TRANSCRIPT OF PROCEEDINGS

PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND

PUBLIC HEARING

WEDNESDAY,
JULY 18, 1979

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PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND

PUBLIC HEARING

Wednesday,
July 18, 1979

Hall of Nations
Edmund Walsh Building
Georgetown University
36th Street, N.W.
Washington, D.C.

The hearing was convened pursuant to notice at 10:05 a.m.

John G. Kemeny, Chairman, presiding.

PARTICIPANTS:

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Governor of Arizona

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Retired President of Texas Instruments

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Graduate School of Journalism,
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PARTICIPANTS: (continued)

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STAFF:

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P R O C E E D I N G S

CHAIRMAN KEMENY: Will the meeting please come to order.

I am happy to see that all members of the Presidential Commission are present and this is the opening of the fourth set of public hearings by the Presidential Commission. A fifth and sixth sets of hearings will occur in August and the dates of those have already been announced.

What we will be trying to do in these three sets of hearings is to present the connected pieces of evidence on various subjects and, therefore, have fairly homogenous groupings. We will try at each hearing to have one, two or three major topics brought out that relate to groups of individuals.

The order of the three hearings is somewhat accidental and it is an accident that we happen to have witnesses from a single company at this particular hearing.

This week, the three half days of hearings will deal with the witnesses from the Babcock and Wilcox Company.

As you will recall at our last open hearings, we had a number of witnesses from the managing utility. Babcock and Wilcox are the vendors of the nuclear steam system for TMI-2 and they played a role in the training of operators.

We expect to hear witnesses today, tomorrow and the day after tomorrow roughly from 10 to 2:00 A. M. Unlike our -- sorry. I guess I am thinking of some previous hearings of

this commission. We are planning it from 10 to 2:00 P. M., but if we go as we did at one previous hearing, maybe 10 to 2:00 A. M. is a better prediction.

Unlike our previous hearings, all the witnesses have been deposed by our legal staff and we will turn to our legal staff in each case to bring out the highlights of those depositions.

Will chief counsel please swear in the first witness?

MR. GORINSON: Mr. Kelly, will you raise your right arm, please?

Do you solemnly swear that the testimony that you are about to give is the truth, the whole truth and nothing but the truth, so help you God?

MR. KELLY: I do.

CHAIRMAN KEMENY: Will you please state for the record your full name and your position within the company?

MR. KELLY: My name is Joseph John Kelly, Jr. I am in the Plant Integration Unit of Babcock and Wilcox Company.

CHAIRMAN KEMENY: Thank you.

Chief counsel.

MR. GORINSON: Thank you, Mr. Chairman.

Mr. Kelly, the Plant Integration Unit is part of the Design Section. Is that correct?

MR. KELLY: That is correct.

MR. GORINSON: And that Design Section is also part

of the Engineering Department at Babcock and Wilcox.

MR. KELLY: Correct.

MR. GORINSON: Could you please explain for the Commission what the responsibilities of the Plant Integration Unit are?

MR. KELLY: We are given various assignments to make sure that the interfaces between various disciplines and set portions of the design -- we integrate the interfaces to make sure that when the pieces are put together that they will fit.

MR. GORINSON: So, that is where it all comes together, in the Plant Integration Unit. Is that correct?

MR. KELLY: Yes.

MR. GORINSON: Could you explain your responsibilities as principal engineer, sir?

MR. KELLY: I am in a subgroup of the Plant Integration Unit, the Nuclear Steam Supply Systems Design Group. As a member of that group, I take assignments as issued by my supervisor.

MR. GORINSON: And who is your supervisor, sir?

MR. KELLY: Mr. Eric Swanson.

MR. GORINSON: Did you become aware during 1977 of the transient that took place at the Davis-Besse plant on September 24, 1977?

MR. KELLY: Yes.

MR. GORINSON: And when did you become aware of that?

MR. KELLY: I believe it was the day of the transient on the 24th.

MR. GORINSON: Could you briefly describe that transient for us?

MR. KELLY: Davis-Besse was at a low power level. The reactor was critical. They were dumping steam to the main condensor. The turbine was not on the line. They were about 7, 9 percent reactor power. When their steam and feedwater rupture control system apparently sent an erroneous signal to the starter feedwater valve, the valve went shut. When the valve went shut, the one generator lost feedwater. The level started to boil down. When the level got low enough, it triggered, again, their steam and rupture control system to shut the main steam isolation valves and main feedwater isolation valves and that resulted in a complete loss of feedwater. Pressure escalated and went up in the reactor coolant system. Pressure on the level went up in the reactor coolant system. Before they reached the high pressure trip point, the operator manually tripped the reactor.

They did, during that pressure increase, lift the electromatic relief valve that reached a set point. After the reactor trip, pressure started downward. The electromatic relief valve did not seat due to some -- or stuck open somewhere along the line and the pressure continued to decrease. They got down to the actuation set point of their safety

engineering system. It actuated and started high pressure injection. Pressurizer levels started to go up Primary pressure was still going down. The operator throttled back on high pressure injection when the pressurizer level was going up.

In a period of about twenty minutes from when the reactor tripped, the incident started, they recognized that the electromatic relief valve had stuck open. They shut the electromatic relief valve, block valve, and stopped that loss of inventory from the reactor coolant system.

After another period of time, I believe, it must have been thirty minutes, pressurizer levels started to go down again.

As a result of my investigation of that incident, I saw that during that period the pressure had gone down to saturation and you had boiling in your reactor coolant loops and that had caused the pressure increase. And what I was seeing now, after thirty minutes of the valve having shut the electromatic relief valve, the level was collapsing again in the reactor coolant system and it had a decrease in pressurizer level.

The operator restarted high pressure injection pumps and recovered pressurizer level again and he had a solid inventory in the loops. His reactor coolant pumps were running. Pressurizer level was going up and primary plant pressure was

going up. At that point, he again throttled back the high pressure injection, brought the transient under control.

MR. GORINSON: So, in the Davis-Besse transient on September 24, 1977, there was a loss of feedwater. Is that correct?

MR. KELLY: It was initiated by a loss of feedwater.

MR. GORINSON: Private operator relief valve stuck open? Or electromatic relief valve?

MR. KELLY: That was another event in that.

MR. GORINSON: Right. But it stuck open during the transient?

MR. KELLY: Yes, it did.

MR. GORINSON: The pressurizer level was increasing at a time during that transient while pressure was decreasing. Is that correct?

MR. KELLY: That is correct.

MR. GORINSON: And the operator's relying on that increasing pressurizer level shut off the HPI?

MR. KELLY: I don't remember whether they shut it off or just throttled it back.

MR. GORINSON: They just throttled it back but they were relying on the increasing pressurizer level.

MR. KELLY: Yeah.

MR. GORINSON: And you just said that you were sent to Davis-Besse to investigate that event. Is that correct?

MR. KELLY: Yes. That is correct.

MR. GORINSON: Is it standard operating procedure at Babcock and Wilcox to go out and investigate a transient?

MR. KELLY: Joe Kelly, you mean?

MR. GORINSON: Joe Kelly.

MR. KELLY: I have investigated two.

MR. GORINSON: What two were those, sir?

MR. KELLY: Davis-Besse and the one we were referring to and I was also sent on March 28, 1979 to investigate the Three Mile Island Unit 2 incident.

MR. GORINSON: Would it be fair to say that you were sent out to investigate these two because they were unusual?

MR. KELLY: Yes.

MR. GORINSON: What made the Davis-Besse transient unusual?

MR. KELLY: It was unusual in that it was complicated. It was not a simple reactor trip, not a simple loss of feedwater. By the time I heard about it, they had known that the electromatic relief valve had stuck open for some reason. They had depressurized, had a partial cooldown of the plant. Because it was complicated, it was not a simple transient. That is why I was sent to investigate it.

MR. GORINSON: How long did you stay at Davis-Besse, Mr. Kelly?

MR. KELLY: Two days.

MR. GORINSON: And when you returned to Lynchburg, did you make a presentation to Babcock and Wilcox personnel on what had happened at Davis-Besse?

MR. KELLY: Yes, I did.

MR. GORINSON: To how many people did you make that presentation?

MR. KELLY: The room was fairly crowded and I have estimated about thirty.

MR. GORINSON: Was that a larger group than would usually be present for a presentation on a transient?

MR. KELLY: I have nothing to compare it with. It was the only one I have made.

MR. GORINSON: Have you ever been in a group that received a presentation of a transient?

MR. KELLY: No.

MR. GORINSON: Okay.

Could you tell us to the best of your recollection who was there at that meeting?

MR. KELLY: Don Montgomery was there. Joe Lauer was there. Bert Dunn, Bob Jones. Fred Weiss was making the presentation with myself. Mr. MacMillan was there for a portion of the time. My unit manager, Bruce Karrasch, was there.

MR. GORINSON: And at that meeting you gave a factual presentation of what had happened at Davis-Besse?

MR. KELLY: My assignment was to try and determine

the sequence of events going to transient and that is what I presented; the results of my investigation.

MR. GORINSON: So, you told them at that meeting that there had been a loss of feedwater and you told them that a pilot operated relief valve stuck open.

MR. KELLY: Yes.

MR. GORINSON: And you told them that pressurizer level had increased while pressure was decreasing.

MR. KELLY: Yes.

MR. GORINSON: And you also told them that the operators had terminated the high pressure injection.

MR. KELLY: O maybe --

MR. GORINSON: Or throttled it back.

MR. KELLY: Yes.

MR. GORINSON: At that meeting did you give them your opinion as to whether operator termination or throttling back of the high pressure injection was appropriate during the Davis-Besse transient?

MR. KELLY: I don't remember giving an opinion like that, no.

MR. GORINSON: Did anyone ask for your opinion during that meeting?

MR. KELLY: Not that I remember; not during the meeting.

MR. GORINSON: After the meeting, did you get into

a discussion with Bert Dunn?

MR. KELLY: Yes, I did.

MR. GORINSON: And who is Bert Dunn, sir?

MR. KELLY: Bert Dunn is the Unit Manager of ECCS, Emergency Core Coolant System.

MR. GORINSON: Emergency Core Coolant System.

CHAIRMAN KEMENY: Just for clarification, may I ask that is the unit that provides high pressure injection. Is that correct?

MR. KELLY: High pressure injection is one of the emergency core cooling systems, yes.

CHAIRMAN KEMENY: I just wanted to connect this.

MR. GORINSON: What was the substance of that discussion, sir?

MR. KELLY: Mr. Dunn expressed a concern after the meeting with me that the operators had terminated or throttled -- I don't remember which -- during that transient. And he said that he could give me scenarios that would have led to possible core damage if they had done that under different circumstances.

MR. GORINSON: Was that the first time you had heard a concern about premature operator termination or throttling back of high pressure injection?

MR. KELLY: Yes.

MR. GORINSON: Was there another transient involving

high pressure injection at Davis-Besse on October 23, 1977?

MR. KELLY: Yes.

MR. GORINSON: Could you describe that transient to us?

MR. KELLY: No, I cannot describe it any detail. I was not assigned to investigate that transient.

MR. GORINSON: And could you briefly tell us what is the purpose of the high pressure injection system?

MR. KELLY: High pressure injection is to maintain a core cooling during a loss of coolant accident.

MR. GORINSON: After talking to Mr. Dunn and having done your investigation at Davis-Besse, is it fair to say that you had concerns about operator understanding of when to terminate or to throttle back with high pressure injection?

MR. KELLY: Yes, it is.

MR. GORINSON: Did you talk to the training department at Babcock and Wilcox about operator understanding of high pressure injection?

MR. KELLY: Have I ever talked to them?

MR. GORINSON: Did you after your concerns became --

MR. KELLY: After the incident of the 23rd of October, I talked to the training department.

MR. GORINSON: And who in that department did you talk to?

MR. KELLY: I went down and talked to simulator

instructors that I had known from work at Crystal River Unit 3. I talked to John Lind, Harry Helmyer. There were other simulator instructors present during that conversation.

MR. GORINSON: And what did Mr. Lind and these other individuals tell you about the subject of high pressure injection?

MR. KELLY: I had told them about the incident of the 24th and about what I had heard about the incident of October 23rd and was down there -- I told them I was asking them to tell me how they approached this discussion or whether they thought the operators' training was sufficient to preclude this. And John Lind, Harry, both told me -- and the other operators agreed with them -- that, yes, that the operators -- I mean, yes, the plant operators are instructed to look at pressurizer level and primary plant pressure and reactor coolant average temperature and make sure that they are all under control before they could terminate high pressure injection. That is the way they are taught. They told me -- well, that was the substance of that conversation. And when I got their concurrence that they were teaching the operators when to secure high pressure injection and I was in agreement with what they had said, then I told Mr. Lind and the others that I was going to write a letter to Nuclear Service to make sure that the written words we were putting out were in accordance with what we were teaching.

MR. GORINSON: What is Nuclear Service, sir?

MR. KELLY: That is another department of NPGD, Nuclear Power Generation Division.

MR. GORINSON: That has now been renamed, hasn't it? The Customer Service Department?

MR. KELLY: At that time it was Nuclear Service; now it is Customer Service.

MR. GORINSON: Did you or Mr. Lind ever address the question during your discussion of why the operators of Davis-Besse had interrupted the high pressure injection if they were being trained correctly?

MR. KELLY: Yes. Well, we talked about that and none of the instructors could understand why they had interrupted.

MR. GORINSON: So, it is fair to say, though, that when you walked away from your meeting with Mr. Lind that you had been reassured on the subject?

MR. KELLY: Oh, yes.

MR. GORINSON: Mr. Kelly, let me put in front of you a document that has been marked as Hearing Exhibit 1 and just to make it clear for the record, this is a document dated November 1, 1977, and it is from J. J. Kelly, Plant Integration to Distribution. And the subject is Customer Guidance on High Pressure Injection Operation. Do you have that in front of you, sir?

MR. KELLY: Yes, I do.

MR. GORINSON: And this is a memorandum which you wrote?

MR. KELLY: Yes.

MR. GORINSON: In the first sentence you state -- well, let me go back one second. Before writing this memorandum, did you have any discussion with Mr. Dunn about the fact that you were going to write a memorandum?

MR. KELLY: As I said, I talked to him the day of that briefing and after the October 23rd incident at Toledo, I may have talked to him again and expressed my concerns. I did talk to my immediate supervisor, Mr. Eric Swanson and we talked it over and I decided to write the memo.

MR. GORINSON: I see. Now, this memorandum went to several people. Can you identify them for us? Who is Mr. Karrasch?

MR. KELLY: Mr. Karrasch is the Manager of Plant Integration Unit.

MR. GORINSON: Mr. Swanson.

MR. KELLY: Mr. Swanson was my supervisory engineer.

MR. GORINSON: In your department, in Plant Integration?

MR. KELLY: Yes. He works for Mr. Karrasch also.

MR. GORINSON: Mr. Finnin.

MR. KELLY: Mr. Finnin, at the time, was in Nuclear

Service. I don't know what his title was.

MR. GORINSON: Okay. And Mr. Dunn.

MR. KELLY: He is the Manager of ECCS.

MR. GORINSON: Mr. Labelle.

MR. KELLY: Mr. Labelle was the Manager of our Safety Analysis Unit; another unit of the Plant Design section.

MR. GORINSON: Mr. Elliott.

MR. KELLY: Mr. Elliott was Manager of Training.

MR. GORINSON: Mr. Hallman.

MR. KELLY: Mr. Hallman was the Manager in Nuclear Service, also.

MR. GORINSON: And this memorandum was based on your concerns arising out of those transients at Davis-Besse 1.

MR. KELLY: Yes.

MR. GORINSON: And in it you recommended that guidelines be set. Is that correct?

MR. KELLY: Oh, yes. I see what you are referring to.

MR. GORINSON: Do you see where I am looking at in the memorandum?

MR. KELLY: I recommend the following guidelines be sent. Yes.

MR. GORINSON: And those would be sent to who?

MR. KELLY: Well, I -- I was asking in the memo for them to review what we were sending out to the customers and

if it was not right or they didn't feel that it was adequate, then I recommended that this be sent to the customer.

MR. GORINSON: I see. So, these would be guidelines that would be sent to the customers, if approved.

MR. KELLY: Yes. And if necessary.

MR. GORINSON: Now, why did you select these particular people to send your memorandum to?

MR. KELLY: Mr. Karrasch was my Unit Manager. I send him copies of everything I write to keep him informed of what I am doing. I talked to Mr. Swanson. He was my supervisory engineer and he and I had discussed sending the memo out. Ron Finnin, I knew worked in the Plant Performance Section of Nuclear Service and I wanted to get his opinion of what I was sending.

Mr. Dunn was the Manager of ECCS. He had expressed a concern at my debriefing after the initial Davis-Besse incident and I knew he would be interested in it and I wanted to keep him informed that I was taking an action on this.

Mr. Labelle was Manager of Safety Analysis and I wanted to see if he had any input into it. I was sending it to Mr. Elliott because I had talked to his people about it and I wanted to keep him informed that I was pursuing this to try and get some written guidelines. And, again, Mr. Hallman, was Ron Finnin's manager.

MR. GORINSON: In the last sentence of your memorandum

it says, I would appreciate your thoughts on this subject. Do you see that, sir?

MR. KELLY: Yes, I do.

MR. GORINSON: Did any of the seven people you wrote the memo to, give you their thoughts?

MR. KELLY: No.

MR. GORINSON: Did you go to any of these people and ask them what they thought?

MR. KELLY: No, I did not.

MR. GORINSON: Sir, does Babcock and Wilcox have a system called "Preliminary Safety Concerns"?

MR. KELLY: Yes.

MR. GORINSON: And at B and W, had that system been in effect at the time you wrote your November 1, 1977 memorandum?

MR. KELLY: Yes, it was.

MR. GORINSON: What is the purpose of the Preliminary Safety Concerns system at Babcock and Wilcox?

MR. KELLY: It is to bring attention to a significant or preliminary safety concern. To bring management attention, get it resolved, have the information disseminated as necessary.

MR. GORINSON: Why didn't you put your November 1, 1977, memo in the form of a Preliminary Safety Concern?

MR. KELLY: I had talked to the instructors in our Training Department. They had reassured me that they were

teaching when to secure high pressure injection. I agreed with what they were teaching. When I wrote this memo, I was not even -- by no means sure that there was a safety concern. It was not clear to me. My purpose was to get somebody to investigate what was being told to the customers and at that point correct it if necessary. And also, I felt that people in my distribution like Mr. Dunn would be better qualified than myself to determine if it was a valid concern for a preliminary safety concern. At the time, I didn't think it was a significant safety concern.

MR. GORINSON: I see. So, at that point, you weren't sure whether it would be safety concern or not.

MR. KELLY: Yes.

MR. GORINSON: Which department in Babcock and Wilcox has responsibility for those Preliminary Safety Concern items?

MR. KELLY: Licensing.

MR. GORINSON: And that is headed by Mr. Taylor?

MR. KELLY: Yes.

MR. GORINSON: Was anybody from Licensing included on this distribution of your memorandum?

MR. KELLY: No, they were not.

MR. GORINSON: What was the reason for that, sir?

MR. KELLY: I was looking at this as a working memorandum to bring attention to what I thought was a concern. I

did not think it was a significant safety concern. I felt that there were people better qualified than me to determine that like Mr. Dunn. I wasn't sure when I wrote this memo if -- I wasn't sure that we weren't already telling him everything I had in this memo on when to secure high pressure injection.

MR. GORINSON: Now, beside the seven people who did not give you their thoughts, was there anyone other than these people who did respond to your memorandum?

MR. KELLY: Yes. I got a written memo back from Frank Walters, from Nuclear Services.

MR. GORINSON: Can we please put in front of Mr. Kelly what has been premarked as Commission Hearing Exhibit Number 2? And that is a handwritten letter from J. F. Walters, Nuclear Service to J. J. Kelly, Plant Integration and the date of it is November 10, 1977: Subject: High Pressure Injection during Transient. Do you have that in front of you, Mr. Kelly?

MR. KELLY: Yes, I do.

MR. GORINSON: Is that the memo you got from Mr. Walters?

MR. KELLY: Yes.

MR. GORINSON: And you reviewed that memo at or about the time you received it on November 10, 1977?

MR. KELLY: Yes, I did.

MR. GORINSON: Did you go back to Mr. Walters after you reviewed the memorandum?

MR. KELLY: No.

MR. GORINSON: Was there some reason why you did not go back to Mr. Walters?

MR. KELLY: After reading Mr. Walters' memo a few times over again in my mind, I didn't feel like Mr. Walters was answering the questions that I had asked or was not addressing the concerns, my concern on the operators securing high pressure injection during a LOCA. I thought that he had misread what I was after and his letter confused me. I didn't see any advantage at that time to pursuing it with Mr. Walters. Instead, it prompted me -- since that was the only response I had gotten -- to escalate the problem up from my level up into a management position.

MR. GORINSON: I see. Well, let's look at the first paragraph of Mr. Walters' memorandum and it says there, in talking with training personnel and in the opinion of this writer, the operators at Toledo responded in a correct manner, considering how they had been trained and the reasons behind the training. Do you see that paragraph?

MR. KELLY: Yes.

MR. GORINSON: What did you believe Mr. Walters meant in that paragraph when you received it on November 10 and reviewed it?

MR. KELLY: I took his words literally. He is saying that he talked with training personnel and in the opinion

of this writer, Mr. Walters, the operators in Toledo responded in a correct mannner, considering the way they had been trained and the reasons behind the training.

MR. GORINSON: All right. Did you focus on the words "considering how they had been trained and the reasons behind that training". Does that raise any question for you?

MR. KELLY: No. Because at that time I had already talked to the training people and I was convinced that they were training the operators correctly. And I just assumed that Mr. Walters was confused or he had asked the wrong questions of them.

MR. GORINSON: I see. But based on that paragraph, it would appear, would it not that there was -- at least on the surface -- could be read to be a conflict between what Mr. Lind was telling you and what Mr. Walters was saying in his memorandum?

MR. KELLY: Yes.

MR. GORINSON: Did you take any steps to resolve the conflict?

MR. KELLY: No. I escalated the problem to Mr. Dunn.

MR. GORINSON: Let's look at the second paragraph. My assumption in the training assumes first that RC pressure and pressurizer level will tend in the same direction under a LOCA. Do you see that sentence?

MR. KELLY: Yes.

MR. GORINSON: Is that what had happened at Davis-Besse?

MR. KELLY: Not during the LOCA portion of that transient, no. As I think I stated, pressurizer level was going up when they had the electromatic relief valve stuck open and pressure was going down.

MR. GORINSON: And he says there, does he not, that the training assumes that they will trend in the same direction?

MR. KELLY: He says, "my assumption", he is talking about himself, and the training assumes they will go in the same direction. That is what he says, yes.

MR. GORINSON: After reading that paragraph, did you believe there was a conflict between what Mr. Lind had told you and what Mr. Walters was writing in his memeorandum?

MR. KELLY: Did I believe there was a conflict? Yes, there was a conflict.

MR. GORINSON: But you did not go back to Mr. Lind?

MR. KELLY: No. I had three or four operators tell me what they were teaching and I didn't know what Frank was referring to.

MR. GORINSON: And you didn't go back to Mr. Walters?

MR. KELLY: No.

MR. GORINSON: Is it fair to say that taking the Walters' memorandum as a whole, because as what you perceived to be misunderstandings or inaccuracies in Mr. Walters' analysis,

that you essentially dismissed Mr. Walters' memorandum.

MR. KELLY: Yes. Its only value to me was to escalate the problem.

MR. GORINSON: To Mr. Dunn?

MR. KELLY: Yes.

MR. GORINSON: And to the best of your knowledge after the matter was escalated to Mr. Dunn, did he write two memoranda stating his concerns about operator interference about high pressure injection?

