to questions by Mr. Fiske about  
17 operator interruption of high pressure injection, you  
18 said from your understanding of procedures and from your  
19 understanding about how the plant was intended to be  
20 operated, the high pressure injection should be left  
21 on until a certain pressure level was reached.

22 As of the spring of 1979, had you ever made  
23 a detailed study of the procedures that were in effect  
24 at any B & W plants?

25 A To the best of my knowledge, no.

1

2

Q Were you specifically familiar with the

3

B & W draft procedures communicated to any B & W

4

plant relating to pressurizer operation?

5

A Again, to the best of my knowledge, no.

6

Q Were you familiar in the spring of 1979 with

7

the B & W limit and precaution relating to the level to

8

which the pressurizer could be filled except under

9

hydrostatic test conditions?

10

A No, I don't believe I was familiar with that limit

11

and precaution.

12

Q Were you familiar with the B & W draft

13

procedure sent to any operating utility relating

14

specifically to loss of reactor coolant, loss of

15

pressure?

16

A To the best of my knowledge, no.

17

MR. SELTZER: I would like to mark as GPU

18

389 Bruce Karrasch's October Activities Report,

19

dated October 31, 1978.

20

(Document above described so marked as

21

Plaintiffs' Exhibit GPU 389 for identification,

22

as of this date.)

23

Q You testified on cross-examination by Mr.

24

Fiske about certain projects which were high priority

25

during the summer of 1978 and the fall of 1978. Do you

1  
2 recall that?

3 A Yes, I do.

4 Q Was the ATWS project a high priority project?

5 A Yes, it was.

6 Q Was it one of the projects that was  
7 consuming a substantial amount of time in the Plant  
8 Integration Unit during the summer of 1978 and the fall  
9 of 1978?

10 A I would say that it was taking something around  
11 half of Art McBride's time, plus up to half the time  
12 of two or three other people in the Plant Integration  
13 Unit. I would consider that a big project for our group.

14 Q You have described how busy you and your  
15 unit were during the latter half of 1978 and into early  
16 1979.

17 How long did it take you, when you sat  
18 down and thought about it, to come up with the answers  
19 to Don Hallman's questions?

20 A No more than a couple of hours. I think the  
21 important point is that I couldn't do it until I had  
22 gathered and understood the evaluations that were going  
23 on in ATWS.

24 Q Take a look at your October Activities Report,  
25 GPU Exhibit 389, and tell me if you find any reference

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in there to ATWS work.

MR. FISKE: You are just showing him the  
October report?

MR. SELTZER: Right.

A No, I don't see any reference at all to the ATWS  
issue in my October Activities Report to Allen Womack.

Q We didn't get all of your activities  
reports, and we looked through the production. We  
don't have all of them.

I am going to show you your August 1978  
Activities Report also and ask you if you can find any  
reference in it to the high priority ATWS program.

(Recess taken.)

BY MR. SELTZER:

Q You said in order to answer Don Hallman's  
first question, you looked at pressure traces  
generated in the ATWS program, right, or you recalled  
information from pressure traces done for the ATWS  
program, right?

A Yes, I think it is more accurate to state that I  
recall the results of the analysis which showed pressure  
traces from the ATWS event.

Q Was it your understanding that the increase  
in pressure caused by the anticipated transient without

scram was a more rapid increase in pressure than would occur with a continuous HPI injection with scram?

A Yes, that was my understanding.

Q Did you therefore conclude that if the reactor coolant system could safely survive the pressure increase of a transient without scram, that the reactor coolant system could therefore safely survive the pressure increase from a high pressure injection with scram?

MR. FISKE: Would it help to hear the preceding question and answer again?

A I would like to hear the last question one more time.

(Record read.)

A In order to look at the potential for damage to the reactor coolant system, you have to look at more than just the pressure trace itself. The additional thing that has to be studied is the stresses which are induced in the reactor coolant system due to the pressure.

The ATWS analysis involved a transient where the pressure and pressurizer level were increasing very rapidly to the set point of the safety valves. When they got there, the safety valves opened and

1  
2 discharged a mixture of water and steam. That analysis  
3 showed that there was no pressure spike in the reactor  
4 coolant system before the relief valves opened. In the  
5 ATWS transient, after the relief valves opened, the  
6 pressure continues to go very, very high, up above  
7 3,000 pounds, and therefore a stress analysis must be  
8 performed to evaluate the structural integrity of the  
9 reactor coolant system.