MR. KELLY: Yes.

MR. GORINSON: And those memoranda were written in February of 1978?

MR. KELLY: Yes.

MR. GORINSON: And you received both memoranda?

MR. KELLY: Yes, I did.

MR. GORINSON: And after you read the memoranda, did anything happen at Babcock and Wilcox to resolve the problem that you had raised in your November 1, 1977 memo?

MR. KELLY: After Mr. Dunn's second memorandum, I thought the problem was resolved.

MR. GORINSON: And by resolved, what do you mean?

MR. KELLY: Well, the second one states that he had had a meeting with Nuclear Service personnel and they had reached an agreement on what words should be sent out to the customers -- I am paraphrasing this -- and that he was satisfied

that those were adequate and he would like to amend the wording in his first memo to agree with his second one and he was writing all of this to Mr. Taylor. And, therefore, from my viewpoint, I could see that ECCS and Mr. Dunn had resolved the problem with Nuclear Service. They had reached an agreement on the words to be sent out to the customers and I thought the problem was resolved at that point.

jsm 1
Tape 2

MR. GORINSON: And you thought those words were then going to go out to the customers?

MR. KELLY: Yes.

MR. GORINSON: Just briefly, you mentioned there was a loss of feed water at Davis-Besse I on September 24, 1977, correct?

MR. KELLY: Yes.

MR. GORINSON: That also occurred at TMI II on March 28, 1979?

MR. KELLY: Yes.

MR. GORINSON: There was a PORV stuck open at Davis-Besse I on September 24, 1977, is that correct?

MR. KELLY: Yes.

MR. GORINSON: That also occurred at TMI II on March 28, 1979?

MR. KELLY: Yes.

MR. GORINSON: And at Davis-Besse I on September 24, 1977, the pressurizer level increased while pressure was decreasing, is that correct?

MR. KELLY: Yes.

MR. GORINSON: That also occurred at TMI II on March 28, 1979, did it not?

MR. KELLY: Yes.

MR. GORINSON: And finally, at Davis-Besse I, on September 24, 1977, the operators throttled back the HPI?

MR. KELLY: Yes.

MR. GORINSON: And they also did that at TMI II, didn't they?

MR. KELLY: Yes. There were differences, too.

MR. GORINSON: Mr. Chairman, I would request that Exhibits 1 and 2 be included in the hearing record.

CHAIRMAN KEMENY: So ordered.

MR. GORINSON: I have no further questions.

CHAIRMAN KEMENY: Thank you. Do any commissioners have questions from the witness before -- Professor Taylor?

COMMISSIONER TAYLOR: I would like to follow up on a remark that was made. You said there were differences. Could you briefly say what you think the important differences were between the sequence up to the point where high pressure injection was turned off at Davis-Besse and at TMI.

MR. KELLY: At Davis-Besse the operators relatively quickly discovered that the electromatic relief valve was stuck open, the PORV, I mean within 20 minutes. At Three Mile Island II it was over 2 hours before the operators discovered that that valve was stuck open. At Davis-Besse the operators, early in the transient, stopped two of the reactor coolant pumps, one in each loop, to minimize their heat-up rate. At Three Mile Island II, the operators stopped all four of the reactor coolant pumps. They were significant differences, in my mind.

CHAIRMAN KEMENY: Could you repeat that last point? I didn't quite get just the last point.

MR. KELLY: At Davis-Besse, they stopped one reactor coolant pump in each loop. In other words, they left one pump running in each loop continuously throughout the entire transient. At Three Mile Island they stopped all four of the reactor coolant pumps.

CHAIRMAN KEMENY: Professor Pigford?

COMMISSIONER PIGFORD: Do you happen to know on what basis did the operators at Davis-Besse learn that the relief was stuck?

MR. KELLY: I don't know what thought process they went through, no -- not that that is your question.

COMMISSIONER PIGFORD: Had that been discussed in any of the discussions on that incident which you have attended?

MR. KELLY: Not that I can remember.

COMMISSIONER PIGFORD: I wasn't asking the thought process, necessarily. Were there any signals indicating that?

MR. KELLY: Oh, yes. They had -- their crunch tank had overpressurized and the rupture disk had ruptured, and they could have that signal available to them.

COMMISSIONER PIGFORD: Is that what led them to decide it had been stuck open?

MR. KELLY: It could have contributed to it, certainly, if they had look at it. What I am saying is, I don't

know, personally, what they looked at. There was a signal available to them.

COMMISSIONER PIGFORD: And what about the tail pipe system? Could that logically have led to the information that was of interest?

MR. KELLY: The relief valve discharge temperature?

COMMISSIONER PIGFORD: Yes.

MR. KELLY: Yes. Yes. These were signals that were available, reactor building temperature and pressure.

COMMISSIONER PIGFORD: But apparently you didn't review those signals when you reviewed the accident.

MR. KELLY: No. My responsibility was to determine the sequence of events as it affected the NSS and not necessarily an interview with the operators to find out why they did anything. It was more important to me to determine that it had been shut after 20 minutes than to determine why it had been shut.

CHAIRMAN KEMENY: Governor Peterson?

COMMISSIONER PETERSON: Since March 28, 1979, have the managers of Babcock and Wilcox investigated why the lesson learned at Davis-Besse was not brought to bear on the operation at Three Mile Island?

MR. KELLY: I don't know.

CHAIRMAN KEMENY: Dr. Marks?

COMMISSIONER MARKS: Mr. Kelly, you said that you

were sent to, as I understood you, TMI II on March 28.

MR. KELLY: Yes, that is correct.

COMMISSIONER MARKS: You were on site in the control room on March 28?

MR. KELLY: No, sir. I was dispatched from Lynchburg to Harrisburg. I was not allowed on site. I did not get actually onto Three Mile Island until Thursday afternoon, March 29.

COMMISSIONER MARKS: Why were you not allowed in? Is that standard procedure?

MR. KELLY: I was told that I was not allowed on site. They had radiation problems, and they were just limiting site access at that time.

COMMISSIONER MARKS: You were the only representative of Babcock and Wilcox dispatched to the site?

MR. KELLY: No, sir, there was -- three of us left very early that day -- well, around noon we were on a chartered plane, and later in that day two more people joined us at -- near Harrisburg. We didn't get onto the Island.

COMMISSIONER MARKS: None of you were allowed on?

MR. KELLY: No.

COMMISSIONER MARKS: Who were the others that accompanied you, and what were their functions in the company?

MR. KELLY: Bob Winks accompanied me. He is in our Control Analysis Unit, which is another unit of our Plant

Design Section. He was -- and Bob Twilly accompanied me. He is in Nuclear Service. Our function was to go up there and review the available plant data and try to reconstruct a sequence of events and, secondarily, to assist our on-site people in any manner that we could.

Later in the day, we were joined by Eric Yoheim, a radiochemist, and Dale Ewell, another radiochemist.

COMMISSIONER MARKS: Who refused you access to the site?

MR. KELLY: The message was relayed to me by Greg Shedell, who is a B&W employee, and I was at his house. He had gotten it from Lee Rogers, who is also a B&W employee who was in the control room at the time as site operations manager, and I don't know where Lee Rogers got the information.

COMMISSIONER MARKS: So it went from Lee Rogers to Greg --

MR. KELLY: Shedell.

COMMISSIONER MARKS: -- Shedell, to you?

MR. KELLY: Yes.

COMMISSIONER MARKS: And you don't know who told Rogers to tell you not to come onto the site?

MR. KELLY: That's right, I do not know.

COMMISSIONER MARKS: Did you consider that a reasonable directive?

MR. KELLY: I felt like I could have been useful on

site. I also felt like I had to yield to their judgment. They were on site, and I was not.

COMMISSIONER MARKS: Is it conceivable that if you had been given access, you might have identified some of the problems, in view of your previous experience with the Davis-Besse and the differences that you just pointed out to Dr. Taylor?

MR. KELLY: No, sir, because by the time I got there to where I was available to be on site, the reactor coolant pumps had already been turned off, and it was hours and hours into the transient.

COMMISSIONER MARKS: But you just said you thought you might be helpful. How do you think you could have been helpful?

MR. KELLY: Well, in the recovery stage if they needed people to communicate, if they needed people to advise them as to what was going on. I think I could have been helpful at that point.

COMMISSIONER MARKS: Can you be more specific?

MR. KELLY: Well, I may have, if I had had the information available to me, been able to make recommendations on the recovery. I was not allowed on there. I was not exposed to the information. I don't think I can be any more specific.

COMMISSIONER MARKS: Do you know who makes decisions on sending out someone from B&W to investigate a transient?

MR. KELLY: I don't know where the decision originates with, no, sir. I don't know.

COMMISSIONER MARKS: And I guess you don't know how many transients have been investigated with respect to B&W reactors.

MR. KELLY: I couldn't give you a number. I know that Bob Winks, who I mentioned, went and investigated a transient at the SMUD utility.

COMMISSIONER MARKS: At what?

MR. KELLY: SMUD, Sacramento.

COMMISSIONER MARKS: Sacramento, California?

MR. KELLY: Yes.

CHAIRMAN KEMENY: Governor Babbitt?

COMMISSIONER BABBIT: Mr. Kelly, when you returned to Davis-Besse for the briefing in Lynchburg, did you indicate that Mr. MacMillan was there for that briefing?

MR. KELLY: Sir, he was there for a portion of it. He was not there for the whole thing. I remember him coming in and I remember him leaving.

COMMISSIONER BABBIT: Do you recall which portion he was there for?

MR. KELLY: No. I was just trying to do that since this has started, and I don't remember which portion.

COMMISSIONER BABBIT: Do you recall whether it was during your part of the presentation or -- who was it, Mr.

Faist was the other lecturer?

MR. KELLY: He was there during my part of the investigation, which would be going over the graphs -- I am implying this now. I went over the graphs and explained, to my knowledge, what the sequence of events was at that time, and he stayed for that portion of it, at least.

COMMISSIONER BABBIT: He was there for that portion?

MR. KELLY: Yes.

COMMISSIONER BABBIT: Do you recall whether he asked any questions?

MR. KELLY: He did not.

COMMISSIONER BABBIT: Mr. Kelly, going back to your discussion with the instructors -- I believe Mr. Lind was one the instructors?

MR. KELLY: Yes, he was one.

COMMISSIONER BABBIT: During those discussions, did Mr. Lind or any of the other instructors give you their opinion of how they could do a better job or what they might have done in the past that they would now correct in light of this discussion?

MR. KELLY: At the time they did not, but since the accident I have gone back to see what they have done, and I have reread -- I'm sorry, I didn't reread, I initially read -- the simulator casualty procedures and the wording involved in there that we write down on when to secure high pressure

injection. I talked to them about specific drills that they give, where they point out that pressurizer level and pressure can diverge and go in different directions, and they teach these as routine.

COMMISSIONER BABBIT: Those discussions were subsequent to the Three Mile Island incident, were they?

MR. KELLY: Yes, yes.

COMMISSIONER BABBIT: Okay. You don't have any recollection of their analyzing to you at the time of the discussions immediately after the Davis-Besse incident?

MR. KELLY: Only that they told me that they tell the operators to be aware of pressurizer level, primary plant pressure, and reactor coolant average temperature at the same time when they consider securing high pressure injection. I remember Mr. Lind telling me that.

COMMISSIONER BABBIT: But you don't remember any other analytical discussion of the training process, simply his conclusion that he had been over all of those points?

MR. KELLY: Sir, maybe I don't know what you mean by analytical discussion.

COMMISSIONER BABBIT: Well, my difficulty is, in all candor, your answer sounds too pat, frankly, and it sounds as if you went down and talked with them and they said, that's very interesting, but we have certainly covered all of those points, and it doesn't sound very real to me, frankly.

MR. KELLY: I had worked with Mr. Lind and Mr. Halmyer at Florida. I knew both of them. I trusted them and respected their judgment. When I explained the sequence of events and they told me that the operators had been trained not to do that or they had been trained to recognize that casualty, I believed them, yes, sir.

CHAIRMAN KEMENY: Commissioner Haggerty?

COMMISSIONER HAGGERTY: The high pressure injection system is really a very significant and essential safety feature in relation to the reactor, is it not?

MR. KELLY: Yes.

COMMISSIONER HAGGERTY: I gather that your concern was related to whether an adequate, completely adequate, set of instructions was being made to the operators that reflected all of the aspects of operating the HPI.

Now, could you tell us what might be the negative consequences of leaving HPI on under those circumstances that existed at Davis-Besse and Three Mile Island. What were the negative things, the bad things that could happen?

MR. KELLY: If the reactor coolant system leak were small enough, you might -- or if there was not a reactor coolant system leak -- you would fill the reactor coolant system completely solid and collapse the steam bubble in the pressurizer and start discharging water out through the relief valves.

COMMISSIONER HAGGERTY: And what would that do?

MR. KELLY: It would -- in perspective, it would continue to cool the cooler. You would be pumping water in a nd out through the relief valves.

COMMISSIONER HAGGERTY: In essence, nothing of real consequence.

MR. KELLY: No.

COMMISSIONER HAGGERTY: Is there any potential for damage by -- to the system by leaving HPI on? In other words, not terminating under the set of circumstances outlined; that is, decreasing the pressure and increasing levels, that you can think of?

MR. KELLY: No, there wouldn't be anything wrong with leaving it on.

COMMISSIONER HAGGERTY: Isn't it true that HPI is not present in all reactor systems of the general type -- it is present in all B&W systems, but not all of them have HPI?

MR. KELLY: I'm sorry, I can't -- I don't know. I can't comment on that.

COMMISSIONER HAGGERTY: I think the important thing, though, is that you believe that HPI was a significant safety tool, and you were concerned that perhaps the instruction relating to that tool was not completely adequate so that the operators would understand how it ought to be used under a variety of circumstances, isn't that correct?

MR. KELLY: That is essentially correct, yes, sir.

CHAIRMAN KEMENY: Commissioner McPherson?

COMMISSIONER MCPHERSON: Mr. Kelly, I believe you said earlier in your responses to counsel that when you wrote the memorandum of November 1, you were not sure that there was a significant safety concern.

MR. KELLY: Yes.

COMMISSIONER MCPHERSON: And I am interested in the meaning of that term, since in the memorandum there appears this sentence: "Since there are accidents which require the continuous operation of the high pressure injector system, I wonder what guidance, if any, we should be giving to our customers on when they can safely shut the system down following an accident."

Does that not express a concern about safety?

MR. KELLY: Yes, sir, that is why I wrote the memo. In my mind, the operative words there, "I wonder what guidance, if any...", I was not sure when I wrote the memo that we were not adequately already guiding the customers on what to do.

COMMISSIONER MCPHERSON: So that the operation of a high pressure injection system or its termination is a significant safety concern, but whether or not B&W was providing the guidance was unknown to you, and it was that that you didn't know. You were uncertain about its significance, is that correct?

MR. KELLY: Well, I was convinced that we were training the operators in what to do. I wasn't convinced in what the written words we were putting out was, and that is what I was trying to address.

CHAIRMAN KEMENY: Professor Pigford?

COMMISSIONER PIGFORD: Mr. Kelly, I wanted to ask you about some other aspects of the Davis-Besse accident that you may have knowledge of as a result of your review. Was the auxiliary feed water lost at Davis-Besse?

MR. KELLY: Sir, one of the pumps on the number two generator did not come up to full speed. The other auxiliary feed water pump did operate correctly.

COMMISSIONER PIGFORD: So perhaps that is another way in which it differs from TMI.

MR. KELLY: Yes, sir, only one of the -- at TMI neither auxiliary feed water pump was available for the first 8 minutes of the transient.

COMMISSIONER PIGFORD: To your knowledge, does that difference during the first 8 minutes result in any large difference in the transient itself?

MR. KELLY: I wouldn't think it would make a large difference.

COMMISSIONER PIGFORD: Have you seen any analysis of that?

MR. KELLY: I have not seen them. I believe that

Mr. Dunn has run analyses like that, and he would be able to answer that.

COMMISSIONER PIGFORD: You don't think it would make a large difference, but these words are qualitating. Could you be more specific? How much difference?

MR. KELLY: Well, what I meant was, I don't think that the isolation of the feed water for 8 minutes at TMI II or the fact that the one feed water pump did not come up to full speed at Davis-Besse is as significant as the small loss of coolant accident that resulted at both plants. That was the overriding portion of the transient that had to be brought under control, in my mind.

COMMISSIONER PIGFORD: Was natural circulation established at Davis-Besse?

MR. KELLY: No, they never stopped the reactor coolant pumps.

COMMISSIONER PIGFORD: Are you familiar with the procedures that operators are supposed to follow in these small break loss of coolant accidents?

MR. KELLY: I have read the procedures that our training department uses in their simulator instructions. I am not familiar with what procedures each individual utility has developed for itself.

COMMISSIONER PIGFORD: Is this in -- could you then tell me this: suppose, at Davis-Besse, that the off-site

power had been lost, which means the pumps cannot operate --

MR. KELLY: Yes.

COMMISSIONER PIGFORD: -- the main cooling pumps. And suppose the pressurizer relief valve had closed when it was supposed to. What procedures are the operators supposed to follow in that case?

MR. KELLY: He would be in a natural circulation mode of core cooling, in that case, so he would be following a natural circulation procedure.

COMMISSIONER PIGFORD: Can he just let it run on automatic? Is that all he needs to do?

MR. KELLY: The system will function automatically. He would have to monitor to make sure that it does function automatically.

COMMISSIONER PIGFORD: He doesn't have to improve on the automatic controls and do anything -- open any valves, close any valves?

MR. KELLY: No, sir. If the system is lined up it will fill up to the appropriate level on the secondary side of the steam generators and naturally circulate.

COMMISSIONER PIGFORD: Suppose auxiliary feed water is also lost. Then what must he do? Excuse me, let me precede that with a question. If auxiliary feed water is also lost and if the relief valve is closed properly, are you aware of the procedure that the operator must follow?

MR. KELLY: No.

COMMISSIONER PIGFORD: You have not seen those at the instruction at the simulation?

MR. KELLY: No, I did not read that procedure.

COMMISSIONER PIGFORD: Do you know if they are there or not?

MR. KELLY: No, I do not.

COMMISSIONER PIGFORD: You have no knowledge of these procedures?

MR. KELLY: You are talking about a compound casualty, I believe, is that right? You are saying that you have lost off-site power and now you have also lost auxiliary feed water?

COMMISSIONER PIGFORD: Yes. The one thing that does work is the pressurizer relief valve is closed.

MR. KELLY: Yes.

COMMISSIONER PIGFORD: You are not familiar with the procedure on that?

MR. KELLY: I'm not -- I don't know if there is a written procedure on that, no.

COMMISSIONER PIGFORD: Well, do you know any procedure, written or otherwise?

MR. KELLY: No.

COMMISSIONER PIGFORD: All right.

CHAIRMAN KEMENY: Commissioner Trunk?

COMMISSIONER TRUNK: How often has each relief valve failed to open?

MR. KELLY: I'm sorry, I can't hear that.

COMMISSIONER TRUNK: How often has each relief valve failed to open, or to close, I mean, to your knowledge?

MR. KELLY: I think I remember seeing a report on the order of 20 times, perhaps. I don't know. I can only tell you that I am aware that they didn't shut at Davis-Besse and Three Mile Island.

COMMISSIONER TRUNK: And you haven't investigated why?

MR. KELLY: Why, ma'am?

COMMISSIONER TRUNK: Why it doesn't do its job.

MR. KELLY: Well, I know why the one at Davis-Besse didn't shut. There was a missing relay in there that would prevent that valve from reseating and getting an adequate blowdown before it would have to reopen, so the valve sat there and chattered at least nine times very rapidly opening and shutting until it beat itself apart. The valve at Three Mile Island, I believe we will find out why it didn't reshut when we can gain access to that valve.

COMMISSIONER TRUNK: But since you knew that it had 18 other failures, didn't you do anything about it to make sure that it would close?

MR. KELLY: Ma'am, I didn't know that until -- that

there were 18 other failures -- until I read a report here recently.

CHAIRMAN KEMENY: Mr. Kelly, may I ask you the following question? Since your concern was whether adequate information was being sent out to the customers, what is your understanding of the process by which B&W decides to send instructions to customers?

MR. KELLY: The instructions were sent out from our Nuclear Service Department, and that is why I included the Nuclear Service people on my original memo. And if we could get agreement, if they thought that they were not adequate, then they would be the ones who would draft the appropriate words and disseminate them to the customers. Nuclear Service generates recommended operating procedures.

CHAIRMAN KEMENY: Do you know of other instances whether you, yourself, or someone else in your department has suggested sending out instructions to customers?

MR. KELLY: On any subject at all?

CHAIRMAN KEMENY: Well, on potential safety issues.

MR. KELLY: There are site instructions sent out and bulletins sent out to the customers routinely.

CHAIRMAN KEMENY: No, but I meant, did you know of any that were initiated by you or your department? Let me be more specific. I am trying to find out whether you, and eventually your supervisors, sending such a suggestion is a very

common occurrence, only in a hundred, or are fairly rare.

MR. KELLY: It is the only time I have ever done it.

CHAIRMAN KEMENY: The only time you have ever done it.

MR. KELLY: Yes.

CHAIRMAN KEMENY: And you don't, from personal knowledge, know of another instance like that?

MR. KELLY: Not that I can recall now.

CHAIRMAN KEMENY: Yes. So, therefore, as far as you know, it is not an exceedingly common occurrence that this should happen?

MR. KELLY: That is correct.

CHAIRMAN KEMENY: Commissioner Lewis?

COMMISSIONER LEWIS: I noticed, Mr. Kelly, on your memorandum that you used the word "generic."

MR. KELLY: Yes, ma'am.

COMMISSIONER LEWIS: Why did you use the term "generic" on that memorandum?

MR. KELLY: To me, it meant I was concerned about all the B&W customers and whether they were getting this information, and the block on the thing that says "customers," I could have put a word that said "all." I could have put -- I could have individually listed every utility. I just used "generic" as a synonym for all customers.

COMMISSIONER LEWIS: So you were indicating, in other

words, that you felt this was a problem, the problem that you saw at Davis-Besse was applicable to all of the B&W plants. Is that correct?

MR. KELLY: Yes. My concern over whether we were sending, if we were sending appropriate words out, was applied to all plants, not just Davis-Besse, yes.

COMMISSIONER LEWIS: Okay. Let me just draw for you a scenario. Suppose that the operators at TMI II knew what you knew at Davis-Besse. Suppose this information had been transmitted to them. Do you think that accident is likely to have happened?

MR. KELLY: I cannot say that it would have made any difference because I thought they already had -- being trained in what they were supposed to do.

COMMISSIONER LEWIS: But obviously, they didn't have it, because they were not proceeding in a way that it is obvious -- I mean, they didn't recognize that the PORV was stuck open, and so on. Had they known that, had they known that this kind of incident had happened 18 months earlier and that information had been transmitted to TMI II, do you think that the accident could have been prevented?

MR. KELLY: Again, you are asking me to speculate something --

COMMISSIONER LEWIS: Yes.

MR. KELLY: -- that I have already considered --

I investigated -- let me answer this way -- I investigated the Davis-Besse transient and also the Three Mile Island II transient, and I was reviewing the graphs of the Three Mile Island II transient, it was obvious to me what had happened. That's all I can say.

CHAIRMAN KEMENY: Mr. Kelly, could I try Commissioner Lewis' question in a slightly different way? I don't ask that you speculate whether the operators did or did not have proper instructions. Simply the following factual question: your memorandum of November 1 has certain suggested procedures on HPI termination. Suppose those had been followed at TMI II? Would that have made a substantial difference in the course of the accident?

MR. KELLY: The question is if they were to follow these instructions --

CHAIRMAN KEMENY: Yes.

MR. KELLY: -- yes, that would have made a difference, I believe.

CHAIRMAN KEMENY: A favorable difference?

MR. KELLY: Yes.

CHAIRMAN KEMENY: A quite substantial one?

MR. KELLY: Yes.

CHAIRMAN KEMENY: Thank you. Dr. Marks?

COMMISSIONER MARKS: I want to just follow up on something, a question I heard. Although you were not allowed

access to the site, did Mr. Rogers, who was in the control room during your presence in the proximity of the site consult you during the period before you had gained access to the site, or any of the other members of B&W that had been dispatched?

MR. KELLY: No, Mr. Rogers was just calling Mr. Shedell and talking to him, and the rest of us were in Mr. Shedell's house. But the only communication was between Mr. Rogers and Mr. Shedell.

COMMISSIONER MARKS: Well, did Mr. Shedell consult you on the basis of Mr. Rogers' conversations with him?

MR. KELLY: He was telling us the information that he had available, and he was relaying that same information back to Lynchburg and asking them for recommendations.

COMMISSIONER MARKS: You mean you served no function while you sat there?

MR. KELLY: That's right.

COMMISSIONER MARKS: I see. Did Lynchburg advise Shedell with regard to any aspects of the accident during this period between the morning of the 28th until you gained access to the site?

MR. KELLY: That day, the first day of the accident I can remember Mr. Shedell relaying information to Lynchburg and asking for Lynchburg's recommendation on restarting a reactor coolant pump. They had already shut them down at this

point in time. When we went out to dinner, the five of us, and came back to Mr. Shedell's house after dinner, the reactor coolant pump was running, so I assumed that the recommendation did come through and was relayed to the people on the site and they acted on it.

I don't remember Mr. Shedell saying that Lynchburg says to do this and --

COMMISSIONER MARKS: Was there any discussion on the 28th of any [illegible]ts of TMI II relevant to your previous experience with Davis-Besse?

MR. KELLY: No, there was not. The information at Mr. Shedell's house was too fragmentary for me to make the connection at that point.

COMMISSIONER MARKS: You mean, during the 28th, it did not occur to you that there were things going on at TMI II which recalled the Davis-Besse accident?

MR. KELLY: No.

CHAIRMAN KEMENY: Commissioner McBride.

COMMISSIONER MC BRIDE: Mr. Kelly, I wonder if you would describe in greater detail the difference that following your instructions, as outlined in the November 1st memorandum, you outlined the difference you feel that following those instructions would have made at Three-Mile.

MR. KELLY: In step B of that instruction, it says once the high pressure injection is initiated, don't stop it unless average temperature is stable or going down and pressurizer level is increasing and primary pressure is at least 1600 pounds and increasing.

That's not what they did. They had them going in opposite directions when they stopped high pressure injection. I think if they would have left it on through those instructions, core cooling would have continued to be provided.

COMMISSIONER MC BRIDE: That means that TMI would have been insignificant, as opposed to the serious situation we're now in, and cooling continued.

MR. KELLY: That's my opinion. It may have been, yes.

COMMISSIONER MC BRIDE: Thank you.

CHAIRMAN KEMENY: Do you have further questions, Professor Pigford? Yes?

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COMMISSIONER PIGFORD: Mr. Kelly, I recall that you said earlier that you thought the open relief valves, the stuck open relief valve would be more important to safety than the loss of auxiliary feedwater. Is that correct?

MR. KELLY: Than the loss of feedwater for that time period, yes, eight minutes or something like that.

COMMISSIONER PIGFORD: Now, let's take this case. Given that we have a reactor in which the feedwater was lost, for some time period, like eight minutes, then which is better, to have the relief valve stuck open or come closed? Assuming everything else works properly, the high pressure injection works automatically and so forth, which is better, to have the relief stay open during that eight minutes or closed? Which is better for safety? Which is better to keep the core from being uncovered?

MR. KELLY: If you lost feedwater for eight minutes and no auxiliary feedwater, pressure's going to be high enough to open that relief valve. It will be open.

COMMISSIONER PIGFORD: Mr. Kelly, do you think it will stay open for eight minutes?

MR. KELLY: If you're not removing primary heat, it may open and shut and reopen.

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COMMISSIONER PIGFORD: Could you please say that once more?

MR. KELLY: If you're not removing any core heat, the pressure will continue to go up and relieve and go down. And then when it reseats, it will reopen again.

COMMISSIONER PIGFORD: Yes, okay. So it will close and then reopen, which is the way it's designed. But from the point of view of avoiding core damage, which is better, for that intermittent opening or for it to just stay open?

MR. KELLY: You're asking questions outside of my area of expertise. But it seems like it may be better to let it stay open and blow down and get high pressure injection on.

CHAIRMAN KEMENY: Mr. Kelly, just before excusing you, I just wanted to summarize two or three major points that I believe you brought out. One is you wrote the memorandum in November of 1977, which we went through, in which you made certain recommendations. That is correct, is it not?

MR. KELLY: Yes.

CHAIRMAN KEMENY: And secondly, you brought out that there were some significant differences, there were also some significant similarities in the events of

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Davis-Besse one and TMI two.

MR. KELLY: Yes.

CHAIRMAN KEMENY: And that you stated your opinion that if particularly the second part of your recommendation had been followed at TMI two, the accident would have been a minor one rather than a major one, in your opinion.

MR. KELLY: That's my --

CHAIRMAN KEMENY: Thank you. Mr. Kelly, you're excused, subject to recall.

Would chief counsel please call and swear in the second witness?

MR. GORINSON: Bert Dunn, please.

MR. EDGAR: Mr. Chairman, my name is George Edgar. I'm counsel for Babcock and Wilcox. Mr. Dunn had reached me early this morning by telephone and explained that he had missed the plane, but he expected to come directly to auditorium by 9:30. And he is not here yet. He intends to be here. But I have no further information.

He has just arrived.

CHAIRMAN KEMENY: While waiting for Mr. Dunn, may I ask counsel if we have any late information on a certain event in the Dunn family?

MR. EDGAR: I didn't hear you.

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CHAIRMAN KEMENY: While we're waiting for Mr. Dunn, may I ask if the counsel has any late information on a certain expected event in Mr. Dunn's family?

MR. EDGAR: I have nothing. This may indeed be the cause of the delay.

CHAIRMAN KEMENY: Yes. For the information of the rest of you -- I understand he's here, isn't he? Do I understand Mr. Dunn is in the building?

MR. EDGAR: Yes, he's just at the witness check-in table.

CHAIRMAN KEMENY: Very good.

Mr. Chief Counsel, would you please swear in the witness?

MR. GORINSON: Mr. Dunn, would you raise your right hand? Do you solemnly swear that the testimony you are about to give will be complete, the whole truth, and nothing but the truth, so help you God?

MR. DUNN: I do.

CHAIRMAN KEMENY: Would you please state your name for the record and your current position with Babcock and Wilcox?

MR. DUNN: My name is Bert Merit Dunn. I am manager of emergency core cooling analysis for Babcock and Wilcox.

CHAIRMAN KEMENY: Thank you. Chief counsel?

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MR. GORINSON: Thank you, Mr. Chairman.

Mr. Dunn, the emergency core cooling analysis unit is part of the design section. Is that correct?

MR. DUNN: It is part of the plant design section.

MR. GORINSON: Plant design section. That's also part of the engineering department at Babcock and Wilcox.

MR. DUNN: That is correct.

MR. GORINSON: What are the responsibilities of your ECCS unit?

MR. DUNN: Our responsibilities would be mainly to provide assurance that the emergency core cooling system, as designed, would prevent excessive core problems under the condition that a loss of coolant accident had occurred at the nuclear plant. We also have additional responsibilities associated with hydraulic loads, which can occur initially at the time of a loss of coolant accident, and for certain considerations regarding the efflux or the fluid that leaves the primary system during a loss of coolant accident, its interactions within the reactor building.

MR. GORINSON: What are your duties as manager of that unit, Mr. Dunn?

MR. DUNN: That would involve maintaining an

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adequate staff, being the coordinator for the unit's activities, providing tools for the staff, and, I suppose, bei in charge of the procedures or technical ways in which we provide the verification for the emergency core cooling system design.

MR. GORINSON: When did you first learn about the events that occurred at the Davis-Besse plant on September 24th, 1977?

MR. DUNN: I would say it would be within one or two days after the event, perhaps the same day.

MR. GORINSON: Did you, within a few days of that event, attend a briefing that Mr. Kelly gave on Davis-Besse?

MR. DUNN: Yes, I believe I did.

MR. GORINSON: And what information about the Davis-Besse events were you given at that briefing?

MR. DUNN: The specifics of that information I have not been able to recall at this time. I think we were given a general description of the primary system parameters and how they evolved throughout the transient.

MR. GORINSON: Did you reach a conclusion at some time that the Davis-Besse transient of September 24th, 1977, was not a normal transient?

MR. DUNN: Yes, sir.

MR. GORINSON: When did that happen?

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MR. DUNN: I again think that would have been within a few days of the 24th.

MR. GORINSON: And what led you to the conclusion that it was an unusual transient?

MR. DUNN: The transient involved the failing in the open position of a relief valve on the top of the pressurizer, termed, I believe, the PORV valve. That valve is not supposed to fail in the open position. It's supposed to reclose, following a pressure spike in the primary system, and it had remained open for an extended period of time.

MR. GORINSON: Were there other events that occurred during that transient that you considered unusual?

MR. DUNN: Yes, there had been a termination of the high pressure injection system during the first minutes of the transient. I can't give you an exact time. I could obtain that information. But it was at a time I felt was inappropriate.

MR. GORINSON: And you learned all those things before Mr. Kelly sent his November 1, 1977 memorandum?

MR. DUNN: Yes, sir.

MR. GORINSON: And did you discuss the Davis-Besse transient with Mr. Kelly?

MR. DUNN: I would have to say I had many

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discussions with Mr. Kelly on the Davis-Besse transient.

MR. GORINSON: Before he sent this memorandum?

MR. DUNN: I believe so.

MR. GORINSON: And did you encourage him to send this memorandum?

MR. DUNN: I believe in the depositions we gave you, I said I did. I think that's still correct. There's some controversy on actively I encouraged it. I certainly would have, and I was seeking such a memorandum to be issued.

MR. GORINSON: Had the issue of operator interruption of high pressure injection been analyzed at Babcock and Wilcox before the Davis-Besse accident?

MR. DUNN: Not to my knowledge.

MR. GORINSON: Was it your view, at or about the time that Mr. Kelly sent this memorandum, that Babcock and Wilcox customers should be given more guidance on the operation of high pressure injection?

MR. DUNN: I believe I'd rather say that we were seeking a forum of discussion on the issue. For reasons that at that time I may not have been aware of, the action in that event could have been quite proper. I did not feel it was at that time. As of today, I still do not feel that was a proper action. But I would say we were seeking a forum for discussion

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to make a decision as to whether or not the operators should be informed or be given additional guidance.

MR. GORINSON: You said something about something not being a proper action. What were you referring to?

MR. DUNN: I was referring to the termination of high pressure injection, as it occurred during that transient, specifically the Davis-Besse transient of September 24th.

MR. GORINSON: Okay. We'll come back to my question, sir. Was it your view at that time that Babcock and Wilcox customers should be given more guidance on high pressure injection?

MR. DUNN: I suppose, considering that at that time, I personally felt that was inappropriate action, then I would have to say that I felt that they should have been given more guidance, or informed of the event.

MR. GORINSON: Before Mr. Kelly sent his November 1, 1977 memorandum, did you speak with B and W's training department to find out what operators were being taught about high pressure injection?

MR. DUNN: No, sir, I did not.

MR. GORINSON: You did receive a copy of Mr. Kelly's November 1, 1977 memorandum.

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MR. DUNN: Yes.

MR. GORINSON: Did you prepare a response?

MR. DUNN: No.

MR. GORINSON: Did you give Mr. Kelly your thoughts on the subject orally?

MR. DUNN: I believe that's correct.

MR. GORINSON: What did you tell Mr. Kelly?

MR. DUNN: Again there would be many discussions in and around this time frame. And the particulars of what I would have told Mr. Kelly I cannot recall. I can say that I felt his memo was aimed at the point I was trying to get resolved, and we were trying to start a forum.

MR. GORINSON: Were you in agreement with Mr. Kelly's recommended guidelines in his November 1 memo? And to help you, there should be a copy of Mr. Kelly's November 1 memo there on the table.

MR. DUNN: I think it would be best to say that the instructions contained in items A and B of this memo point in the right direction, in the direction that I would indicate -- would feel would be very positive towards resolving my concerns. But I'm not sure that I would wholly agree that they were entirely adequate at that time. Again we were trying to start a forum in which we could completely, you might say, knock

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out all of the considerations.

MR. GORINSON: You wanted further discussion on the subject?

MR. DUNN: Further discussion. What I wanted was a full reactor coolant system. I'm not sure that this prescription of 1600 PSIG provides me that.

MR. GORINSON: When you say a full reactor cooling system, what do you mean, sir?

MR. DUNN: I mean full of water, in its liquid form.

MR. GORINSON: You mean going solid, is that what that's --

MR. DUNN: I would not mean going solid. I used reactor coolant system. I would rather it be considered reactor coolant system less the pressurizer.

MR. GORINSON: After Mr. Kelly wrote his memorandum, what happened? Was there any response?

MR. DUNN: Not that I was aware of.

MR. GORINSON: Did Mr. Kelly tell you whether he was getting response from the company, from the people he'd written to?

MR. DUNN: The lack of response on the Kelly memo, or to integration in general prompted a follow-on memo by myself. I'm sure that in preparing that memo, I asked the question as to whether there had been

LA 13 1 response on this issue.

2 MR. GORINSON: Could we put in front of Mr. Dunn
3 what's been premarked as Commission Hearing Exhibit Number
4 3? This is a memo from Bert Dunn to Jim Taylor, dated
5 February 9th, 1978. Do you have that in front of you,
6 sir?

7 MR. DUNN: Yes.

8 MR. GORINSON: Is this the follow-up memo you
9 just referred to?

10 MR. DUNN: Yes.

11 MR. GORINSON: And specifically what led you
12 to write this memorandum on February 9th, 1978?

13 MR. DUNN: I think the best characterization
14 would be that I had not seen positive action, which
15 I could interpret as leading to instructions to prevent
16 premature operator termination of high pressure injec-
17 tion or resolution of my concern in a fashion that
18 would say it really wasn't premature.

19 MR. GORINSON: You sent this to Jim Taylor.
20 He's the manager of licensing. Is that correct?

21 MR. DUNN: That's correct.

22 MR. GORINSON: And why did you address this to
23 him?

24 MR. DUNN: I felt Mr. Taylor was an influential
25 person concerned with safety and could, so to speak, start

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the ball rolling.

MR. GORINSON: I see. Now, on the second page of your memorandum, you list as copiees various other individuals in the organization. Can we just quickly go through and identify those people and what their titles are?

Who is Mr. Swanson?

MR. DUNN: Mr. Swanson is a supervisor in the integration unit. Integration is an additional unit within the plant design section. In particular, I believe Mr. Swanson is Mr. Kelly's supervisor.

MR. GORINSON: Mr. Roy?

MR. DUNN: Mr. Roy, at this time, was the manager of the plant design section.

MR. GORINSON: And today what is Mr. Roy's position?

MR. DUNN: He is the manager of the engineering department.

MR. GORINSON: Mr. Karrasch?

MR. DUNN: Mr. Karrasch would be the manager of the integration unit.

MR. GORINSON: Mr. Bailey?

MR. DUNN: Mr. Bailey is a ngineer within the licensing section, assigned to the generic licensing unit.

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MR. GORINSON: Mr. Kelly, that's the Mr. Kelly who had written the November 1, 1977 memorandum. Is that right?

MR. DUNN: Yes, sir.

MR. GORINSON: Mr. Kane?

MR. DUNN: Mr. Kane is a member of the licensing section. At the time of issuance of this memo, he was either a unit manager, in charge of operating plants, or on special assignment to that section.

MR. GORINSON: Mr. Agar?

MR. DUNN: Mr. Agar is additionally a unit manager in the licensing section.

MR. GORINSON: Mr. Pittman?

MR. DUNN: Mr. Pittman, I cannot specifically give you his title. He is a member of the nuclear service department.

MR. GORINSON: Mr. Phinny?

MR. DUNN: Mr. Phinny would also be a member of the nuclear service department.

MR. GORINSON: And Mr. Scott?

MR. DUNN: Again, I belive Mr. Scott is a member of the nuclear service department.

MR. GORINSON: In writing this February 9th, 1978 memorandum, you were addressing the same concern that had previously been addressed by Mr. Kelly.

MR. DUNN: Yes, sir, I believe that's correct.

MR. GORINSON: And thus the concern that arose out of the events at Davis-Besse one?

MR. DUNN: Yes.

MR. GORINSON: And can we look at the second paragraph of your February 9th, 1978 memo, the last sentence of that second paragraph? Would you read that for us, sir?

MR. DUNN: Yes, I think I'd like to say that up until this time, I believe the memo contains a description of the events at Davis-Besse. And I carry on to say, "Had this event occurred in a reactor at full power with other than insignificant burnup, it is quite possible, perhaps probable, that core uncovery and possible fuel damage would have resulted."

MR. GORINSON: And what did you base that on, that conclusion?

MR. DUNN: Primarily my experience involved with the prediction of loss of coolant accidents, for approximately eight years, and a knowledge that high pressure injection, under the conditions of a loss of coolant accident, is necessary to prevent the events I've described.

MR. GORINSON: I see. It was your view, was it not, as expressed at the beginning of the third paragraph,

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that Babcock and Wilcox had not supplied sufficient information to reactor operators in the area of recovery from LOCA?

MR. DUNN: Well, inasmuch as I wrote that sentence, yes.

MR. GORINSON: And was this memorandum also designed to provide a basis for discussion?

MR. DUNN: I believe that was my intent in writing this.

MR. GORINSON: Why were these particular individuals copied on the memorandum to Mr. Taylor?

MR. DUNN: I would say that, in all probability, Mr. Kelly and myself and probably Mr. Swanson discussed my issuance of a memo, for which I was responsible for the content. But we accumulated names of people within the various sections that we felt could start a forum of discussion during which an acceptable prescription for termination of high pressure injection could be identified.

MR. GORINSON: Did you include the training department in that forum for discussion, at all?

MR. DUNN: I don't believe so.

MR. GORINSON: Did you talk to the training department before writing your memorandum?

MR. DUNN: No, sir, I did not.

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MR. GORINSON: Are you aware of a system at Babcock and Wilcox called a preliminary safety concern system?

MR. DUNN: Yes.

MR. GORINSON: And what department is responsible for that system? For administering it.

MR. DUNN: The administration responsibilities lie within the licensing section of the engineering department.

MR. GORINSON: Is that Mr. Taylor's section?

MR. DUNN: Mr. Taylor is the person to which the form is addressed, and responsible at least for the initial form of discussions and distribution of the concern.

MR. GORINSON: Why wasn't this memorandum on a preliminary safety concern form?

MR. DUNN: I think the answer would be that I felt that this memorandum, if it were successful in instigating a review of my concerns and achieving resolution of those concerns, would have been sufficient. Had this not accomplished that in my mind, I believe then I would have issued a PSC.

MR. GORINSON: Did you consider this to be a safety concern at the time you wrote the memorandum?

MR. DUNN: I consider it to be a highly possible

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concern to the safety of a plant.

MR. GORINSON: And something that's a highly possible concern for the safety of a plant, is that something that normally goes on the preliminary safety concern form?

MR. DUNN: It would be a candidate for the preliminary safety concern form. I would say it's not absolutely mandatory that it goes on that.

MR. GORINSON: So you thought that putting it in memorandum form would still get the attention you believed it deserved.

MR. DUNN: Yes.

MR. GORINSON: Did Mr. Taylor respond to your February 9th memorandum?

MR. DUNN: I'm unclear on that point. I mentioned in my discussions during the deposition that there may have been a telephone communication between myself and Mr. Taylor. There was no w. tten communication.

MR. GORINSON: Well, can you tell us what the substance of that telephone communication was with Mr. Taylor?

MR. DUNN: Well, if, in fact, it occurred -- and I mentioned that I was very unclear on that, it would be what you'd call a ghost in my memory -- the content, as

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it appears there, is that Mr. Taylor was redirecting the memo to the nuclear service department.

MR. GORINSON: Did he tell you why he was redirecting it to the nuclear service department?

MR. DUNN: I don't believe so, in that conversation.

MR. GORINSON: Did you point out to Mr. Taylor during that telephone conversation the last paragraph of your memo of February 9th, which says, "I believe this is a very serious matter and deserves our prompt attention and correction"?

MR. DUNN: I would not say I specifically pointed that out. I think I felt that Mr. Taylor had read the memo and understood its implications.

MR. GORINSON: But he did not tell you why it was being routed to the nuclear service department.

MR. DUNN: Well, I wouldn't say he did not tell me. I said I did not recall that conversation in detail, or even if it really occurred.

MR. GORINSON: Have you ever learned from Mr. Taylor why he routed this memorandum to the nuclear service department?

MR. DUNN: He has given me some reasons.

MR. GORINSON: What were those reasons?

MR. DUNN: He felt the memo was misdirected and

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for resolution should have gone to nuclear service.

MR. GORINSON: Did he tell you why it was misdirected?

MR. DUNN: He felt that it was a matter of a changing procedure, which would be accomplished -- or could be accomplished best by that department.

MR. GORINSON: After you had put in your February 9th memo, what occurred next, sir?

MR. DUNN: As I recall, the first thing that occurred is I was approached by a member of the nuclear service department and we held discussions concerning the memo. I believe, to some extent, there was a brief explanation as to why I considered it inappropriate, the termination of high pressure injection, as it occurred in Davis-Besse.

Following that, a alternate prescription for termination of high pressure injection was put forward by this person. And after review and discussion of the alternate procedure, I concluded that it satisfied my concerns, as well as the one I had provided in my February 29th memo. Nuclear service felt it was more practical, more implementable. And I documented my agreement with that alternate prescription in a follow-on memo.

MR. GORINSON: Who was the person from nuclear

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service that you were dealing with?

MR. DUNN: Well, I'm going to have to give a hazy response to that. I've searched my memory many times to try and identify that individual. And I cannot positively identify him. But I have asked around the section, the nuclear service section, as to who that individual would be. And the most likely candidate would be Mr. Cal Goslow.

MR. GORINSON: Now, just so we understand, is it fair to say that the people you were dealing with from nuclear service did not dispute your prediction that, had the event occurred in the reactor at full power with other than insignificant burnup, it is quite possible, perhaps probable, that core uncovery and possible fuel damage would have resulted? Did they challenge that during your discussion?

MR. DUNN: They may have. I would say that after the discussion and the explanation of the reasons I had for predicting that, that they -- the individual, I'm using the word "they"; that's probably overstating it -- the individual with whom I was discussing the events deferred to my judgement, if he didn't necessarily believe it. And I'd say I felt he was believing me.

MR. GORINSON: But from your perception, they did not challenge you -- or he did not challenge you, from

LA 23

your discussions with him.

MR. DUNN: Again, I would say that we had, I think, a discussion of the reasons I made the prediction. Now, that means he probably asked me something on the order of how could this happen, which is a possible challenge. But by the end of those discussions, there weren't those concerns evident in the talking, the bantering.

MR. GORINSON: He didn't tell you you were wrong.

MR. DUNN: No, not anything that flat.

MR. GORINSON: Is it fair to say the bulk of the discussions concerned the prescription?

MR. DUNN: Yes, it would be fair to say that.