10 In the situation where the high pressure  
11 injection pumps are on and the reactor is tripped, once  
12 the relief valves open, they can relieve the full amount  
13 of flow rate being injected by the pumps, and therefore  
14 the pressure does not go above 2500 p.s.i., so the real  
15 question -- excuse me -- the important question for the  
16 high pressure injection scenario is will there be a  
17 spike before the valves open, which is the question that  
18 Don asked.

19 The important question for ATWS is how high  
20 does the pressure go and will the reactor coolant system  
21 maintain its integrity.

22 Q It didn't take the ATWS analysis for you  
23 to know that the set point for the relief valves was  
24 2500 p.s.i., did it?

25 A No, it did not.

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Q And it didn't take the ATWS program for you to know that the relief capacity of the safety valves exceeded the pumping capacity of the high pressure injection pumps, did it?

A No, I don't believe it did.

Q What did the ATWS program add, then, to your ability to answer Question 1?

MR. FISKE: He just told you two minutes ago.

MR. SELTZER: I don't think he answered it.

I think as we have developed it now, he knows that the pressure is going to be relieved at 2500 and he knows it can handle the full capacity of the high pressure injection pumps.

Q What else do you need to know to answer Don Hallman's question?

MR. FISKE: He told you.

MR. SELTZER: Don't --

MR. FISKE: Let's have it read back.

(Record read.)

(Recess taken.)

BY MR. SELTZER:

Q Now you can answer the question with Mr. Fiske's objection stated. The question is, what did the ATWS program add to your ability to answer Question 1?

2       A       Don was asking if there would be a pressure spike  
3       in the reactor coolant system before the relief valves  
4       opened. Until the ATWS analysis was completed, I did  
5       not know whether or not there would be a spike during  
6       the time that the valves were going from a closed  
7       position to an open position. The analysis confirmed  
8       that there would be no spike.

9       Q       In what form is that information? In other  
10       words, if somebody looked back through the ATWS material,  
11       what form would you see that information in?

12       A       To the best of my recollection, the results of the  
13       analysis are presented as curves or graphs of reactor  
14       coolant system pressure versus time. Those curves  
15       demonstrate that there is no pressure spike at the point  
16       where the pressure reaches 2500 p.s.i.

17       Q       Are the tracings based on empirical data?

18       A       To the best of my knowledge, they are based on  
19       computer calculations.

20       Q       So it is a computer simulation of operation,  
21       not actual experience?

22       A       Yes, to the best of my knowledge.

23               MR. SELTZER: I would like to mark your  
24       August Activities Report, dated September 1, 1978,  
25       as GPU Exhibit 390.

(Document above described so marked as Plaintiffs' Exhibit GPU 390 for identification, as of this date.)

Q Do you recognize that as a copy of your August Activities Report sent to Al Womack on September 1, 1978?

A Yes, I do.

Q Do you see anything in there about the ATWS projects?

A No, I do not see anything in the August Activities Report to Al Womack on ATWS.

Q Do you see anything in there, including under "New Commitments," which is on the last page, that refers to Don Hallman's request that Plant Integration lend assistance on the questions that Hallman raised in GPU Exhibit 80?

A No, I do not.

MR. SELTZER: I have no further questions.

FURTHER EXAMINATION

BY MR. FISKE:

Q You testified earlier, I believe, that the work on the ATWS project was under way before August of 1978; is that correct?

A Yes, to the best of my knowledge, it was under way

1  
2 before August of 1978.

3 Q Yesterday, there was marked as an exhibit  
4 the monthly progress report for December 1978, and that  
5 was marked as GPU Exhibit 379, and I will show you that  
6 and ask you if you see the reference to the ATWS matter  
7 in that document.

8 A Yes, there is a reference to the ATWS evaluation  
9 in item "C" under "Accomplishments."

10 Q You testified in response to Mr. Seltzer's  
11 questions that in coming to the conclusion that  
12 existing procedures should require that HPI be left on  
13 until pressure has come back up to at least 1640 pounds  
14 per square inch, you had not reviewed any of the  
15 procedures that in fact had been issued to the  
16 operating utilities. Do you remember that answer you  
17 gave him?

18 A Yes, I remember that answer.

19 Q What, then, was the basis for your conclusion  
20 in January 1979 that existing procedures should require  
21 that HPI should be left on until pressure came back to  
22 at least 1640 pounds per square inch?