MR. GORINSON: Can we put in front of Mr. Dunn a document that's been premarked as Commission Exhibit Number 4, and it is a memorandum dated February 16th, 1978, from Bert Dunn to Jim Taylor, subject, operator interruption, high pressure injection? Do you have Exhibit Number 4 in front of you, Mr. Dunn?

MR. DUNN: I have my February 16th memo in front of me.

MR. GORINSON: Okay. Is that the follow-up memo you were referring to?

MR. DUNN: Yes.

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MR. GORINSON: And this represented the resolution of the discussions between yourself and the person from nuclear service?

MR. DUNN: Yes.

MR. GORINSON: And, as you state in the last paragraph, you found the scheme to be acceptable?

MR. DUNN: Yes.

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Tape 4

MR. GORINSON: You sent this memorandum to Mr. Taylor as well. What was your reason for doing that?

MR. DUNN: I believe this memo goes to Mr. Taylor as an attempt to communicate with him that action had taken place on my concerns and that in my opinion a prescription which would satisfy myself as well as the nuclear service had been agreed to.

MR. GORINSON: Did you know at that time that Mr. Taylor believed that these memos had been misdirected?

MR. DUNN: I think misdirected -- the word misdirected comes out much later. I knew at that time -- let me restate that a little bit -- if my memory of the phone conversation is accurate, and I would like to again say that it is very foggy, I would have known that Mr. Taylor had passed this on to the Nuclear Service Department.

MR. GORINSON: Was it still your view though as of February 16th that licensing was playing a part in the resolution of this matter?

MR. DUNN: Certainly, by issuing the original memo to Mr. Taylor, action which had not been evident for over a month had started.

MR. GORINSON: So the answer would be yes? You assumed licensing was playing a part in this?

MR. DUNN: Well, I don't know that they were playing an active part in it but it had the appearance that at least they were an instigator of some value.

sg 2

MR. GORINSON: So the answer from your point of view was that you assumed they were playing some part in it? Is that correct?

MR. DUNN: If that part could be as small as a telephone call to somebody in Nuclear Service or a communication that would say, hey, I think you ought to do something about this, then they may have had a part.

MR. GORINSON: Now, as you understood it on February 16th, 1978, were the recommendations contained in that memo going to be distributed to B and W's customers?

MR. DUNN: I was operating under that assumption.

MR. GORINSON: Excuse me, I didn't --

MR. DUNN: I was operating under that assumption.

MR. GORINSON: So it was your understanding that it was going to be sent to customers?

MR. DUNN: Yes, I would think that would be the only way in which the recommendations could be incorporated.

MR. GORINSON: And were those recommendations sent to the customers? After February 16th, 1978?

MR. DUNN: To my knowledge, no.

MR. GORINSON: Did you have further discussions with Nuclear Service between February and August of 1978 as to problems or concerns that Nuclear Service had with the recommendations contained in your February 16th memorandum?

MR. DUNN: Again, to my knowledge, I did not have

sg 3

discussions of that nature.

MR. GORINSON: Do you know what Nuclear Service did with your February 16th memorandum?

MR. DUNN: I know of some follow-up communication on the memorandum.

MR. GORINSON: What follow-up communication is that, sir?

MR. DUNN: In August -- or I believe it is in August, I think it is August 3rd of 1978 a memo was written from Mr. Don Hallman to Mr. Bruce Karrasch on this subject.

MR. GORINSON: Could we give Mr. Dunn a copy of what has been pre-marked as Commission Exhibit number five? This is an August 3rd memorandum from D.F. Hallman to B.A. Karrasch. Is this the memorandum you were just referring to, Mr. Dunn?

MR. DUNN: Yes, sir.

MR. GORINSON: When were you told about that August 3rd memorandum?

MR. DUNN: I am not exactly sure. I think it was within a month of March 28, 1979. It was certainly after March 28, 1979.

MR. GORINSON: So it was after March 28, 1979 that you learned about it?

MR. DUNN: That I became aware of it, yes.

MR. GORINSON: The memorandum, you will note, lists you as copy "E" in the right hand corner.

MR. DUNN: Yes, sir.

MR. GORINSON: But to your knowledge, and to your recollection, you do not remember seeing that memorandum before March 28th, 1979?

MR. DUNN: That is correct.

MR. GORINSON: What was your reaction when you heard about the existence of this August 3rd, 1978 memorandum?

MR. DUNN: I don't think my reaction is printable. I was very upset.

MR. GORINSON: Why was that?

MR. DUNN: Primarily because it was one of the first indicators that I had that the instructions had not gone out. And I believe I had also had verbal discussions that the instructions had not gone out. I also expected, when I heard about it, that I had been on distribution for this memo and that would then mean that I had the possibility -- or would have had the possibility to again instigate action along the lines of my concern.

MR. GORINSON: Looking at the memorandum itself, Nuclear Service, in the middle of the paragraph, Mr. Hallman recommends that two incidents should be evaluated. Do you see that?

MR. DUNN: Items one and two?

MR. GORINSON: Yes, sir.

MR. DUNN: Yes, I see that.

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MR. GORINSON: What was your reaction to those concerns that were being raised by Nuclear Service?

MR. DUNN: At what time, sir?

MR. GORINSON: When you learned of the memorandum and had an opportunity to read it.

MR. DUNN: I think my reaction would be that I did not believe them to be concerns but worthy of evaluation and that I would say we should probably check those items for consequences but that in my belief they would not provide consequences severe enough to change the prescriptions.

MR. GORINSON: Let us take a look at the first one. It says that the pressurizer goes solid with one or more HPI pumps continuing to operate. Would there be a pressure spike before the release opened which could cause damage to the RCS. Do you see that?

MR. DUNN: Yes, sir.

MR. GORINSON: If that question were answered affirmatively, would that give rise to a safety concern?

MR. DUNN: I think my answer should be that there are concerns about going solid when it is not necessary but in line with the conditions for which we are using the high pressure injection system in the event of a loss of coolant accident, this concern would not be as weighty as the accident.

MR. GORINSON: So it would be a less significant concern? Is that what you are saying?

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MR. DUNN: I think that is probably pretty good.

MR. GORINSON: What about the second question? What damage would the water surge through the relief valve discharge piping and quench tank cause? If that is answered affirmatively, does that give rise to any safety concern?

MR. DUNN: By affirmatively, you mean that damage would occur?

MR. GORINSON: Yes, there is damage.

MR. DUNN: Well, underwriting these concerns would be the possibility that if we hadn't had a LOCA and the prescription was followed, there may be the possibility of creating one. However, again, the prescription is necessary to survive a loss of coolant accident and I would say that should take precedent. We would not have, for example, core damage in these events. We would probably have some equipment that would have to be replaced. We would have effluent into the reactor building if the quench tank, for example, burst. But we would be in a recoverable mode.

MR. GORINSON: So there would be equipment damage? Is that what you are saying?

MR. DUNN: Well, if I break a quench tank -- I consider that equipment damage.

MR. GORINSON: Now, the last sentence of the paragraph that follows those questions, says, "yet, the references suggest" and I see the references at the top of your two memoranda, "the

sg 7

possibility of uncovering the core if present HPI policy is continued". See that?

MR. DUNN: Yes.

MR. GORINSON: Is core uncovery a significant safety concern?

MR. DUNN: Not core uncovery in itself. A loss of coolant accident, I think is a significant safety issue. Okay? Durig the loss of coolant accident we can undergo a certain degree of core uncovery and here, when I talk about core uncovery I am talking about two separated regions of cooling -- a region of basically water with steam bubbles located in it and I would say that portion of the core below that region is covered; and a region of just steam above that region, that portion I would call uncovered. We can have that type of event to a certain extent. We cannot have a large amount of it without having severe core damage. Now, core damage itself is not the end of the game. Exceedingly high temperatures are required to cause the major concerns with the loss of coolant accident. Again, these high temperatures would be possible at slightly greater core uncovery than those that would cause fuel damage.

MR. GORINSON: When you have got core uncovery it is significant though, is it not?

MR. DUNN: I think it is significant, yes.

MR. GORINSON: To you knowledge, were those two questions in the August 3rd memorandum evaluated by the Plant

Integration Section? After the memorandum was received by them?

MR. DUNN: I would have to testify with hearsay information on that point.

MR. GORINSON: Go ahead.

MR. DUNN: Well, I don't know that they were evaluated. What I have heard is that Nuclear Service was told to go ahead with my instructions -- do what I wanted done, in other words.

MR. GORINSON: When were they told that?

MR. DUNN: I don't know that.

MR. GORINSON: And who was it that told them that?

MR. DUNN: Bruce Karrasch told me that he told them that.

MR. GORINSON: Did he give you a time when he told them that?

MR. DUNN: No.

MR. GORINSON: Let me have placed in front of you what has been pre-marked as Exhibit Six and also Exhibit Seven. These are notifications that were sent out by Babcock and Wilcox following the TMI II on supplementary operating instructions for the HPI system. One is dated April 4th, 1979 and that is Exhibit Six. Exhibit Seven is dated April 17th, 1979 --

CHAIRMAN KEMENY: Did I hear you state that these were sent out after the Three Mile Island accident?

MR. GORINSON: Yes. Mr. Dunn, were you consulted prior to the time the April 4th, 1979 instructions to customers

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went out from B and W?

MR. DUNN: Yes, sir.

MR. GORINSON: And do you know if your February 9th and February 16th memos were reviewed before this instruction was sent out to the customers?

MR. DUNN: I believe that these instructions relied heavily on my input and in creating the ideas which were to be supplied to the operating plants, I relied on my February 16th memo.

MR. GORINSON: And to your knowledge, was this the first time that the company had sent out the supplemental instructions that you were requesting be sent out?

MR. DUNN: From the Babcock and Wilcox Company to the operating utilities, yes, I believe we had communication with the NIC in which basically supplied this formula prior to the issuance of this.

MR. GORINSON: But prior to that time, the recommended procedure set out in the February 16th memorandum had not gone out to the customers?

MR. DUNN: To my knowledge that is correct.

MR. GORINSON: Exhibit 7, which is the April 17th revision or modification to the original supplementary instructions, could you explain the basis for that modification, sir?

MR. DUNN: I may not be able to explain the basis totally but I think I can shed a considerable amount of light on

it. It is my understanding that some of our customers were concerned about going solid in a condition where the reactor had not undergone a loss of coolant accident. This primarily relates to the containment of the 20 minute dead space in the original instructions. The original instructions contained the words, if high pressure injection is actuated, leave it in place for 20 minutes, or words to that effect. During 20 minutes it would be possible to pump enough water into a reactor coolant system to fill it solid and cause the PORV or the code safeties to relieve fluid. If we did not have a loss of coolant accident that action would be unnecessary. To allow some relief from the 20 minute rule, we wrote the third section which still indicates a full reactor coolant system with water and allows you to terminate the high pressure injection if it is necessary to prevent the prssurizer from becoming, growing, an indicated off-scale.

MR. GORINSON: So the modification was done at the incidence of B and W's customers?

MR. DUNN: Well, the customers were concerned about it I think. At least one of our management personnel was also concerned about the issue. I don't know whether he was concerned before the customers got concerned or afterwards.

MR. GORINSON: What is his name?

MR. DUNN: Allan Momak.

MR. GORINSON: Let us turn to another subject, if we

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can, Mr. Dunn. In February of 1979, there was a meeting in Lynchburg concerning the loss of pressurizer level indication, off-scale on the low side. Were you present at that meeting?

MR. DUNN: I think so.

MR. GORINSON: Maybe we can help you a little with this. Put in front of Mr. Dunn a document which has been marked as Hearing Exhibit Number 8 and it is from J.T. Willse, Licensing to the distribution. It concerns loss of pressurizer level indication. Have you seen that memo before?

MR. DUNN: I am not absolutely sure. I think I have seen this memo in the depositions and I have probably seen it before that time.

MR. GORINSON: But it shows you as being in attendance at that meeting.

MR. DUNN: Yes, that is indicated.

MR. GORINSON: What was the NRC's concern, as you understand it, that gave rise to that meeting?

MR. DUNN: The NRC, if I am correct and I am not a lead party in this meeting, I am a participant but not a lead person -- I believe their concern was that if the steam generators were to overfill during an event that would cause the initiation of the auxilliary feedwater system, the system could be depressurized or cooled to the extent that the steam space in the pressurizer would expand into the reactor coolant system proper.

MR. GORINSON: And would that cause a loss of pressurizer level indication?

MR. DUNN: Certainly, in order to expand into the reactor coolant system the water -- I said steam space expand -- that would mean the water would drop below the low level indicator.

MR. GORINSON: Now, in preparation for this February 14th meeting, did you have an internal B and W meeting?

MR. DUNN: Yes.

MR. GORINSON: And did you attend that meeting?

MR. DUNN: I believe I did.

MR. GORINSON: Was that on February 9th?

MR. DUNN: That is what I have been told.

MR. GORINSON: In any event it was within a few days of the February 14th meeting?

MR. DUNN: Yes.

MR. GORINSON: And what was discussed at that meeting?

MR. DUNN: It is my understanding and recollection that that was a dry run of our presentations to be given at the 14th meeting.

MR. GORINSON: So you just worked through the presentation that you were giving to the NRC?

MR. DUNN: That is my recollection.

MR. GORINSON: Who was present at the February 9th meeting? The best that you can remember.

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MR. DUNN: Well, there were a number of people involved in and around this time. I don't know that I can really reconstruct that meeting in my head. There would have been Mr. Bob Winks, I believe very surely that he was at the meeting; additionally, I think Mr. Eric Swanson was at the meeting; probably a number of other people that I don't recall at this time, as well.

MR. GORINSON: At that February 9th meeting, did you raise the problem of the pressurizer level going up, as well as going down?

MR. DUNN: No, I did not.

MR. GORINSON: You just confined your attention to pressurizer level going down?

MR. DUNN: Yes. My role in the discussions at this time was to provide back-up information which would state that even if the steam bubble expanded in RCS, the reactor coolant system, there would not be any adverse consequences of that.

MR. GORINSON: Did it occur to you that it might be a subject to be raised, considering that this meeting would also concern another transient that had occurred?

MR. DUNN: No. We were discussing an event entirely separate from a loss of coolant accident.

MR. GORINSON: Was there a meeting with the utilities prior to the date of the February 14th meeting?

MR. DUNN: Not that I am aware of.

MR. GORINSON: You didn't attend any such meeting?

MR. DUNN: No.

MR. GORINSON: Now, on the bottom of the second page it states the conclusion, stated by Mr. Foster of the NRC. He stated that the loss of pressurizer level indication was merely an operational inconvenience and that loss of pressurizer level was not a safety concern. You see that, sir?

MR. DUNN: Yes.

MR. GORINSON: Had that been discussed during the meeting? The question of it being an operational inconvenience rather than a safety concern?

MR. DUNN: During the February 14th meeting?

MR. GORINSON: Yes.

MR. DUNN: I would assume that it had been. I am sure that that is the point we were trying to make to the NRC during that meeting.

MR. GORINSON: Was that point discussed during the February 9th meeting?

MR. DUNN: In all probability. We were trying to get that conclusion to be drawn.

MR. GORINSON: Okay. Would you explain to the Commission what the operational inconvenience would be for the operator?

MR. DUNN: Well, as far as determining the condition of the reactor coolant system, as to whether or not it has steam in it and its margins between a solid reactor coolant system

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plus the pressurizer, if you will, and a system in which he had steam, he would not have level information that would indicate how far away from injecting steam into the primary system he would be and he would have to rely on pressure and temperature readings to achieve that information.

MR. GORINSON: So he would have the pressure and temperature readings to rely on even if he didn't have the level indication?

MR. DUNN: Yes.

MR. GORINSON: That would be the operational inconvenience?

MR. DUNN: Yes. I also believe he may be for a short time out of specifications.

MR. GORINSON: Excuse me, I didn't hear that.

MR. DUNN: He might be for a short time out of his technical specifications. I can't swear to that but it would seem that those would require him to maintain his pressurizer level within indication.

MR. GORINSON: So that he might possibly be outside technical specs?

MR. DUNN: Momentarily.

MR. GORINSON: Did you, at any time, review the Michelson report?

MR. DUNN: Yes, sir.

MR. GORINSON: When did B and W become aware of the

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Michelson report?

MR. DUNN: I think I get this date wrong every time I discuss it. This time I am going to say in April. I have got a copy of the Michelson report with the date stamped on there.

MR. GORINSON: And was your group assigned to do an evaluation analysis of what Michelson was saying?

CHAIRMAN KEMENY: Excuse me, April of which year?

MR. DUNN: Oh, April of 1978.

CHAIRMAN KEMENY: Thank you.

MR. GORINSON: Okay, so it was April of '78 and at that time you received the assignment to evaluate and analyze the Michelson report?

MR. DUNN: My unit was made aware of the Michelson report. It was a request from a customer and we would receive, I guess, an assignment to evaluate it.

MR. GORINSON: And who in your group was given that assignment?

MR. DUNN: Mr. Bob Jones.

MR. GORINSON: And did you reach any conclusions as to the merits of the Michelson report?

MR. DUNN: Yes, I believe we reached conclusions as to the merits of the Michelson report. Bob was the original person within ECCS aware of the report. I was made aware of the report in a briefing that he gave to me. I think we would say that we concluded that an individual within the TVA organization

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had done a review and I think it might best be characterized as a developmental review and that he was creating a lot of his arguments from first principals, as opposed from somebody else's arguments of small breaks. He had a number of questions about those small breaks and the evolutions of the LOCA transients and did not understand how these issues or concerns were incorporated within our evaluation of small breaks and that we should provide him with information which would illustrate or show him how these concerns were incorporated; or, if you will take another word, allowed in our evaluation of small breaks.

MR. GORINSON: Well, is what you are saying that the issues raised by Michelson were already included in B and W analyses?

MR. DUNN: Yes.

MR. GORINSON: So that in your view there was nothing new in the Michelson report?

MR. DUNN: In my view there was nothing new in the Michelson report. We had either directly included the phenomena or we had bounded it.

MR. GORINSON: Let me have put in front of you --

CHAIRMAN KEMENY: Excuse me, Chief Counsel, would you give us a definition of what bounding means?

MR. DUNN: What it means to me is that as far as the consequences of a loss of coolant accident, I have done a number of evaluations which in my opinion, and in the opinion of the

reviewers I am sure, result in worse conditions or worse results it will use cladding temperatures, a typical result, or a typical perameter you would look at, these accidents would result in higher peak cladding temperatures. There are other criteria which you evaluate than just peak clad temperature. In any case we seek to provide analyses which are worst relative to that -- those criteria -- and convince ourselves that in fact we have chosen the appropriate accidents to evaluate.

Tape 5

MR. GORINSON: Let me have put in front of you, Mr. Dunn, a document that has been pre-marked as Hearing Exhibit Number 9 and it says at the top Michelson Story Comments. It is a hand-written document. Do you have that in front of you sir?

MR. DUNN: Yes, sir.

MR. GORINSON: Is the date on that document April 14th, 1979?

MR. DUNN: Either April 14th or April 19th.

MR. GORINSON: Okay. It is an April date.

MR. DUNN: Yes.

MR. GORINSON: And was this document prepared by your?

MR. DUNN: Yes.

MR. GORINSON: For what purpose was this document prepared?

MR. DUNN: The "Michelson Report" had become a public issue. This document was prepared to provide background material via which Babock and Wilcox could respond to the, at that time,

criticism for which the Michelson report was being used.

MR. GORINSON: Who did copies go to, Mr. Dunn? This document?

MR. DUNN: Of this particular one I believe it only went to my boss. I used it in briefing various people that were to appear in public but I don't believe I gave a copy of it to anybody but my boss. Now, I could be wrong on that. There could be other copies.

MR. GORINSON: And who were the people that you briefed with this document?

MR. DUNN: There were a number of them. I probably was involved in briefing Dr. Don Roy. I can't recall the specific incidents. I certainly discussed it in depth with my boss. It was apparent in a number of forums that might cause him to have to respond on the Michelson report issue and at one time we did have a discussion with Mr. John MacMillan on the issue.

MR. GORINSON: Okay. When was the discussion with Mr. MacMillan?

MR. DUNN: It was before one of his congressional hearings and I would have to go back and talk to some people about the specific date. I can't give you a date, probably about a month after the accident.

MR. GORINSON: Mr. Chairman, I would ask that Exibits 3 through 9 be included as part of the hearing record.

CHAIRMAN KEMENY: So ordered.

(The documents previously marked for for identification as Exhibits 3 through 9 were received in evidence.)

MR. GORINSON: I have no further questions.

CHAIRMAN KEMENY: Mr. Dunn, you are Manager of the ECCS Analysis Unit within planned design, is that correct?

MR. DUNN: That is correct.

CHAIRMAN KEMENY: And would it be correct to say that the ECCS system is one of the very important safety systems within the nuclear power generation system?

MR. DUNN: I would believe that.

CHAIRMAN KEMENY: Therefore, in effect, you hold a highly responsible position?

MR. DUNN: Yes, sir.

CHAIRMAN KEMENY: Within that context I would like to turn to your initial memorandum, the memorandum of February 9 -- you don't need to look at it in detail, I am not going to ask you detailed questions about it -- but I am curious then how many memoranda vaguely of that sort have you written in the past few years? I mean, is it one, is it ten, is it a hundred?

MR. DUNN: Being as you have used the word memorandum, from myself or my unit -- I might very well delegate such a memorandum to somebody else --

CHAIRMAN KEMENY: Yes, I understand that.

MR. DUNN: There may be four or five. I can recall two

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at this time.

CHAIRMAN KEMENY: Very good. You recall two but there may have been four or five. At any rate it is not twenty or thrity memoranda.

MR. DUNN: No, sir.

CHAIRMAN KEMENY: So it is not an example that your unit would have been flooding the company with memoranda of this kind?

MR. DUNN: No, sir. I believe we do our job very well. I would say we are not necessarily perfect but the instance where we have to do these kind of things are not daily.

CHARIMAN KEMENY: To the best of your recollection have your other memoranda used phrases roughly similar to "this is a very serious matter and deserves our prompt attention"?

MR. DUNN: No, I think that phrase was picked because I had not seen action. Okay. The other memorandums I am recalling, we had started action and action was under way so I don't think that particular phraseology would be appropriate.

CHAIRMAN KEMENY: Yes. So in that manner you were using that phrase in effect, because you felt action was important in this case?

MR. DUNN: At this time that is my recollection of why I used it, primarily from the words here. I don't remember.

CHAIRMAN KEMENY: How concerned were you later that year that you were not seeing action?

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MR. DUNN: I was unconcerned. I was operating under the assumption that we had reached agreement and that action had taken place.

CHAIRMAN KEMENY: Yes. By action here, I assume you mean that you thought that proper instructions -- instructions you consider proper had been sent to customers, would that be correct?

MR. DUNN: Well, I would defer on the word instruction and say that at the least we had provided them with the incidence of Davis Besse and the opportunity to avail themselves of the instructions.

CHAIRMAN KEMENY: That was your assumption and that is why you were not more concerned?

MR. DUNN: Yes.

CHAIRMAN KEMENY: Other commissioners? Commissioner McPherson?

COMMISSIONER MCPHERSON: Just a brief recapitulation: You wrote the first memorandum on February 9th, 1978 and you succeeded that with one on February 16th, 1978, both pointing to this potentially serious problem. On August 3rd, 1978 Mr. Hallman in Nuclear Services expressed some concerns that they had and said that as a result of those concerns and their lack of resolution, there had been no methods, no instructions, no recommendations sent to customers. Finally, on April 4th, 1979 instructions were sent out which were amended on April 17th, 1979.

sg 23 1 Is that statement as to the memoranda correct?

2 MR. DUNN: As I recall.

3 COMMISSIONER MCPHERSON: So that is a total of about

4 20 months from the first memorandum of yours on February 9th to

5 the final memorandum of April 17th, embodying these recommen-

6 dations to the customers. That is February 9th, '78; April 17th,

7 '79 --

8 MR. DUNN: Yes, sir.

9 COMMISSIONER MCPHERSON: And, of course, Three Mile

10 Island had intervened on March 28th, '79. Can you, in layman's

11 terms, describe the differences between your recommendations on

12 February 9th and the final methods sent out on April 17th? Can

13 you describe either the evolution of that recommendation or

14 simply the differences between the two?

15 MR. DUNN: Let me try. Let me first say that what is

16 attempting to be accomplished here is that during the recovery

17 from a small break, prior to turning off the systems which are

18 allowing you to survive the incident, we are attempting to achieve

19 a reactor coolant system condition which is as much like normal

20 as possible. And in my mind that means with almost as much water

21 in the system as we had during the start of the event. In that

22 fashion then a second event or if termination has been premature,

23 we can restart the systems and continue the accident in as good

24 a condition as we were to survive the initiation of it. In that

25 fashion then the evaluation of the initial event becomes a

bounding evaluation of the second phase. So we are trying to get a reactor coolant system full of water again. The difference between the two issuances of instructions, does not really change that intent. So from that standpoint, from the practical standpoint of what it is meant to accomplish, it would accomplish it almost identically. With the single exception that, whereas we instructed a dead band space of 20 minutes in which we did not want anybody doing anything, we modified that in order to allow prevention of an accident provided the one single event of the pressurizer becoming full was evident. We still maintain even in that instruction, the requirement to have a sub-cooled reactor coolant system so that the system would have still been full of water. It is just as good an instruction but sometimes you like to put a little dead space in for evaluation so that actions don't take place too rapidly.

COMMISSIONER MCPHERSON: The changes between the '78 recommendation versus the April 17th, '79, the final message to customers are not substantial. If I understand what you are saying they are not substantial in their specifics?

MR. DUNN: To the intent of the instruction that is true. The provision for eliminating the 20 minute rule may very well be substantial. Okay. If I had this action for another event, I would not like to cause a loss of coolant accident and part of that instruction may very well be quite substantial.

COMMISSIONER MCPHERSON: Mr. Dunn, at any point in

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the period after the Davis Besse accident, to your knowledge, did any personnel from the Nuclear Regulatory Commission ever express concern about the state of high pressure injection system instruction for training? With respect to B and W reactors?

MR. DUNN: Could I have the timeframe of that, sir?

COMMISSIONER MCPHERSON: Well, any time after Davis Besse.

MR. DUNN: It is my understanding that a memo was written within the staff and that --

COMMISSIONER MCPHERSON: Within whose staff?

MR. DUNN: Within the NRC staff. And that it bears a strong relationship to the subject of termination of high pressure injection.

COMMISSIONER MCPHERSON: Bears a strong relationship?

MR. DUNN: I believe it is almost identical, expressed in slightly different terms to my subject in my February memos. And it, I think, relates to Davis Besse transient. I am not really sure of that. It dwells on the loop seal configuration for our pressurizer surge line, which I think is somewhat inappropriate. It is not a proper point to dwell on but I believe it also indicates that because of this loop seal there may be a termination of the high pressure injection at the wrong time, or it may be doesn't state it quite that distinctly, it may say that this may cause an indicated high pressurizer level at a time when the reactor coolant system proper is not full of water.

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That may be more accurate as to the content of that memo.

COMMISSIONER MCPHERSON: Was that memo sent to B and W?

MR. DUNN: Not to my knowledge.

COMMISSIONER MCPHERSON: It remained within the Nuclear Regulatory Commission?

MR. DUNN: That is my knowledge at this time, yes, sir. We have that memo now.

COMMISSIONER MCPHERSON: But you had no knowledge of it during February 1978?

MR. DUNN: That is the state of my knowledge. That is my opinion, yes. We did not know about that until after March 28, 1979.

CHAIRMAN KEMENY: Commissioner Pigford?

COMMISSIONER PIGFORD: Mr. Dunn, referring to your recommendation in your memorandum of February 16, your second recommendation -- the hot leg -- let the hot pressure injection be such that the hot leg temperature is more than 50 degrees Fahrenheit below the saturation temperature -- was it your expectation that this would be an instruction to the operator?

MR. DUNN: Was it my recommendation?

COMMISSIONER PIGFORD: Was it your expectation that this would lead to instruction to the operator?

MR. DUNN: Yes, sir.

COMMISSIONER PIGFORD: Was it your understanding that

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the operators would have some means of determining the saturation temperature?

MR. DUNN: They have thermacouples on the hot legs.

COMMISSIONER PIGFORD: How does that give you the saturation temperature?

MR. DUNN: Well -- oh, I am sorry. They have thermacouples from which to read the reactor coolant temperature. The saturation temperature would have to be inferred from the reactor coolant system pressure, either via diagrams supplied to him within a procedure or via access to what we would call state equations, or via steam tables.

COMMISSIONER PIGFORD: Did the recommendation that B and W finally sent out include those provisions of determining the saturation temperature?

MR. DUNN: Well, I think I have misled you a little bit. The actually mechanics of how this type of instruction is implemented within a control room would not be my domain. It would only be that those mechanics should accomplish this fact, or what I am trying to accomplish here. I believe we did provide a graph either directly with the instructions or after that time from which a person could correlate the variables necessary.

COMMISSIONER PIGFORD: That would be some attachment to the instructions of April 17, 1979?

MR. DUNN: Either to that one or it had already gone out.

28

COMMISSIONER PIGFORD: Gone out previously?

MR. DUNN: It may have gone out previously.

COMMISSIONER PIGFORD: About when would you think?

MR. DUNN: I am not sure. It is certainly not very hard to have access to that information.

COMMISSIONER PIGFORD: Was it your understanding that the operators at the B and W plants normally do this translation to obtain pressure and to obtain saturation temperature? Was it your understanding at the time you wrote this memorandum?

MR. DUNN: I don't think I asked myself that question. I would think it would be my understanding that they did not normally do that.

COMMISSIONER PIGFORD: Did you have any knowledge as to whether that translation was included as part of the training program at B and W?

MR. DUNN: No, I did not.

COMMISSIONER PIGFORD: You have no knowledge?

MR. DUNN: I have no knowledge.

CHAIRMAN KEMENY: Commissioner Marrett?

COMMISSIONER MARRETT: I would like to go back to your memo of February 9th, the third paragraph, the incident points out that we have not supplied sufficient information to reactor operators, is the reference there to the utility or to the actual person?

MR. DUNN: Yes, the words probably are slightly

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confusing. I would say the reference is to the utility.

COMMISSIONER MARRETT: To the utility?

MR. DUNN: Yes.

COMMISSIONER MARRETT: So am I understanding it correctly that although this was sent to Licensing, the unit that actually was responsible later was Nuclear Service or customer service. That is the department that was handed this?

MR. DUNN: Well, we have an assumption on my part, you know, during this time period -- and with that in mind. I assumed them to be responsible. With that in mind, yes, Nuclear Service would be the person handling that.

COMMISSIONER MARRETT: But what I am asking -- this memo did go to Nuclear Service and the subsequent memo, or the one that followed yoru next one did come from Nuclear Service? Is that right?

MR. DUNN: The August memo?

COMMISSIONER MARRETT: Yes.

MR. DUNN: The August memo came from Nuclear Service. This memo, the follow-up, February 16th memo is not directed to Nuclear Service but it had Nuclear Service personnel on it for distribution.

COMMISSIONER MARRETT: I believe a point in the organizational chart, training is a section in Nuclear Service. Is that correct?

MR. DUNN: I believe that is correct, yes.

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COMMISSIONER MARRETT: Now, when you make a reference to there being insufficient information to reactor operators, was there any indication -- although I understand you were not directly in contact with training -- but was there any challenge made to that statement on the argument that training -- the training department was already taking care of HPI questions through the training that was given? In other words, was there a response saying, this is unnecessary because we have, in fact, in the training incorporated directions directly to the operators, the persons in the control rooms themselves? Did anything come up that said that training was taking care of this already?

MR. DUNN: Well, first it is my understanding that B and W supplies training to the personnel at the customer's request. So we could not, I believe, presume to have trained every operator that operates one of our plants. I believe the customers have the option of other people within the nuclear community to provide training to their operators, and can, in fact, do it themselves if they wish.

Secondly, there was, to my knowledge, no such challenge to my concerns. No such statement that said, hey, we have already done all of this.

COMMISSIONER MARRETT: There certainly have been statements in some of the other materials that there was indication from some person, at least with reference to HPI, training was taking this into consideration. Did you have, based on your

impressions if you were not directly involved with training, any ideas about what was going on in the training department with reference to these issues?

MR. DUNN: Did I have --?

COMMISSIONER MARRETT: Did you have any impressions about what training was doing about these areas?

MR. DUNN: At the time that I wrote this memo?

COMMISSIONER MARRETT: Yes.

MR. DUNN: No, ma'am.

CHAIRMAN KEMENY: Mr. Marks?

COMMISSIONER MARKS: Mr. Dunn, when a transient such as the Davis Besse or the TMI II occurs, is there a regular practice at B and W which involves individuals knowledgeable about reaction to emergency, to gather somewhere to be able to respond to the emergency?

MR. DUNN: There is no regular procedure for that but it occurs I believe as a natural course of events.

COMMISSIONER MARKS: What does that mean?

MR. DUNN: Obviously we are intimately concerned with the plant and with the successful mitigation of an event. The first contact is made generally through the Service Department and if there is support to be given to the plant, they would assemble the necessary people to provide that support.

COMMISSIONER MARKS: But there is no, so to speak, table of organization for such an assembly that you know of?

MR. DUNN: In the form of a procedure that would call out a certain number of people to go to a certain room and gather to correspond on a certain telephone, or perhaps a command central, there is none that I know of.

COMMISSIONER MARKS: And none has been instituted yet?

MR. DUNN: Well, I may not be capable of responding to that question. I will say I do not know of one.

COMMISSIONER MARKS: You are certainly not involved?

MR. DUNN: No, I --

COMMISSIONER MARKS: Do you want to express an opinion as to whether you think it would be desirable as a -- in terms of the adequacy and orderliness of a response to support in dealing with an emergency?

MR. DUNN: I could express a personal opinion. I think it is desirable. I think one has to be very careful with such things. The utility is the person that is on the location; has the best information; and other people who are not intimately familiar with the operation of a nuclear power plant, particularly if given authority, could cause extremely severe problems at that plant during an accident. Now, I would personally feel that if such a committee were put in place, properly trained and qualified for that particular plant, or type of plant, depending on the need -- by type of plant I mean I would feel qualified to counselin response to emergency core cooling, procedures, modifications if they are needed for

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a reason that I don't know of today on any of the B and W plants, I would not feel qualified to respond on a Westinghouse plant. I think that would be highly inappropriate for me to do that. In that fashion, yes.

COMMISSIONER MARKS: Mr. Kelly testified that on March 28th the on-site B and W representative was calling through to Lynchburg for advice. Were you involved in providing that advice?

MR. DUNN: I was involved in the Lynchburg command post, which I think would be a proper characterization of that room at that time, from time to time, mainly during the afternoon of the 28th. I found out about the incident actually at about 11:30 of that morning. I don't know that -- it was not clear that we were in direct communication with control and with that individual. I believe we were late in the evening when the pumps started but we were generating advice and attempting to get it to the customer.

COMMISSIONER MARKS: Were you sort of satisfied with the procedures or was there any sort of post-crisis analysis of whether tnis was a satisfactory way of dealing with this type of crisis?

MR. DUNN: There is no analysis of that to my knowledge. Personally I was not satisfied with it.

COMMISSIONER MARKS: Do you know who makes the decisions about sending people out to investigate transients with

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B and W plants, such as the Davis Besse or TMI II?

MR. DUNN: I believe it is a joint decision. I think in the case of Davis Besse it was arrived at jointly between the manager of Nuclear Service and the manager of plant design. There may have been some equipment personnel that went along as well.

COMMISSIONER MARKS: You are not involved in those decisions?

MR. DUNN: I can be consulted in those decisions if it appears that personnel with the background in my field would be useful in either diagnosing the problems or supporting the customer. Generally, the people that go to the field, they are to collect the information and diagnose.

COMMISSIONER MARKS: Were you consulted about sending out a team in the Davis Besse or TMI II before they were sent out?

MR. DUNN: I wasn't consulted. I believe that at approximately 11:30 I was made aware that it was in all likelihood a stuck open QRV and I suggested that it might be appropriate we did have a few sentence communication on that and what we decided was that we were going to collect data at a place for analysts, in Lynchburg, and that if at some time in the future the data that had been collected proved inadequate from the standpoint of whatever use I would make of it, that then it might be appropriate to send one of my personnel. And

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I think that is a correct decision to make.

COMMISSIONER MARKS: I am not clear. We understand that a team was sent out which left Lynchburg around noon.

MR. DUNN: Yes.

COMMISSIONER MARKS: And what I am trying to find out is were you involved in the decision to send the team and its composition, since, as I understand it, you are in charge of the emergency core cooling systems and if I understand what that means, it is conceivable at lest that you should be involved in that kind of decision as to whether to send and who to send.

MR. DUNN: Well, the personnel that were sent, if I can try and explain this to you -- were sent primarily from the standpoint of data collection to provide data back to Lynchburg so that an understanding of the accident could be obtained within Lynchburg and we could learn from it. I did not believe these were -- it was the intent then to send these people up there to resolve the accident. Okay? They certainly would have been made available and I think a little later in the day, the consequences of the accident became more well-known to us and we did start trying to do that.

CHAIRMAN KEMENY: Commissioner Haggerty.

COMMISSIONER HAGGERTY: The preliminary safety concern procedure, as contrasted with your memo, you explained why you wrote a memo. What happens with a PSC, however? What's the difference in procedure? When it gets into licensing, I understand that licensing has to react. But does it start a different chain of events? Does the PSC, for example, go outside of B and W, to NRC or to the particular customer involved, if that were the case?

MR. DUNN: The PSC is a more formalized way of resolving a concern. It may or may not progress to the point where the information about the concern would go outside of Lynchburg. I could say its benefits are primarily in that it more mechanistically assures resolution of a concern. It has a wide distribution, as to potential for involving a lot of people. If, at the end of the procedure, the concern is considered reportable, then there it would be communicated to the NRC, but only if it was considered reportable.

COMMISSIONER HAGGERTY: Presumably a PSC has to be resolved, one way or the other. I presume that's part of the procedure. That's what you mean by being formal. It has to be pursued to some kind of conclusion, either that nothing further needs to be done or that

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something needs to be done.

MR. DUNN: Presumably, yes.

COMMISSIONER MC PHERSON: Pat, can I interrupt you to ask a question on that? In the PSC procedure, are there deadlines for response? That is, if you had written that memo on a PSC form on February 9th, 1978, and it had gotten into -- it inaugurated the process of the safety concern, would there have been deadlines for people to respond to your memo, in the course of that process?

MR. DUNN: Well, there may have been deadlines. They would not be created by the PSC procedure. They would have been created very much in the same fashion that deadlines could have been created out of my memos. It would depend on the extent to which the concern had to be evaluated. The PSC procedure does not say, you do this in this much time, until after the event is termed reportable. At that time -- and I don't know whether this was in effect in February of '79. But at least today, the time an event is declared reportable, our vice president is made aware of it and he then has 48 hours within which to communicate the information to the NRC.

COMMISSIONER MC PHERSON: That's an event such as Davis-Besse.

LA 3

MR. DUNN: No, that's from a PSC. Let's say, as an example, it's declared this is a safety concern. It's no longer preliminary. It becomes a reportable item. The vice president is notified. And then there's the only fixed deadline, which is 48 hours to report it to the Commission.

COMMISSIONER HAGGERTY: Do you initiate a PSC?

MR. DUNN: I have had PSCs written from my unit, partially been involved in them. I do not believe that I've been the person that signed the bottom line, though.

COMMISSIONER HAGGERTY: But you department has initiated a PSC.

MR. DUNN: My unit has, yes.

COMMISSIONER HAGGERTY: Your unit has. Your memo, of course, was addressed to the licensing -- head of licensing. It did deal with a safety matter. One way or another, he, in turn, felt it was a nuclear service activity, rather than a responsibility to resolve, presumably because if the communication and training, since they were both in nuclear service, that they could handle the entire thing. Certainly you must have felt the memorandum was more flexible or that this thing was at somewhat lower levels of seriousness than would require a PSC, or there's something distasteful

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about starting a PSC.

MR. DUNN: In general, I would prefer handling work through the less formal mechanism of memos and interaction on a personal basis. If that doesn't work, I'm prepared to write a preliminary safety concern.

CHAIRMAN KEMENY: Professor Taylor.

COMMISSIONER TAYLOR: Is there any work at B and W that you would characterize as research and development on emergency core cooling system design, operation, possible problems, opportunities for fixing?

MR. DUNN: Well, I think we have, in the past, fixed the emergency core cooling system, at least in one area. There is work that goes forward from time to time within the research divisions on phenomena during a loss of coolant accident. Generally, this work is what we would term as single effects. To give an example, B and W has tested the coolability of a reactor core under small break conditions, in which there is a boiling pot mode of heat transfer, to verify that our predictions of that type of heat transfer are accurate and to verify some other information about that type of heat transfer.

That does not necessarily mean a check of the system itself. Those particular experiments resulted very favorably to us. Our ideas about how that cooling

mechanism would occur were supported, borne out, and, in fact, shown to be better than we would require. So that kind of verified our ideas.

There are times when, in the review of the accident analysis -- there's no formal procedure to say, hey, we're going to, every six months, look at the ECCS system and try to dream up what's wrong with it. But from time to time, knowledgeable engineers have concerns about it. And, in at least one incidence, that's led to a modification of the system, to require cross-connects to the high pressure injection lines, to maximize the effective injection of the high pressure system under the assumption of a single failure in the system.

COMMISSIONER TAYLOR: Now, is the work that you've just been giving examples of work that's done -- I believe you used the phrase "research division," or "research unit," is that separate from the engineering division, or whatever it is, of B and W? In other words, let me ask this. Is this work that you do in your unit, or is this organization a separate group of people at B and W?

MR. DUNN: It could go both ways. Within Lynchburg, we have two types of units or personnel concerned with emergency core cooling or loss of coolant

LA 6

accidents. There is my unit, which is responsible for the licensing activities, in terms of generation of data to provide the NRC to convince them that the systems are appropriate, well-designed, and will function. I would call us the first line, or the troops.

We have a support organization, which is primarily concerned with developing methods. Generally, these would be things we would request. We might ask that a certain heat transfer correlation be investigated for applicability and perhaps incorporated in our computer codes.

I could do that work. I am free to do that work if it's necessary. But, by and large, the work would be performed by what we would call the technical staff personnel, which is a separate organization.

COMMISSIONER TAYLOR: Is that separate from engineering?

MR. DUNN: No, that is not separate from engineering. That is still within engineering. It's a separate section within engineering.

The mechanical R & D, or the physical R & D, wherein we're taking a pipe and running it and seeing how fast water flows through it, for example, that would be performed either in our alliance research center or in the -- there is a small research center which

occasionally becomes involved -- we become involved with for chemical type effects. Or it could be contracted out to a university, for example.

COMMISSIONER TAYLOR: Do you have much contact with the people in the research center, in the sense that it would be natural, or unusual, for you to discuss, for example, the Davis-Besse transient or any other real operational question that you become aware of? Or do you tend to address your own unit to that and not interact with the research center?

MR. DUNN: From the standpoint of an operational concern, I would not interact, in all likelihood, with the research center. If I needed basic information to address a concern in operations and this was outside of my present state of knowledge, I might very well go to them. But I would not expect that that type of contact would be made. Our involvement with them generally is along the lines of, I would like to perform this test to see what happens; these are the parameters around which I want to base the test; this is the type of event I want to test; and this is what I want measured.

COMMISSIONER TAYLOR: Is all or most of that work company-supported, or is there any significant amount of what one might call R & D on ECCS performance, design, and so on, that's supported by the government,

LA 8

specifically by NRC?

MR. DUNN: By and large, the vast majority of R & D efforts in emergency core cooling systems and the results or effects or impacts of those systems on loss of coolant accidents is performed by the government.

COMMISSIONER TAYLOR: Does B and W do quite a bit of that work? Do you have any sense of how much work of this kind is done in B and W, under contract to NRC?

MR. DUNN: Well, I'm not sure that I can give you a total response to that. I think we probably do not do too much physical testing. But I'm not sure how much involved we are in programs like the Navy programs, in which there may be contracts associated with emergency core cooling, which I'm not intimately aware of, or well aware of even. So I can't respond totally to that. You can really talk to the R & D division.

We do have a number of analytical programs with the government, in which we are investigating preliminary concerns with, for example, alternate fuel cycles, what are the ECCS concerns for alternate fuel cycles, maybe what are the ECCS concerns, which should we look at if we decide to create a new reactor design.

COMMISSIONER TAYLOR: Are you aware of any

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discussion, any papers, for example, on the Davis-Besse transient that have turned up at meetings of the American Nuclear Society or any comparable professional organization, as opposed to formal memoranda within B and W or communications between NRC and B and W? What I'm trying to get at is the extent to which the nuclear engineering analysis community, as a whole, goes into these questions of what happened at Davis-Besse and what does that imply for our particular system whether it's B and W or Westinghouse or whatever.

I have a sense -- and I'm trying to get some idea of whether it's correct or not -- that at that level of detail, that is, what happened at Davis-Besse, there's very little sort of professional general discussion of these matters at professional conferences and so on. Is that view correct or not?

MR. DUNN: That's, I think, a fairly difficult question to respond to. It's very wide range. Relative to the aspect of the high pressure injection termination, the event I thought was most serious, I don't believe there has been presentations -- Let me rephrase this a little bit. Treating the Davis-Besse incident of September 24th, if that's right, as a loss of coolant accident, I don't believe there has been presentations in the forums you suggested. There may very well have

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presentations in the forum of what happened, a description of the events that occurred standpoint, or perhaps somebody was interested in some other aspect that occurred at the same time, steam generator performance, for example, and I might not know about that.

CHAIRMAN KEMENY: Professor Lewis.

COMMISSIONER LEWIS: Mr. Dunn, I'd just like to get something clear. When did you first become aware of the Hallman memorandum? Was that after Three Mile Island or earlier, the August memorandum?

MR. DUNN: That was after Three Mile Island.

COMMISSIONER LEWIS: In other words, you didn't know about that at the February 14th meeting that was held in Lynchburg?

MR. DUNN: Well, the memo wasn't issued -- oh, yes, it was.

COMMISSIONER LEWIS: It was before.

MR. DUNN: I got my dates backwards. No, I was not aware of it at that time.

COMMISSIONER LEWIS: So when that meeting was held in Lynchburg, the meeting that was called by the NRC and that was attended by the utilities, at that time, you thought the word had already gone out about high pressure injection. Is that correct?

MR. DUNN: Yes, ma'am. But that wouldn't be

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the reason I wouldn't have mentioned it at that meeting.

COMMISSIONER: Okay, I'm kind of curious. I was looking at Mr. Willse's memorandum and he said, "This meeting was requested by the Region II inspectors. The purpose of this meeting was thought to be to discuss the loss of pressurizer level indication on all B and W plants." It seems to me it was a perfect time for this particular issue to be raised. And I wonder why, or whether it was raised at that meeting.

MR. DUNN: Well, that meeting was called to address concerns associated with overcooling transients, where we have shrunk the primary system. It was not called to address concerns where we are losing pounds of water. We still have as much water available in those events to start with, as we do when we finish them. Quite likely, the make-up systems for the reactor will turn on to higher capacity and we'll wind up with more water.