23 MR. SELTZER: I don't think that is what  
24 he said in his prior testimony.

25 MR. FISKE: I believe he testified --

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2

MR. SELTZER: I think he said 1600 p.s.i.

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I think you are just showing it is really counsel

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that is giving testimony here and not the witness

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and supplying greater precision than the witness

6

was capable of supplying.

7

MR. FISKE: Do you care to leave that comment

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on the record?

9

MR. SELTZER: I am really objecting more to

10

leading and mischaracterizing of the testimony.

11

Q My question is simply what was the basis

12

for your belief in January 1979 that the existing

13

procedures should prevent the interruption of HPI when

14

pressure was below the actuation point?

15

A During my tenure as manager of Plant Integration,

16

I became quite knowledgeable in the design and operation

17

of the plant safety systems. That knowledge included

18

an understanding that the set point for high pressure

19

injection was a very important variable in the plant.

20

For instance, the design included a key

21

lock bypass that required the operator to actually take

22

an action by turning a key before he could take the

23

pressure intentionally below 1600 p.s.i. without high

24

pressure injection automatically coming on.

25

I also knew that all of the analysis that

1  
2 had been done using the high pressure injection system  
3 assumed that the high pressure injection system stayed  
4 on until pressure had recovered to above 1600 p.s.i.  
5 To me, it was inconceivable that anybody would be  
6 instructed to terminate high pressure injection below  
7 that set point.

8 Q You had not, I take it, reviewed the specific  
9 procedures that were in effect at TMI-2 as of January  
10 1979; is that correct?

11 A I had not reviewed the procedures. I assumed that  
12 the procedures would not allow the operator to terminate  
13 high pressure injection below the set point based upon  
14 my knowledge of the analysis and the design.

15 Q But you did not know in January 1979 that  
16 in fact the procedures in effect did require the  
17 operators to leave HPI on until pressure had risen back  
18 above 1600?

19 MR. SELTZER: Objection, no foundation,  
20 leading.

21 Q Apart from the assumption that you made, not  
22 having actually read the procedures, you did not know for  
23 a fact that the procedures in fact did require that HPI  
24 be left on until pressure came back above 1600 p.s.i.?

25 MR. SELTZER: Objection. I wouldn't object

2

if you say, "You didn't know whether the procedures specified," but I think if you leave it where you have, there is no foundation that that is what the procedure provides.

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MR. FISKE: The foundation is the procedure itself.

7

8

MR. SELTZER: I object because you include a statement that is contrary to fact.

9

10

THE WITNESS: Would you read back the question?

11

12

(Question read.)

13

MR. FISKE: The foundation for my question is the procedure which GPU was fined for not following on the day of the accident.

14

15

16

(Record read.)

17

A I did not know for a fact what the requirements in the procedure were.

18

19

MR. FISKE: That is all I have.

20

FURTHER EXAMINATION

21

BY MR. SELTZER:

22

Q At the time you reached the conclusion which

23

you did about operator interruption of high pressure

24

injection and what you thought the procedures provided,

25

is it correct that you had either forgotten about or

1  
2 were ignorant of the fact that the Davis-Besse operators  
3 had terminated high pressure injection during a transient  
4 at their B & W plant prior to pressure being restored  
5 to the high pressure injection actuation set point?

6 MR. FISKE: For how long?

7 MR. SELTZER: They did it. That is my point.

8 (Record read.)

9 A Yes, it is correct.

10 MR. SELTZER: I have no further questions.

11 FURTHER EXAMINATION

12 BY MR. FISKE:

13 Q Is it also correct that you were not aware  
14 at that time that the operators at Davis-Besse within  
15 20 minutes had correctly diagnosed the situation and  
16 restored high pressure injection until pressure came back  
17 up above the set point?

18 A That is also correct.

19 MR. SELTZER: Thank you, Mr. Karrasch.

20 (Time noted: 4:25 o'clock p.m.)

21  
22 BRUCE ADOLPH KARRASCH

23 Subscribed and sworn to before

24 me this day of , 1981.

25

CERTIFICATE

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

I, JOSEPH R. DANYO, a Notary Public  
of the State of New York, do hereby certify  
that the continued deposition of BRUCE ADOLPH  
KARRASCH was taken before me on September 30,  
1981, consisting of pages 494 through 591.

I further certify that the witness had been previously duly 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 15 day of October, 1981.

Joseph R. Danyo

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