Mentioning of a concern about high pressurizer or mentioning my concern with Davis-Besse, I think would have just had the result of diverting the meeting. And appropriate personnel were probably not at that meeting. There would have been some cross-connect in the fashion that I was at that meeting, and I believe I'm an appropriate personnel for those discussions. But

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I believe that the only result would have been a diversion of the meeting and getting the meeting side-tracked and not accomplishing, or accomplishing as well what the meeting was intended to accomplish.

COMMISSIONER LEWIS: Is it possible that you didn't raise the question because it was an NRC meeting and not particularly a private meeting between B and W and the utilities? I mean, was the presence of the NRC at that meeting an inhibiting factor in your not raising this question?

MR. DUNN: Actually, ma'am, I'm not a very inhibited person. I would say not. I would say there are ways to talk to the NRC. You can discuss things with them. I just don't think that I would have felt that an appropriate time to have such a discussion.

COMMISSIONER LEWIS: Now in hindsight, you're aware that a Met. Ed. representative was at that meeting. Mr. Hillbish was attending that particular meeting six weeks before Three Mile Island.

MR. DUNN: I wasn't aware of that until you mentioned it. But that wouldn't [illegible] allow it. I was under the impression that [illegible] customers were at that meeting, and they are certainly one of them.

COMMISSIONER LEWIS: So had this question been raised, he might have been aware of some of the problems.

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MR. DUNN: I suppose that's true.

COMMISSIONER LEWIS: Okay, thank you.

CHAIRMAN KEMENY: Commissioner Trunk?

COMMISSIONER TRUNK: Have you or any of your staff ever sat in on an operator training class, you know, to give a lecture or to see that courses were run correctly?

MR. DUNN: We have, from time to time, participated in operating training, in the form of providing a lecture on loss of coolant accidents. We do not do this frequently. In general, there is a group, which is called safety analysis, it's a unit within the plant design section, which does provide a lecture on accidents. Most of the time it has occurred that they have provided, in addition, the lecture on loss of coolant accident. We certainly have discussions among ourselves as to what they may present. But, by and large, they decide what to present at that lecture.

We also need to understand that the lectures, that series of lectures is optional to the utility. They do not have to purchase that from Babcock and Wilcox.

As far as sitting in in a fashion which would give me a good review of the overall operator training, during which you might expect me to spot where the training was inappropriate or stressed the wrong things,

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et cetera, we have not done that, prior to March 28th. I believe we're trying to formulate plans to accomplish that.

COMMISSIONER TRUNK: Have you ever taken a B and W training course, or anybody on your staff?

MR. DUNN: People on my staff have taken a B and W training course. It's an abbreviated course aimed at normal operations, not emergency.

COMMISSIONER TRUNK: Well, where do the people get the emergency training, then? How do they get it? Shouldn't they be versed in everything?

MR. DUNN: My people?

COMMISSIONER TRUNK: Everybody, yeh.

MR. DUNN: I don't think everybody can know everything. We're responsible for having a design and place capable of mitigating a loss of coolant accident. You've got me in a hard way. I have to agree with you that the operation of the system -- and in retrospect, I surely wish I had participated in the type of thing you're talking about. But at the time, we were operating under the assumption that if the accident was severe enough to cause the actuation of the high pressure injection system or the low pressure injection system, that it would be continued in operation. So I didn't have a reason to doubt the training.

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COMMISSIONER TRUNK: Well, I think if you would sit in on some of these things, you probably would have noticed it. From what I understand, you hadn't been to one of these things for three or four years, or you hadn't given a lecture.

MR. DUNN: Yes, I believe the lecture I gave myself was three or four years, or maybe even longer, ago. That wouldn't have spotted it for me, though, that lecture. Where I might have spotted such a thing was in participating with the operators and allowing, during the time that the normal instructors were giving them information.

COMMISSIONER TRUNK: Well, what determines if the instructors are qualified? I mean, is there anybody overseeing them?

MR. DUNN: Well, they certainly are part of an organization. They have management over them. And I suppose that management is responsible for seeing that their instructors are qualified.

COMMISSIONER TRUNK: But I'm under the impression that a team goes into the simulator. And maybe only one person pushes all the buttons and the other two just watch. I mean, what happens if one guy is sick and the other two have a replacement? They probably wouldn't know what to do.

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MR. DUNN: I think that's simplifying training considerable. I would not agree with your statement, the other two wouldn't know what to do. And I wouldn't agree that operators are that single-minded or trained to be that single-minded.

COMMISSIONER TRUNK: I have that plant in my back yard. I want it as safe as possible. I want those fellows to know the thing inside and out.

MR. DUNN: Yes, ma'am, I understand your concern. I want it to be that way, too.

CHAIRMAN KEMENY: Commissioner Trunk, we will have the manager of training for B and W as one of the witnesses, so you'll have further opportunity to explore that.

Mr. Pigford, did you have a question?

COMMISSIONER PIGFORD: In your recommendation of February 16th, the item two qualified it after a certain number of minutes. Wouldn't it be simpler just to state when you have such a loss of coolant accident, leave the high pressure injection on, period?

MR. DUNN: It may be.

COMMISSIONER PIGFORD: Is there any problem to that recommendation?

MR. DUNN: The only immediate problems to that recommendation, that occur to me, are, one, positive

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identification of a loss of coolant accident is a somewhat difficult process, particularly for extremely small loss of coolant accidents. If we break a large pipe on a system, the pressure falls right out of the bottom, the low pressure injection system, and the core flood tanks actuate, and that's generally quite obvious. For a small break, we achieve a reduction in reactor coolant system pressure and, in general, achieve saturated conditions. Something quite similar to that could occur, for example, in an overcooling transient, wherein a serious amount of cold water had been injected to the secondary side of the steam generator. If it were an overcooling transient, as opposed to a small break, the continuous injection of high pressure fluid has a potential for causing a loss of coolant accident. That would be one reason.

COMMISSIONER PIGFORD: Could you please explain?

MR. DUNN: Well, the reactor coolant system is only so big. It will contain, as a rough number, 500,000 pounds of water. If I attempt to push 550,000 pounds of water into the system, there is not enough room for it. This would cause very high pressure. And that pressure would have to be relieved. There are code safety valves supplied for that purpose. However, the code safety valves have a small possibility of

LA 18

becoming damaged. They may not reseat. And if I continued the high pressure injection, they wouldn't reseat, except momentarily, the nature of their relieving action. And that, then, becomes a loss of coolant accident, which, although in my mind there are not terribly bad consequences to that particular accident, we wouldn't want to have one. We wouldn't want to cause one.

The second item that may happen is the accident may be securable, as in the fashion of the PORV. That's a loss of coolant accident for which a block valve is provided and for which I can stop having a loss of coolant accident. Once I do that and reachieve a fairly normal condition of the reactor coolant system, in my mind, it's better to stop with the emergency systems and go back into the normal control of the plant.

COMMISSIONER PIGFORD: Now, in some of your reports, you have small break analyses, and you have mentioned that in some cases it is necessary to use operator action during the early stages of these accidents to mitigate the accident consequences. What kind of operator action did you find out?

MR. DUNN: Well, at B and W, we approach -- at least it's my opinion that we approach safety and a loss of coolant accident rather aggressively.

COMMISSIONER PIGFORD: Excuse me, if you can give

LA 19

a fairly short, specific answer, and then, if you need to elaborate, that would be good.

MR. DUNN: All right, well, I was going to go into that in the next sentence, and then I would like to elaborate, if I may.

As I mentioned, we approach it, I think, rather aggressively. There is an operator action required for mitigation of a small break, which relates to balancing the high pressure injection.

COMMISSIONER PIGFORD: Maybe it throttles the high pressure injection?

MR. DUNN: Not necessarily. Let me tell you what I'm trying to accomplish. And the particulars of how each utility would accomplish these facts are not immediately at my knowledge. I can find them out. I have provided criteria, what they should accomplish.

In the event of a small break, located between the high pressure injection injection point and the reactor vessel, additionally in the event that this break is at the bottom of the reactor coolant piping, at the very bottom, additionally in the event that this is a rather small break, and also that I have undergone a loss of one of my high pressure injection trains, for some reason -- that would be the single failure criteria -- it is possible that the active high pressure

LA 20

injection strain is injecting fluid in two locations. One of those locations is in an intact pipe and one of those locations is in the broken pipe. Under those specific circumstances, it's possible that the water injected in the broken leg, I call it, will not reach the reactor vessel. In order to achieve a higher ratio of water reaching the reactor vessel, we inform the operator to line up his pumps so that no more than 30 percent of the total high pressure injection capability is going to any single injection nozzle. In that fashion, instead of running the risk of losing 50 percent of my pump capacity, I only lose 30 percent of my pump capacity.

Now, it's my understanding that that is being made automatic within the plants. But for some period of time, they are doing that manually.

COMMISSIONER PIGFORD: If you have a loss of auxiliary feedwater and a small break, what kind of operation operator intrusion is necessary to keep the core from being uncovered. Have you had that case?

MR. DUNN: We have bounded that case. I can respond to you.

COMMISSIONER PIGFORD: Please. My question is what kind of operator intrusion or action is required to keep the core from being uncovered?

MR. DUNN: The only intrusion for the small break would be the one I just described to you; whereas, we would want him to balance his high pressure injection in the event that the LOCA part of the scenario described was between an injection line and the reactor vessel. Other than that the reactor will cool in a boiling mode successfully with just the high pressure injection.

COMMISSIONER PIGFORD: Suppose there is no break or the break is very, very small, what is required?

MR. DUNN: In that event, it would probably have to be a break so small as to be able to be mitigated by the normal makeup systems. In which case, we would term it a "leak". Perhaps, if I can divert you into a non-break, just a total loss of all feedwater --

COMMISSIONER PIGFORD: That is the case I am posing to you. What operator action is necessary?

DO2

MR. DUNN: Initiation of the high pressure injection system would be called for. There are, you know, auxiliary feedwater systems on the plant available to provide independent means of cooling. If both main and auxiliary feedwater are lost, obviously need a heat sink, I have to use a containment building.

COMMISSIONER PIGFORD: So, you have to initiate high pressure injection at high pressure. Is that correct?

MR. DUNN: Yes, sir.

COMMISSIONER PIGFORD: Now, have you analyzed since the Three Mile Island accident that transient using your computer codes? To be more specific, let's say calculation of the pressure temperature and so forth during the first few hours.

MR. DUNN: We analyzed that type of transient in 1973. We are presently repeating that particular transient and the status of that calculation is well along; probably 75 percent complete. We have no reason to doubt the 1973 results. We did want to perform them with the current state of knowledge. We have analyzed many very similar events. These have been the type of event of a PORD opening initially. The one you are describing will cause the PORD and the safeties to open at some time.

COMMISSIONER PIGFORD: Now, in the case of Three Mile Island, the auxiliary feedwater was unavailable for eight

minutes. From your analyses, if it had been available, how much difference would it have made to the transient, to the onset of core uncoverage, leaving all other operations and phases the same?

MR. DUNN: Leaving all other parameters the same, there may have been a difference in the results. Let me quantify and expand on this a little bit. The B and W ECCS systems will prevent the occurrences at Three Mile Island. I believe that or I wouldn't be in my position right now. And I am very sincere in stating that. We have several unique features associated with our systems which assist in the prevention of such accidents. The TMI-2 incident involves many parameters and I would like to go through those. There is the initiating event --

COMMISSIONER PIGFORD: Before you go into the detail, do you happen to know the non-specifics of the question. I think you are giving us some back up on the whole system, right?

MR. DUNN: I am going into the events at Three Mile Island to properly characterize the answer in my response to my question.

COMMISSIONER PIGFORD: Could you give us an answer and then you can provide the backup? Do you happen to have calculated this case?

MR. DUNN: The Three Mile Island simulation, sir?

DC4

CHAIRMAN KEMENY: The specific question, Mr. Dunn, was, how much difference did it make to the accident that the auxiliary feedwater was not available for eight minutes?

MR. DUNN: What I am trying to respond with is that is unclear as to how much difference that makes. It is not obvious that that would have prevented the occurrences of Three Mile Island. It is not -- there is the possibility that it would have. May I continue?

There is the initiating event in the loss of main feedwater. There is the non-availability of auxiliary feedwater for at least some time. Directly in response to your concern, this may have diverted the operator's attention or it may have caused further damage to the PORD than would have been expected under a normal loss of main feedwater event. Okay. Normally, we don't expect damages to the PORD. We do expect it to open and function.

I guess, in carrying it on, the third significant event is the termination or restriction of high pressure injection. Fourthly, the PORD must not be recognized as an open -- in an open position for 50 to 60 minutes.

Finally, the reactor coolant's pumps must be terminated. Those events must lie in approximate sequence of TMI-2 and in the time frame that they occurred at TMI-2 in order to produce the results of that accident. Had the high pressure injection not been terminated, the system would have evolved

to an acceptable void fraction and no consequences would have been incurred. Had the reactor coolant pumps been maintained in position, the reactor could have cooled itself with steam flow.

So, the answer is that it is not obvious whether or not the auxiliary feedwater or lack of emergency feedwater to the secondary site of the steam generators was meaningful. I would certainly allow that the same process could have occurred had the auxiliary feedwater been available initially.

COMMISSIONER PIGFORD: Have you calculated the case, Mr. Dunn?

MR. DUNN: Yes. I am sorry. Excuse me. I have not calculated that case under the assumption that the high pressure injection system was cut back.

COMMISSIONER PIGFORD: Had you calculated -- Excuse me. I will rephrase.

In an earlier analysis by your group, you reported some calculation of the effect of auxiliary feedwater being left closed and with a .04 square foot rate and you reported that as the worst case break in the range of interest. Does that mean that happens to be the size that gives you the worst results of all of the small breaks you considered?

MR. DUNN: I think somehow we have got some facts mixed up. If I am not wrong and if this is coming from my deposition and I may have been wrong, I think that was a .01

D06

square foot break as opposed to a .04.

COMMISSIONER PIGFORD: I am referring to a report BAW 10104, Revision 3, dated August 1, 1977.

MR. DUNN: Okay.

COMMISSIONER PIGFORD: You remember that?

MR. DUNN: I remember it. I don't have it in front of me. The accident there does not involve the loss of auxiliary feedwater to my recollection.

COMMISSIONER PIGFORD: Neglecting auxiliary feedwater has been investigated. What does it mean "neglecting it"?

MR. DUNN: I think it would be appropriate if I could have a copy of the report to get the context again.

COMMISSIONER PIGFORD: I will supply one. I certainly don't want to ask you from your report if you --

Do you see the paragraph with the circles around it?

MR. DUNN: Yes, sir. I am just trying to find the section in the report in which this statement is made.

In response to the word "neglecting" in here, it is my impression that this means not modeling, not having a simulation which would not have auxiliary feedwater available.

COMMISSIONER PIGFORD: Does that mean that in your model, you assume that it is not available? Is that correct?

MR. DUNN: We generally assume that the auxiliary feedwater is available.

07

COMMISSIONER PIGFORD: But I mean in that calculation?

MR. DUNN: Well, if in fact we were referring to a calculation here, yes, that would be what it means. I am not sure at this time whether this is a calculation or an analysis performed without the aid of computers, for example.

COMMISSIONER PIGFORD: Does it mean that in that particular case, the auxiliary feedwater was not available?

MR. DUNN: That is what I would believe it would mean.

COMMISSIONER PIGFORD: Then as you read through further, it appears that you are comparing it to an earlier calculation with auxiliary feedwater available and would you read out that sentence that has the results in it, that comparison.

MR. DUNN: The sentence that starts, the calculated results?

COMMISSIONER PIGFORD: Yes. It is where comparison with the previous calculations, which I think are with auxiliary feedwater available.

MR. DUNN: The calculated results showed an improvement in core liquid volume over the previous case reported in the SMUD ESFAS CR with auxiliary feedwater.

COMMISSIONER PIGFORD: And does that mean that it is -- when you do not have auxiliary feedwater available, you improve the results?

D08

MR. DUNN: No, sir.

COMMISSIONER PIGFORD: What does it mean?

MR. DUNN: It means that between the earlier analysis and the analysis methods -- excuse me -- between the earlier analysis and the methods that were in place for the earlier analysis, which I have to place in about the 1973 time frame for this, and the method of analysis justified in this report, a large number of other improvements in the simulation had occurred. And that because of those other model improvements which relate to fluid tracking within the primary system, results of this calculation were -- and analysis -- and/or analysis were improved over the 1973 variety.

COMMISSIONER PIGFORD: Even though this one now has no feedwater available, the other things may result in a net improvement. Is that correct?

MR. DUNN: Yes, sir.

COMMISSIONER PIGFORD: Now, tell me if the feedwater were not available in such a transient and if you lost outside power, which is the case that you calculate, then which is better from the point of view of insuring that the core remains covered with water? To have the pressure relief valve stay open or to have it open and close as designed?

MR. DUNN: Could I have the first parts of the question again?

COMMISSIONER PIGFORD: If you lost outside power

and if you had no auxiliary feedwater?

MR. DUNN: Okay. If I lost outside power and I had no auxiliary feedwater, would it be better to have the relief valves open and close as they are designed to do or to have them stay open?

COMMISSIONER PIGFORD: Yes. From the point of view, strictly, of keeping the core covered with water.

MR. DUNN: Now, as I understand our system, the core would stay covered in both cases. From the standpoint of margins of covering, if the valves were to stay open, after some period of time, the reactor coolant system would evolve to a lower pressure, which would increase the capability of the high pressure injection systems to supply water and that may then mean that we would have a larger margin to core uncovery.

COMMISSIONER PIGFORD: Okay. In which case would you have the temperature farther below the saturation temperature at a given time of an accident.

MR. DUNN: I do not believe we would be below the saturation pressure in either case. Perhaps, if the valve is opening and closing, there may be times at which we are a small degree below saturation.

COMMISSIONER PIGFORD: Mr. Dunn, does your group also evaluate the effects on containment of these calculated accidents?

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MR. DUNN: To a certain extent. We evaluate the resultant pressure and temperature within the containment as a result of the types of accidents and we involve the -- calculate the hydraulic loadings in the fashion of jet entrenchment calculations. And that is at an option to the utility.

COMMISSIONER PIGFORD: Do you happen to recall at what time in the Three Mile Island accident the containment pressure reached the negative sufficient because the isolation of the containment?

MR. DUNN: No, sir. I do not recall that at this time. It is my understanding that it did at one time, but I don't recall exactly when that occurred.

COMMISSIONER PIGFORD: Well, what would you expect from such an accident, at one kind?

MR. DUNN: Well, the accident at Three Mile Island.

COMMISSIONER PIGFORD: Or such an accident. You have analyzed such accidents for other reactors, haven't you?

MR. DUNN: Yes. I think it is important as to whether it is a loss of coolant accidents somewhere in the piping or a loss of coolant accidents which has some control in the form of quench tank. I would expect the reactor building to go to the required signal, which I believe is 4 PSIG. Let me say, slowly. It would not go that level rapidly.

COMMISSIONER PIGFORD: For the Pebble Springs plant, your analysis for the case of loss of feedwater and for a small

break accident projected the containment isolation at four pounds per square inch, at less than ten minutes. Is that correct?

MR. DUNN: That may very well be. I didn't come prepared to discuss details on Pebble Springs.

COMMISSIONER PIGFORD: Okay. That analysis was done back in --

MR. DUNN: Pardon me a minute. Would you excuse me, sir. There is a contract for which B and W has responsibility. I usually refer to it as PG and E. I am not absolutely positive that

COMMISSIONER PIGFORD: That is the one.

MR. DUNN: That is the one. Okay.

COMMISSIONER PIGFORD: In fact, let me state my conditions a little clearly to show you the relevance. As stated all feedwater is lost and water is lost through the pressurizer, through the relief valve, through the reactor coolant drain bank. And then it says that in less than ten minutes, containment pressure reaches the 4 PSI set point. Does that still sound reasonable to you?

MR. DUNN: What size break was this?

COMMISSIONER PIGFORD: Well, it appears to be the relief through the pressurizer, which I guess is the length of the supplemental relief valve.

MR. DUNN: You mean the PORV?

COMMISSIONER PIGFORD: Yes.

MR. DUNN: Well, to respond to you, sir, I would have to go and do a calculation on that particular event.

COMMISSIONER PIGFORD: If I show you the table, which I am assuming was supplied by your group, would that help?

MR. DUNN: That table could have been supplied by our group.

COMMISSIONER PIGFORD: Does some other group in B&W supply such analyses to their customers?

MR. DUNN: No, I don't believe another group within B&W. The question in my mind is whether we supplied that or whether the architect-engineer supplied that information.

COMMISSIONER PIGFORD: Does the architect-engineer himself do this kind of analysis?

MR. DUNN: Yes, sir, at times. It would depend on the utility's option as to who they contracted to do that.

CHAIRMAN KEMENY: Commissioner Pigford, could I try a suggestion, since there are a couple of areas in which the witness really was not prepared in the sense that we hadn't

prepped him to be prepared for this area. Would it be satisfactory to you if you submitted those questions in writing, simply requested from Mr. Dunn an answer to your question?

COMMISSIONER PIGFORD: Of course.

CHAIRMAN KEMENY: It seems, since you clearly came well prepared in the areas in which you were previously questioned, it would seem to me fairer if you submitted these in writing. Would that be acceptable to B&W counsel?

COMMISSIONER PIGFORD: Certainly.

MR. DUNN: Yes.

COMMISSIONER PIGFORD: Since I have kind of confused the record, at least let me make a short statement on where I am heading so he can think about it. I am puzzled that in the NELP analysis that I have before me which appears in the Tedesco Report from the NRC, which is for Portland General Electric, a B&W reactor, and I have stated the conditions, the containment seems to isolate so quickly, at less than 10 minutes, whereas my understanding from Three Mile Island is that the containment did not isolate until much, much, much longer. And I think other parts of the record will show how long, and so I am not going to take the chance of making a mistake of showing, telling. I think it is hours. And I am curious as to the difference. Thank you.

MR. EDGAR: May we have one clarification on this? Mr. Dunn does not know at this time whether or not the analysis

in question was performed by B&W or not, and if indeed that was not the case, would it be suitable to the Commission to direct that question to the person to whom the analysis -- or who did the analysis?

CHAIRMAN KEMENY: Absolutely. Yes, that is perfectly acceptable to the Commission.

Let's see, I believe Governor Babbitt wished to ask some questions. Governor Babbitt?

COMMISSIONER BABBITT: Mr. Dunn, I am interested whether prior to the distribution of the Fairburn memo of April 4, 1979, with respect to the use of the high pressure injection system, prior to that time, where would I go for writings or documents indicating what B&W policy was for the use of HPI during these low pressure transients?

MR. DUNN: I think you would have to go to two locations. The operating procedures for a reactor are within the domain of the utility as, for that matter, are final approval of almost everything. B&W prepares guidelines for emergency procedures, it is my understanding. Within the emergency procedures, you would find information relative to that.

It would then occur to me that you should go to the training department who is instructing operators on how to deal with the operation of the plant and evaluate what they are saying. At least that is what I would do if I was seeking the information you are.

CHAIRMAN KEMENY: In a moment I am going to declare a recess. I did not do it earlier because I know, Mr. Dunn, that you are anxious to return to your family. Incidentally, we wish your wife the very best. The event hasn't occurred yet, has it?

MR. DUNN: No, it hasn't, sir. Thank you.

CHAIRMAN KEMENY: We wish you the very best. Just to try to sum up two or three key points, returning your memoranda of concern in February of 1978, there you suggested certain types of procedures. My question does not relate to every detail of that procedure, just to that kind of recommendation. Would it be fair to say that that type of procedure would have been relevant to the Three Mile Island II accident?

MR. DUNN: Well, I think that is a very good question. I don't think that type of procedure would have hurt. I believe, had the principles behind my concerns been part of the operators' general knowledge, that in that case it could very well have prevented the results at TMI II. If the instructions had been embodied in the form of a procedure, then we have to ask ourselves what were the procedures at Three Mile Island. I can't swear to it, but I have been led to understand that the emergency procedures there called for maintaining high pressure injection until the system was above 1600 psig.

If my procedure had been followed as that one apparently was, and I don't want to throw stones or anything like that, it might not have made any difference.

CHAIRMAN KEMENY: But -- let's see, was that last reference that if your procedure had been followed at which point, it would have made more difference?

MR. DUNN: At which point during the transient?

CHAIRMAN KEMENY: Yes. It wasn't quite clear to some of us, at which point would your procedure have made more difference?

MR. DUNN: At the point -- what I -- let me just say it almost the same way and see if it becomes clearer. It is my understanding that within the emergency procedures for Three Mile Island there is a statement that says you leave the high pressure injection functioning until the reactor's coolant system reaches 1600 psi or above, okay? To my knowledge, during the time that the core damage occurred, the reactor coolant system was not above 1600 psi. It certainly was not above that value during the time at which we were seriously depleting the water inventory in the reactor cooling system.

That would be the point in time in which my instructions would have been valuable. Had my instructions been followed as that one was, you know, it wouldn't make any difference.

CHAIRMAN KEMENY: P[illegible]e best of your knowledge, your instructions, or anything equivalent to it, was not followed at TMI II, is that correct? I am not asking what their instructions were, but you have analyzed what happened there.

MR. DUNN: Yes, sir. Nothing equivalent to my instructions was followed at TMI II during the first at least two hours, 2-1/2 hours, of the transient.

CHAIRMAN KEMENY: Yes. I am talking only about that period, and is it -- as an expert on the high pressure injection system, is it your opinion that if something equivalent to your recommendations had been followed during that period, it would have made a substantial difference?

MR. DUNN: Yes, sir. Had my instructions been followed at TMI II, we would not have had core damage; we would have had a minor incident.

CHAIRMAN KEMENY: Thank you. The witness is excused, and the Commission will take a ten-minute recess.

(Witness excused.)

(Brief recess.)

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CHAIRMAN KEMENY: Mr. Chief Counsel, please swear in the witness.

MR. GORINSON: Mr. Walters, would you raise your right hand? Do you solemnly swear that the testimony you are about to give will be the truth, the whole truth, and nothing but the truth, so help you God?

MR. WALTERS: I do.

CHAIRMAN KEMENY: Could you please state for the record your full name and your current position at B and W?

MR. WALTERS: My name is James Michael Walters. I am Supervisory Engineer, the Plant Performance Section of Nuclear Service, now known as Customer Service.

CHAIRMAN KEMENY: Chief Counsel?

MR. GORINSON: Mr. Rockwell.

MR. ROCKWELL: Thank you, Mr. Chairman. Mr. Walters would you tell the Commission what the Plant Performance Services Section does?

MR. WALTERS: We have general responsibility in the area of plant testing, mainly physics testing, and overall document production for plant testing and guidance for operators instructions.

MR. ROCKWELL: And would you describe what the function of the Nuclear Service Department, now the Customer Service Department, is.

MR. WALTERS: We are mainly -- draft plant operations,

getting a plant all aligned initially, testing the performance of the plant both initially and subsequently but mainly in the operation and performance area.

MR. ROCKWELL: And Mr. Walters, specifically, what is your job as the Supervisory Engineer in the Plant Performance Services Section?

MR. WALTERS: My responsibility is again, mainly to supply procedures, mainly testing procedures that we think are necessary to test the plant either in the initial start-up or in the case of relayed cycles on operating reactors, mainly coolant physics testing.

MR. ROCKWELL: Mr. Walters, I direct your attention to Hearing Exhibit number 1, which should be on your table. Do you have it before you? It is a memorandum from Mr. Kelly to a number of individuals.

MR. WALTERS: Yes, we have a copy.

MR. ROCKWELL: You have Hearing Exhibit number 1 before you?

MR. WALTERS: Yes, sir.

MR. ROCKWELL: Do I correctly identify it as a November 1st, 1977 memorandum from Mr. Kelly to a number of individuals?

MR. WALTERS: That is correct.

MR. ROCKWELL: Did that memorandum come to your attention at some point on or about November 1st, 1977?

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MR. WALTERS: That is correct.

MR. ROCKWELL: How did it come to your attention?

MR. WALTERS: I received it in my in basket from my immediate supervisor, Mr. Hallman.

MR. ROCKWELL: And where there any instructions when it came to you?

MR. WALTERS: Yes, sir. It has something on the order of what do I think about this, or something like that.

MR. ROCKWELL: Did you talk to Mr. Hallman at that time?

MR. WALTERS: I do not recall. I probably did.

MR. ROCKWELL: Did you respond to the Kelly memorandum in connection with Mr. Hallman's note to you?

MR. WALTERS: Yes, I did.

MR. ROCKWELL: In preparing your response did you consult with some people at Babcock and Wilcox?

MR. WALTERS: Yes, I did.

MR. ROCKWELL: I refer you now to Hearing Exhibit Number 2. Do you have that before you?

MR. WALTERS: Yes, I do.

MR. ROCKWELL: And is that your response to Kelly's November 1st, 1977 memorandum?

MR. WALTERS: Yes, that is true.

MR. ROCKWELL: Do I correctly identify it as a November 10th, 1977 memorandum from yourself to Mr. Kelly?

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MR. WALTERS: Yes, sir.

MR. ROCKWELL: In preparing your response, can you tell me who you talked to at B and W?

MR. WALTERS: Well, yes. I have testified before that I talked with ex training personnel within -- outside of the training department but still within Nuclear Services. Since the last deposition, I am a little hazy on the actual people I talked to -- I talked to the three people identified before, Mr. Gossolo, Street, and Smith. At this time only Mr. Smith remembers me talking with him on this matter.

MR. ROCKWELL: This is based on conversations which you had with these three people since your deposition?

MR. WALTERS: That is correct.

MR. ROCKWELL: In reviewing the Kelly memorandum, when it came to you, did you believe that it raised a valid point?

MR. WALTERS: Yes.

MR. ROCKWELL: Did you have any concerns about the way Mr. Kelly had raised his prescription?

MR. WALTERS: Yes. We -- I say we, me and Mr. Smith -- after talking with him, we did have some concerns.

MR. ROCKWELL: Would you describe them please?

MR. WALTERS: As I stated before, I want to make sure we get the process probably because of our input, our concern was addressing a non-LOCA initiator transient, and overcooling

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transient, and that is an area we were concerned and if we literally played reliance on the prescription in Mr. Kelly's memo that we may take the plant solid in ensuing transients.

MR. ROCKWELL: In reference to Mr. Smith whom you believe you consulted in preparing your memorandum, am I correct in understanding that he was a former instructor in the Babcock and Wilcox Training Department?

MR. WALTERS: That is correct.

MR. ROCKWELL: And that he had a number of years of experience in that Department as an instructor?

MR. WALTERS: That is correct.

MR. ROCKWELL: But at the time you talked to him, he had moved on to the Customer Service Department? Is that correct?

MR. WALTERS: That is correct.

MR. ROCKWELL: I am referring you now to Hearing Exhibit Number 2. Let me read to you the first paragraph, Mr. Walters: "In talking with training personnel and in the opinion of this writer the operators at Toledo responded in the correct manner considering how they had been trained and the reasons behind the training". What was your understanding, Mr. Walters, of how they had been trained? In light of your use of that term in that paragraph?

MR. WALTERS: I thought that generally speaking the operators had been trained to diagnose pressure level and pressure

training in the same direction and that in the TECO transient that he correctly responded in this, in the second part of the TECO transient.

MR. ROCKWELL: Would it be fair to say, Mr. Walters, that based on your knowledge in the fall of 1977, the termination of high pressure injection on the basis of the pressurizer level was appropriate?

MR. WALTERS: No, it would not.

MR. ROCKWELL: It is not fair to say that?

MR. WALTERS: No.

MR. ROCKWELL: Would you provide Mr. Walters with a copy of his deposition?

I am referring you, Mr. Walters, to the second section of your deposition, page 14, line 10. Do you recall that deposition being taken on July 13, 1979?

MR. WALTERS: Yes.

MR. ROCKWELL: And there was a court reporter present? Is that correct?

MR. WALTERS: Yes.

MR. ROCKWELL: My questions and your answers were taken down, is that correct?

MR. WALTERS: That is correct.

MR. ROCKWELL: Quoting now from line 10, question: You have to say yes, that termination of HPI, on the basis of pressurizer level alone was appropriate in terms of your know-

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ledge in the fall of 1977. Is that correct? Answer: Yes. Is that transcript accurate?

MR. WALTERS: Yes.

MR. ROCKWELL: That was based on your knowledge and experience, having been an employee at Babcock and Wilcox for some eight to ten years as of the fall in 1977?

MR. WALTERS: I think it is fair to say that in most general cases that is true. Not in all cases.

MR. ROCKWELL: Referring you now, Mr. Walters, to the second paragraph of your memorandum, let me read the first sentence: "My assumption and the training assumes first that RC Pressure and Pressurizer Level will trend in the same direction under a LOCA." Is that an accurate reading of the sentence?

MR. WALTERS: Yes, sir.

MR. ROCKWELL: Do you believe that nuclear reactor operators in general at that time had the same assumption?

MR. WALTERS: I think so.

MR. ROCKWELL: Referring you now to the fourth paragraph, Mr. Walters, I quote: "If you intend to go solid," this is on page two, "If you intend to go solid what about problems with vessel mechanics." Would you tell us what problems of vessel mechanics you were concerned about?

MR. WALTERS: As I stated in my deposition before, I was involved, being in Nuclear Service and with the responsibility for keeping these plants operating, I was essentially

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concerned about an availability problem in that if we took the plant solid, that the ensuing analysis or paper work involved would present us with a long down time on that particular plant.

MR. ROCKWELL: Would that mean that a long down time would mean a substantial time off line for the plant?

MR. WALTERS: That is correct.

MR. ROCKWELL: And the plant would not be generating electricity during that time?

MR. WALTERS: That is correct.

MR. ROCKWELL: You referred to hydro-ing the RCS in your memo. By that you mean going solid, Mr. Walters?

MR. WALTERS: Yes, sir.

MR. ROCKWELL: Were the operators ever taught to go solid at any time? And by oeprators I mean operators generally.

MR. WALTERS: I do not believe they were ever taught to go solid, that is correct.

MR. ROCKWELL: Would it be fair to say that they were never taught to go solid under any conditions?

MR. WALTERS: To the best of my knowledge.

MR. ROCKWELL: And that is based again on your experience and on your having been employed at B and W for some ten years as of the fall of 1977?

MR. WALTERS: That is correct.

MR. ROCKWELL: And would it also be fair to say that your assumption is that they were taught -- not only were they

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never taught to go solid but they were taught never to go solid?

MR. WALTERS: I did not have first-hand information that they were never taught to go solid, no.

MR. ROCKWELL: Is that your understanding?

MR. WALTERS: That is my understanding.

MR. ROCKWELL: After Mr. Kelly received your memorandum, did he contact you about the points that you raised in your memorandum?

MR. WALTERS: No, I do not remember any contact with Mr. Kelly concerning his memo.

MR. ROCKWELL: To your knowledge, did anything happen in the three months between the time your memorandum was directed to Mr. Kelly and the time that Mr. Dunn's memorandum was issued on February 9th, 1978?

MR. WALTERS: I initiated no action, nor do I personally know of any.

MR. ROCKWELL: Were you aware of any action being taken during that period of time?

MR. WALTERS: No, I am not.

MR. ROCKWELL: Let me go back a moment, Mr. Walters, if your assumption that you indicated a moment ago is true, namely that operators believed on the basis of their training instruction that they are never to go solid, would it be possible to create instructions which would distinguish for operators those circumstances where they might permissibly go

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solid? And those circumstances where they should not go solid? And to provide that to the operators in the form of instruction?

MR. WALTERS: Yes, I think that is true.

MR. ROCKWELL: To your knowledge, has that instruction never been written or provided to operators?

MR. WALTERS: Not to my knowledge.

MR. ROCKWELL: Did you receive Mr. Dunn's memorandum on or about February 9th? Now, I refer you to Hearing Deposition, Exhibit 3.

MR. WALTERS: Excuse me?

MR. ROCKWELL: I am referring you to Hearing Deposition, Exhibit 3. Did you receive that memorandum from Mr. Dunn on or about February 9th, 1978?

MR. WALTERS: I received a copy of the memo, yes.

MR. ROCKWELL: Okay. How did that come to your attention?

MR. WALTERS: Mr. Street brought the memo to my attention.

MR. ROCKWELL: Did you then bring it to the attention of your supervisor?

MR. WALTERS: At some period of time after that I am sure I did, but at what time I do not remember.

MR. ROCKWELL: That would be Mr. Hallman?

MR. WALTERS: That is correct.

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MR. ROCKWELL: Who assumed, within your department or section, the responsibility for acting on and following up on Dunn's February 9th memorandum?

MR. WALTERS: I accepted the responsibility.

MR. ROCKWELL: Did you have a reaction to that memorandum once you had read it?

MR. WALTERS: Yes, essentially the same reaction that I had to the previous Kelly memo.

MR. ROCKWELL: In other words, your concerns about the prescription that was offered in the memorandum were the same?

MR. WALTERS: That is correct.

MR. ROCKWELL: Did you undertake to do anything about that concern at that point?

MR. WALTERS: Yes, sir, I assigned a Mr. Gossolo to go down and talk to Mr. Dunn and to see if we could address our concerns about the prescription that he had offered.

MR. ROCKWELL: To your knowledge, did Mr. Gossolo do that?

MR. WALTERS: Yes, sir.

MR. ROCKWELL: And what was the result of that?

MR. WALTERS: I think the outcome of the discussion was Mr. Dunn's second memo.

MR. ROCKWELL: And that would be Hearing Exhibit

No. 4. Do you have a copy of that before you?

MR. WALTERS: Yes, sir.

MR. ROCKWELL: And that was a result, as I understand it, then, of conversations which Mr. Gossolo had had, at your direction, with Mr. Dunn.

MR. WALTERS: That is correct.

MR. ROCKWELL: Did you receive a copy of the February 16th memorandum?

MR. WALTERS: Yes, at some point, I did.

MR. ROCKWELL: Okay, you are not listed on the distribution of that memorandum, are you?

MR. WALTERS: That is correct.

MR. ROCKWELL: How did you receive it? From whom?

MR. WALTERS: I don't believe I've been able to recall, but I assume it would have been Mr. Street again.

MR. ROCKWELL: When you received it, did you have a chance to review it?

MR. WALTERS: Yes, sir.

MR. ROCKWELL: What was your opinion of the revised prescription that that February 16th memorandum offered?

MR. WALTERS: My personal opinion was that it still did not address the overcooling transient, overcooling

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initiated transient that we'd been talking about all along, as well as other concerns, how I would pass this along to operators, how would they understand and be able to react to this prescription.

MR. ROCKWELL: What did you do about the concerns that you held at that point, after February 16th?

MR. WALTERS: As the best I remember, and again I talked to Mr. Gossolo in the last couple days, I think I testified that we talked to Mr. Dunn after that, or Mr. Gossolo did. His statement to me, that was incorrect, that he talked to Mr. Cartin of that Plant Integration maybe one time after that about the subject, about what could we do about it.

MR. ROCKWELL: Am I correct in understanding that in conversations that you've had since your deposition, you've determined that Mr. Dunn was not contacted after February 16th, but rather Mr. Cartin of Plant Integration was.

MR. WALTERS: That's true.

MR. ROCKWELL: Did you ever tell Mr. Dunn, following your receipt of his February 16th memorandum, that you still had reservations about the prescription offered in it?

MR. WALTERS: No, I never talked to Mr. Dunn.

MR. ROCKWELL: And you believe Mr. Gossolo had

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perhaps one contact with Mr. Cartin, from the time after February 16th?

MR. WALTERS: That is correct.

MR. ROCKWELL: Did there come a time when you were concerned about whether appropriate or timely action was being taken?

MR. WALTERS: Yes, sir, I did.

MR. ROCKWELL: Can you describe what steps you took at that point?

MR. WALTERS: I don't know exactly what time, but previous to August 3rd, I had a conversation, or a couple of conversations with my immediate supervisor, Mr. Hallman. I made the suggestion that maybe we should draft a memo to Plant Integration and see if we could elicit some response through that means.

MR. ROCKWELL: Was that memorandum drafted by you?

MR. WALTERS: Yes, sir, it was.

MR. ROCKWELL: And referring you to Hearing Exhibit No. 5, do you have that before you?

MR. WALTERS: Yes, I do.

MR. ROCKWELL: And that memorandum, to your knowledge then, was forwarded to Mr. Karrasch on August 3rd, 1978. Is that correct?

MR. WALTERS: As far as I know, it was.

MR. ROCKWELL: And Mr. Karrasch would be manager

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of the Plant Integration Unit in the Design Section of the Engineering Department. Is that correct?

MR. WALTERS: That is true.

MR. ROCKWELL: And he also is Mr. Kelly's supervisor. Is that correct?

MR. WALTERS: Yes, sir.

MR. ROCKWELL: Were the concerns that are expressed in that memorandum about the prescription offered by Mr. Dunn the same concerns that you had held back in the fall of 1977 and in February of 1978?

MR. WALTERS: Yes, sir, they were.

MR. ROCKWELL: Did the memorandum to Mr. Karrasch get the issue resolved?

MR. WALTERS: No, sir.

MR. ROCKWELL: Could you tell us what happened?

MR. WALTERS: Well, to the best of my knowledge, peripherally -- I was on the peripheral only -- I questioned Mr. Hallman and Mr. Hallman questioned Mr. Karrasch a couple of times verbally about a response to the memo. And we, as far as I know, did not receive one.

MR. ROCKWELL: Mr. Walters, referring to your concerns about going solid, can you tell us what your view of that concern is, in contrast, or in comparison to the possibility of core uncovery?

MR. WALTERS: Okay, when I talk about the

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initiator of the overcooling transient and not in LOCA situations, my concern was that once we were into an overcooling transient, if the HPI pumps were left on for some X minutes, that we would put enough water into the system to go up against the code relief valves and therefore create a LOCA, and not that -- We had no problem, or we're not concerned with his prescription on a LOCA initiated event.

MR. ROCKWELL: Would it be a fair summary of your views to say that once you're in a loss of coolant accident that your concern about going solid is no longer present and that going solid is possible in that situation, in your view?

MR. WALTERS: That is true, mainly meaning in a LOCA situation in '77, when I wrote the memo, I was not aware that the two parameters, RC pressure and pressurizer level, would trend in opposite directions under a small LOCA. Therefore, my assumption in the memo, as written, I assumed that these would trend in the same direction. And, therefore, under a LOCA situation, you would not really have a solid system with a high indicated pressurizer loss.

MR. ROCKWELL: To your knowledge, Mr. Walters, was the material that was set forth in Dunn's February 16th memorandum ever conveyed to B and W's utility customers

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before March 28th, 1979?

MR. WALTERS: To the best of my knowledge, it wasn't.

MR. ROCKWELL: It was not?

MR. WALTERS: It was not.

MR. ROCKWELL: From the time you first received Kelly's memorandum in the fall of 1977, did you ever personally talk with Mr. Dunn or Mr. Kelly about the concerns raised in their respective memoranda?

MR. WALTERS: No, I'm sure I didn't talk to Mr. Dunn and I do not believe I talked to Mr. Kelly.

MR. ROCKWELL: Mr. Chairman, that's all I have.

CHAIRMAN KEMENY: Thank you, Mr. Rockwell.

May I just follow up one question asked of you by counsel. As I understand it, your concern was that while the Dunn recommendations might be appropriate for the LOCA caused accident, they would not be appropriate for overcooling transients.

MR. WALTERS: That's a fair statement.

CHAIRMAN KEMENY: What happens to the reactor coolant temperatures in an overcooling accident?

MR. WALTERS: They experience a severely downward trend.

CHAIRMAN KEMENY: Severe downtrend. Therefore would it be reasonable to assume that it would be more than

50 degrees below the saturation point?

MR. WALTERS: I think that's true.

CHAIRMAN KEMENY: Yes. I'm only trying to pinpoint the nature of your concern, because in the revised memorandum which occurred after talking to one of your colleagues, the second point, which is presumably the one that concerns you, speaks of keeping it down for X minutes, but allowing it to go off, taking off high pressure injection, once you're 50 degrees below the saturation temperature.

MR. WALTERS: Yes.

CHAIRMAN KEMENY: And presumably in this accident, it would have been all along 50 degrees below the saturation.

MR. WALTERS: Yes, sir, I think so.

CHAIRMAN KEMENY: So, therefore, your concern was that under these circumstances, keeping it on for X, even if that were a small number of minutes, would be the inappropriate thing.

MR. WALTERS: Yes.

CHAIRMAN KEMENY: Could I ask you, then, is there some fairly clear way that an operator could determine early whether the accident was caused by a LOCA or not?

MR. WALTERS: I do not believe he can within a few minutes, let's say less than five minutes. I believe in the area of ten, twenty minutes, he can.

LA 9

CHAIRMAN KEMENY: Yes, but does that not create a dilemma, then, for the operator, that if you have a procedure where if it's caused by a LOCA, you should keep on the high pressure injection system for no less than a certain number of minutes, but if it isn't, he shouldn't, and it takes him longer than that to determine what caused the accident?

MR. WALTERS: Yes, sir, I agree. In fact, one part of my whole concern was how do I convey these prescriptions to the operator so that he will have a simple understanding of it.

CHAIRMAN KEMENY: Yes, I suspected that that was the case. I wanted to bring that out, as a matter of fact. Thank you.

Other commissioners? Commissioner Haggerty?

COMMISSIONER HAGGERTY: Mr. Walters, you keep relating your knowledge in the fall of 1977 to the pressure and level trending in the same direction. But the facts are that Kelly's memo of November 1st says the operator stopped HPI when pressurizer level began to recover without regard to primary pressure. So he was clearly raising the question of a difference in direction. The Dunn memo of February 9th does the same thing. So clearly, from both the design standpoint and the ECCS analysis standpoint, they were saying that you could have a circumstance, a

clear statement of two phases existent, that the pressure and the temperature would not trend in the same direction.

MR. WALTERS: That was my first knowledge of that, yes, when these memo came to my attention.

COMMISSIONER HAGGERTY: Well, but your memo was written after the November 1st memo.

MR. WALTERS: Right. What I'm getting at is that I was not addressing my solution, or my concerns to the very first initial, say, five minutes, I think, in that area, of the TECO transient, where indeed, yes, they did trend in opposite directions. My concern was about 20 minutes later, the operator found the stuck open relief valve, things appeared to begin then to get normal. The pressurizer level and pressure then again starting, recovered and trended in the same direction. And if we had left the HPI pumps on for a period of 20, 30, whatever minutes, we would then have gone up against the code relief valve, but not the initial action.

COMMISSIONER HAGGERTY: I understand that. It seems to me that you're raising questions that relate to difficulty of communicating this to operators, and the proper issue was how you resolve those difficulties, not really to avoid the issue. And I can understand the difficulty of conveying it to operators, with the indicators present and all the rest of that. But then that only made

LA 11

that issue more serious. If the problem of having two-phased condition was present, and hence terminating HPI was exactly wrong, then the issue was how do you convey that properly to operators, not avoiding it or postponing it because it's difficult to convey it. Is that not true?

MR. WALTERS: Yes, sir, I think that's true.

CHAIRMAN KEMENY: Commissioner Lewis.

COMMISSIONER LEWIS: Mr. Walters, isn't it true that one of the selling points for B and W is the availability. It seems one of the pluses for your nuclear power facility is that it's more available than many of the other plants.

MR. WALTERS: I'm not personally aware of that, but it certainly would be, if that's the facts.

COMMISSIONER LEWIS: In other words, it would be to the advantage of a customer to have availability.

MR. WALTERS: Yes, ma'am, to all our concerns when it comes to electric power bills.

COMMISSIONER LEWIS: Okay. And, therefore, you're saying that generally speaking the operators are trained to lean in the direction of wanting to keep the facility available.

MR. WALTERS: Yes, I think they're always trained to try to minimize damage to the plant.

COMMISSIONER LEWIS: Okay. And in order to do that,

they would try to avoid going solid.

MR. WALTERS: In most cases, true.

COMMISSIONER LEWIS: Given that mind set, isn't it possible that faced with the kind of transient that occurred at Davis-Besse and later at TMI two, the operators then would not even consider, until almost too late, the possibility of going solid?

MR. WALTERS: My personal opinion is, and what I know is that that's not true. They're taught not to rely on one single indication. They're taught to seek a third opinion, a qualifying piece of instrumentation, and not to rely on the one single, in this case, pressurizer level. So, no, I do not think that's the case.

COMMISSIONER LEWIS: Thank you.

CHAIRMAN KEMENY: Dr. Marks.

COMMISSIONER MARKS: I'd like to explore with you the follow-up on the August 3, 1978 memo, which apparently you drafted for Mr. Hallman to go to Mr. Karrasch.

MR. WALTERS: That's correct.

COMMISSIONER MARKS: Now, we've received testimony today which suggests that this was an important issue. Can you tell me why you didn't feel more urgency in getting a response to this? You didn't ever get a response to this memorandum, you said.

MR. WALTERS: That's true.

LA 13

COMMISSIONER MARKS: Well, don't you feel you had a responsibility to get a response to something that is potentially as important as this, for someone who is in charge of operating reactors?

MR. WALTERS: Well, that's a very difficult question to answer. I can only answer, that is true, but in the mainstream of business, day after day, some things, I reckon you have to say slip through the crack.

COMMISSIONER MARKS: Slip through the crack. How often do things slip through the crack, of this importance, do you think?

MR. WALTERS: Well, let's hope they're very seldom. I can't responsibly answer that question. Hopefully this is the only time, maybe, it's ever happened. It's only been highlighted since TMI two.

CHAIRMAN KEMENY: Mr. McPherson

MR. MC PHERSON: These questions may not be properly addressed to you, but maybe you can help with their answers. The pilot operated relief valve that stuck open was purchased by B and W to its specifications from Dresser Industries. Is that correct?

MR. WALTERS: To my own knowledge, that is true. But I do not have that --

MR. MC PHERSON: You do not have first hand knowledge.

There was testimony earlier today that there may have been as many as 20 incidents in which the pilot operated relief valve had stuck open, which is one event that places on the operator this terrific decision as to whether to know that by one means or another and to know what to do with the high pressure injection system that could have that effect.

First of all, do you know -- you are in charge of the Operating Reactors Division here. Does that problem, that frequency of malfunction come before you? Had you been aware that that valve was sticking open on occasion?

MR. WALTERS: I was aware that there had been maybe two or three transients on which the valve had stuck open, but nothing greater than that. I do not know where the number 20 came from. The number 20 that was testified to this morning.

MR. MC PHERSON: Do you know how that valve works? Is it controlled from the control room?

DO2

MR. WALTERS: Very superficially, yes. I am not familiar with intimate details on it.

MR. MC PHERSON: Do you know whether the supplier of the valve was contacted to be talked to about the frequency of the malfunction of the valve.

MR. WALTERS: No, I have no knowledge of that.

MR. MC PHERSON: There was, I believe, evidence at an earlier hearing or perhaps it was in the Commission's trip to Three Mile Island that the control room operator had in effect set the signal to that valve to close, but because of the construction of the valve, the only signal that came back to him was that the signal had been sent. In other words, it did not come back to him that it had been reseated.

MR. WALTERS: Yes, I think that is a fair statement.

MR. MC PHERSON: That is kind of like one hand clapping in the old Chinese story. Was this a matter of any concern to your division that the control room operator could not be sure when he hit that button or lever that he was effectuating what he was intending to do.

MR. WALTERS: I can't address that for the company. I think that there would be other situations that the operator would know the valve was not closed and regardless of whether the valve closed or not, there is a block valve there that he could have closed and have blocked it off at any rate.

MR. MC PHERSON: But he would really only use the

block valve if he knew that the other valve was open, wouldn't he?

MR. WALTERS: That is probably correct.

MR. MC PHERSON: If he had set a signal to close the other valve, but didn't know whether that signal had been effective or not in doing that, then he wouldn't know whether to close the block valve.

MR. WALTERS: In a short period of time, I believe that is true, but I don't believe that in a period of hours that that is correct.

MR. MC PHERSON: You think that that should have been identified earlier by the operator from the variety of evidence that was available to them.

MR. WALTERS: That is correct.

MR. MC PHERSON: Would it be your division's responsibility if it were learned that either the valve was continually malfunctioning or that the signal was insufficient to properly advise the control room operator? Would it have been your division's responsibility or somebody else's responsibility in the Nuclear Service Department to have gone to the designers or to the suppliers and give us the better product.

MR. WALTERS: No. Not the responsibility of Nuclear Service. We would probably have or did highlight the situation within the company, but there would be a mechanical equipment section of engineering that would take on the

D04

responsibility of going to the actual vendor and addressing that.

MR. MC PHERSON: Would the notice of those malfunctions come to you ordinarily in your operating reactor?

MR. WALTERS: Not ordinarily. Only on a peripheral --

MR. MC PHERSON: To whom would they go?

When something goes wrong in a plant, when a piece of vital equipment such as this malfunctions periodically, who learns about it in the plant?

MR. WALTERS: Within B and W?

MR. MC PHERSON: Yes.

MR. WALTERS: I reckon -- well, it is hard to answer because mainly a lot of people would know about it eventually. The first person that would probably be aware of it is the Manager of Operating Plant Services, which is in the Nuclear Service.

MR. MC PHERSON: Is that in the engineering?

MR. WALTERS: No. That is the Nuclear Service.

MR. MC PHERSON: Nuclear Services. Operating Plant Services, that is Mr. Phinny.

MR. WALTERS: That is correct.

MR. MC PHERSON: So, he would get these complaints?

MR. WALTERS: Yes.

CHAIRMAN KEMENY: Commissioner Marrett.

COMMISSIONER MARRETT: To return to your memo of

11, 1977, the second paragraph, my assumption and the training assumes that the pressure and pressurizer will trend in the same direction, I believe in the deposition taken most recently, you indicate that that should not be "the training", but your own training, is that correct?

MR. WALTERS: Yes, ma'am. I was trying to make a clarification there that in this memo was my own opinion and not the opinion of B and W's training department.

COMMISSIONER MARRETT: Are you suggesting by making that revision that you did not want to comment on the kind of training that is given in B and W, that you were not knowledgeable enough about that training? I would like to understand the difference between having stated "the training", which was interpreted as B and W training and your revision which now says you are only talking about your own training.

MR. WALTERS: Right. I did not want to mislead that -- I was never trained by the B and W training center to be an operator. My training is peripheral training in talking to quite a few people, not necessarily what B and W training department trains the utility operators.

COMMISSIONER MARRETT: So, are you suggesting that you would not want to express -- or be able to describe B and W training? Is that what you are saying by making that revision?

MR. WALTERS: Yes.

COMMISSIONER MARRETT: Then I suppose I have some

D06

problems because in continuing on that deposition, you were asked were the operators taught to hydro the RCS at any time and your comment, no, the operators are not taught to hydro the RCS at any time. Would it be fair to say they are never taught to hydro the RCS; your answer, I think that is a fair statement. I am wondering how you could give a very positive indication here about what the operators are trained to here and give the hesitation that I now hear about knowledge on training. Is that a discrepancy?

MR. WALTERS: In the scenario of taking a plant solid, as I testified also, there is no reason during normal operation of a plant to allow a plant to go solid. Indeed, you do not want to do that. That is like a first law and not something that I question or not what the B and W training center says. I am pretty sure that that has been the case. You lose pressure control as well as maybe ensuing problems. I think maybe me and the training center would agree on that subject. I am just trying not to speak for them, the training department.

COMMISSIONER MARKETT: When did you discover having made that slight error in the statement itself, the inclusion of the "the" before the training? Was that in reviewing the memo quite recently or subsequent?

MR. WALTERS: Well, I think I saw that a week ago or something and last Friday in the deposition, when I had the

chance, I made that statement.

COMMISSIONER MARRETT: Did that come about after a discussion with anyone? To be perfectly candid, someone might get the impression that this was after a great deal of discussion, saying what are the implications of indicating "the" training, as opposed to taking on the responsibility of saying simply this is myself who is giving the statement. I guess I would just like to get some clarification. Was this your looking back over and saying, I shouldn't have used that word. That is not what I meant. Or was it, what interpretation might be given if I talk about B and W training in general.

MR. WALTERS: Well, what prompted it was, indeed, was the first scenario and questions from counsel, the first deposition. We seemed to be going around in circles on this and I decided I had better make it more clear as soon as I got the chance of what I was really talking about regardless of what the English sounded like.

CHAIRMAN KEMENY: Let's see, Mr. Walters, I would like to try to pull together certain threads.

Suppose, just for a moment, you had had no concern about Mr. Dunn's memorandum. What would have been the sequence of events to get [illegible] information out to customers? I know you have concerns. I am stipulating that. But suppose you wouldn't have had concerns, what would have happened to Mr. Dunn's concerns?

D08

MR. WALTERS: We would have, within the service organization, I would have assigned it to one of my engineers and we would have come up with some formulation that we send out by a process known as site instruction to the individual customers.

CHAIRMAN KEMENY: And that would have been sent out to all your customers or all of your relevant customers?

MR. WALTERS: That is true.

CHAIRMAN KEMENY: On what kind of timetable. What is a typical time period after you have made such a decision?

MR. WALTERS: Probably less than a month.

CHAIRMAN KEMENY: Less than a month.

MR. WALTERS: It varies. Some go out. If there is an urgent problem and we are aware of all of it, it goes out probably in 24 hours. Some may take a few weeks. It depends on how much discussion between engineering and us to formulate the final answers.

CHAIRMAN KEMENY: Yes. However, you did have some serious concerns and, therefore, you persuaded your supervisor, Mr. Hallman, as I understand, to raise the issue with Plant Integration and you weren't getting answers and in August of last year, you were still pushing -- if I may use that word -- to get this resolved.

MR. WALTERS: That is true.

CHAIRMAN KEMENY: And was it at any time prior to

March of this year resolved to your satisfaction?

MR. WALTERS: Prior to March of this year?

CHAIRMAN KEMENY: Yes.

MR. WALTERS: No, it was not resolved to my satisfaction.

CHAIRMAN KEMENY: Not resolved. Therefore, from this testimony, if your concerns had not existed Mr. Dunn's February memorandum might have been out to the customers say in March or April of last year or if the August memorandum had been responded to fairly promptly, the information might have been out to the customers before the end of calendar '78.

MR. WALTERS: I think that is a fair assumption.

CHAIRMAN KEMENY: But these events did not happen and therefore Three Mile Island 2 did not have these instructions or instructions like these available prior to the accident.

MR. WALTERS: They did not have information from this particular memo I sent to them.

Thank you. You are excused, subject to recall and given the lateness of the hour, the Commission will recess until 10:00 A. M. tomorrow morning.

(Thereupon, the Commission was recess until 10:00 A. M. on July 19, 1979.)

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

EXHIBIT 1.
Page 1 of 1

To
Distribution

From
J. J. Kelly, Plant Integration

Cust.
Generic

Subj.
Customer Guidance On High Pressure Injection Operation

This letter to cover one customer and one subject only.

[illegible] ISLAND COMMISSION
[illegible] EXHIBIT 1
DATE July 18-20, 1979

File No.
or Ref. VIII 3

Date
November 1, 1977

DISTRIBUTION

B. A. Karrasch
E. W. Swanson
R. J. Finnin
B. M. Dunn
D. W. LaBelle
N. S. Elliott
D. F. Hallman

Two recent events at the Toledo site have pointed out that perhaps we are not giving our customers enough guidance on the operation of the high pressure injection system. On September 24, 1977, after depressurizing due to a stuck open electromatic relief valve, high pressure injection was automatically initiated. The operator stopped HPI when pressurizer level began to recover, without regard to primary pressure. As a result, the transient continued on with boiling in the RCS, etc. In a similar occurrence on October 23, 1977, the operator bypassed high pressure injection to prevent initiation, even though reactor coolant system pressure went below the actuation point.

Since there are accidents which require the continuous operation of the high pressure injection system, I wonder what guidance, if any, we should be giving to our customers on when they can safely shut the system down following an accident? I recommend the following guidelines be sent:

a) Do not bypass or otherwise prevent the actuation of high/low pressure injection under <u>any</u> conditions except a normal, controlled plant shutdown.

b) Once high/low pressure injection is initiated, do not stop it unless: Tave is stable or decreasing <u>and</u> pressurizer level is increasing <u>and</u> primary pressure is at least 1600 PSIG and increasing.

I would appreciate your thoughts on this subject.

JJK:jl

[illegible] [illegible] MEMORANDUM THE BABCOCK & WILCOX COMPANY

EXHIBIT 2
Page 1 of 2
THREE MILE ISLAND COMMISSION
[illegible] EXHIBIT # 2
[illegible] July 19-20, 1979

J. J. Kelly Plant Integration

[illegible] F. Walters Nuclear Service

TOLEDO

FILE NO. OR REF.

DATE 11/1[illegible]/77

High Pressure Injection during transient

Ref. Your letter to DISTRIBUTION; Same Subject Dated NOV 1, 1977.

In talking with the training personnel and in the opinion of this writer the operators at Toledo respond in the correct manner considering how they have been trained and the reason behind this training.

My assumption and the training assumes first that RC Pressure and Pressurizer Level will tend in the same direction under a LOCA & For a small leak they keep the H.P System on up to a certain flow to maintain Press & Level.

In the particular case at Toledo, there was no LOCA of any [illegible] and with the small leak the inventory in the system came back as expected but due to the [illegible] of the RCS the RCS pressure cannot respond any quicker than the pressurizer heaters can heat the

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old in the now pushed back into the pressurizer.
[illegible] the H.P.I system on after Pressurizer level indication
is locked high, will result in the RCS pressure
increasing and eventually hydroing the RCS when
it becomes solid. If this is the intent of your letter
and the thoughts behind it, then the operators are not
taught to hydro the RCS everytime the HPI pumps
are initiated.

If you intend to go solid what about problems with
[illegible] mechanics. Also will the Code and electromagnetic
valves relief water (via steam) at significant flowrates
to keep the RCS from being hydroed.

CC. R. J. FINNIN

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EXHIBIT 3
Page 1 of 2

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

THREE MILE ISLAND COMMISSION
EXHIBIT NO. 3
DATE July 18-20, 1979
WITNESS

To: Jim Taylor, Manager, Licensing

From: Bert M. Dunn, Manager, ECCS Analysis (2138) Bert M. Dunn

Cust.

BOS 661.5

File No. or Ref.

Subj.: Operator Interruption of High Pressure Injection

Date: February 9, 1978

This letter to cover one customer and one record only.

This memo addresses a serious concern within ECCS Analysis about the potential for operator action to terminate high pressure injection following the initial stage of a LOCA. Successful ECCS operation during small breaks depends on the accumulated reactor coolant system inventory as well as the ECCS injection rate. As such, it is mandatory that full injection flow be maintained from the point of emergency safety features actuation system (ESFAS) actuation until the high pressure injection rate can fully compensate for the reactor heat load. As the injection rate depends on the reactor coolant system pressure, the time at which a compensating match-up occurs is variable and cannot be specified as a fixed number. It is quite possible, for example, that the high pressure injection may successfully match up with all heat sources at time t and that due to system pressurization be inadequate at some later time t_2.

The direct concern here rose out of the recent incident at Toledo. During the accident the operator terminated high pressure injection due to an apparent system recovery indicated by high level within the pressurizer. This action would have been acceptable only after the primary system had been in a subcooled state. Analysis of the data from the transient currently indicates that the system was in a two-phase state and as such did not contain sufficient capacity to allow high pressure injection termination. This became evident at some 20 to 30 minutes following termination of injection when the pressurizer level again collapsed and injection had to be reinitiated. During the 20 to 30 minutes of noninjection flow they were continuously losing important fluid inventory even though the pressurizer indicated high level. I believe it fortunate that Toledo was at an extremely low power and extremely low burnup. Had this event occurred in a reactor at full power with other than insignificant burnup it is quite possible, perhaps probable, that core uncovery and possible fuel damage would have resulted.

The incident points out that we have not supplied sufficient information to reactor operators in the area of recovery from LOCA. The following rule is based on an attempt to allow termination of high pressure injection only at a time when the reactor coolant system is in a subcooled state and the pressurizer is indicating at least a normal level for small breaks. Such conditions guarantee full system capacity and thus assure that during any follow on transient would be no worse than the initial accident. I, therefore, recommend that operating procedures be written to allow for termination of high pressure injection under the following two conditions only:

1. Low pressure injection has been actuated and is flowing at a rate in excess of the high pressure injection capability and that situation has been stable for a period of time (10 minutes).

2. System pressure has recovered to normal operating pressure (2200 or 2250 psig) and system temperature within the hot leg is less than or equal to the normal operating condition (605°F or 620°F).

I believe this is a very serious matter and deserves our prompt attention and correction.

BMD/lc

cc: E.W. Swanson
D.H. Roy
B.A. Karrasch
H.A. Bailey
J. Kelly
Z.R. Kane
J.D. Agar
R.L. Pittman
J.D. Phinny
T. Scott

EXHIBIT 4
Page 1 of 1

HE BABCOCK & WILCOX COMPANY
[illegible] GENERATION GROUP

THREE MILE ISLAND COMMISSION
4
July 18-20, 1979

o

Jim Taylor, Manager, Licensing

rom

Bert M. Dunn, Manager, ECCS Analysis (2133)

BOS 663-5

ust.

File No.
or Ref.

ubj.

Operator Interruption of High Pressure Injection

Date

February 16, 1978

This letter to cover one customer and one subject only.

In review of my earlier memo on this subject, dated February 9, 1978, Field Service has recommended the following procedure for terminating high pressure injection following a LOCA.

1. Low pressure injection has been actuated and is flowing at a rate in excess of the high pressure injection capability and that situation has been stable for a period of time (10 minutes). Same as previously stated.

2. At X minutes following the initiation of high press re injection, termination is allowed provided the hot leg temperature ind cation plus appropriate instrument error is more than 50°F below the saturation temperature corresponding to the reactor coolant system pressure less instrument error. X is a time lag to prevent the termination of the high pressure injection immediately following its initiation. It requires further work to define its specific value, but it is probable that 10 minutes will be adequate. The need for the delay is that normal operating conditions are within the above criteria and thus it is conceivable that the high pressure injection would be terminated during the initial phase of a small LOCA.

I find that this scheme is acceptable from the standpoint of preventing adverse long range problems and is easier to implement. Therefore, I wish to modify the procedure requested in my first memo to the one identified here.

cc: E.W. Swenson
D.H. Roy
B.A. Karrasch
E.A. Bailey
J. Kelly
E.R. Kane
J.D. Agar
R.L. Pittman
J.D. Phinny
T. Scott
R. Dawes

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EXHIBIT 5
Page 1 of 1

BABCOCK & WILCOX COMPANY
R GENERATION GROUP

[illegible] COMMISSION
5
July 18-20, 1979

cc: E. R. Kane
J. D. Phinney
B. W. Street
B. M. Dunn
J. F. Walters

B. A. Karrasch, Manager, Plant Integration

D. F. Hallman, Manager, Plant Performance Services Section (1149)

BDS 663-5

File No.
or Ref.

Date

Operator Interruption of High Pressure Injection (HPI)

August 3, 1978

This letter to cover one customer and one subject only.

References: (1) B. M. Dunn to J. Taylor, same subject, February 9, 1978.
(2) B. M. Dunn to J. Taylor, same subject, February 16, 1978.

References 1 and 2 (attached) recommend a change in B&W's philosophy for HPI system use during low-pressure transients. Basically, they recommend leaving the HPI pumps on, once HPI has been initiated, until it can be determined that the hot leg temperature is more than 50°F below T_{sat} for the RCS pressure.

Nuclear Service believes this mode can cause the RCS (including the pressurizer) to go solid. The pressurizer reliefs will lift, with a water surge through the discharge piping into the quench tank.

We believe the following incidents should be evaluated:

1. If the pressurizer goes solid with one or more HPI pumps continuing to operate, would there be a pressure spike before the reliefs open which could cause damage to the RCS?

2. What damage would the water surge through the relief valve discharge piping and quench tank cause?

To date, Nuclear Service has not notified our operating plants to change HPI policy consistent with References 1 and 2 because of our above-stated questions. Yet, the references suggest the possibility of uncovering the core if present HPI policy is continued.

We request that Integration resolve the issue of how the HPI system should be used. We are available to help as needed.

D F Hallman

D. F. Hallman

DFH/fch
Attachments

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SITE INSTRUCTION NO. 35 — EXHIBIT 6 Page 1 of 2

DISTRIBUTION 3, 4, 5, 7, 8, 9 — 7/301 8/115

RESPONSE REQ'D FROM All

APPROVED [signature] for JOH

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

To: DISTRIBUTION

From: G.T. FAIRBURN, SERVICE MANAGER [signature]

Cust.: DPC, MET ED, FPC, AP&L, SMUD, & TECO

File No. or Ref.: T 3.35

Subj.: SUPPLEMENTARY OPERATING INSTRUCTIONS FOR HPI SYSTEM

Date: APRIL 4, 1979

This letter to cover one customer and one subject only.

THREE MILE ISLAND COMMISSION
HEARING EXHIBIT # 6
DATE July 18-20, 1979
WITNESS

DISTRIBUTION

CD RUSSELL
RC LUKEN
JT JANIS
GT FAIRBURN

The following information has been reviewed and approved for transmittal to your customer. Please advise your customer by telecon that this is being forwarded and then telecopy information.

"Although details of the causes and course of events of the incident at Metropolitan Edison's TMI-2 plant on March 28, 1979 are still being developed, it appears that the incident was initiated by a loss-of-main feedwater flow (LOFW) and that a distinguishing characteristic of this transient compared to other previous LOFW transients was the securing of the High Pressure Injection (HPI) system. Consequently, all operating plants are advised to implement the following immediately:

If the HPI system has actuated because of low pressure condition, it must remain in operation until either:

1. Both LPI pumps are in operation and flowing at a rate in excess of 1000 gpm each and the situation has been stable for 20 minutes.

OR

2. The HPI system has been in operation for 20 minutes and all hot and cold leg temperatures are at least 50° below the saturation temperature for the existing RCS pressure. If 50° subcooling cannot be maintained, the HPI shall be reactivated.

If the HPI system has been activated and if RC pumps are in operation, at least one RCP pump per loop should be maintained."

GTF/hh

cc: GJ Brazill, JH Taylor, CE Mahaney, EJ Domaleski, DC Winterich, RL Boyer, WS Delicate, KR Ellison, JR Bohart, JA Lind, RL Pittman, Central Files

REVIEWED FOR ACCURACY
ENGINEERING: [signature] DATE: 4/4/79
NUCLEAR SERVICE: [signature] DATE: 4/4/79

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EXHIBIT 6
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Babcock & Wilcox

Power Generation Group

P.O. Box 1260, Lynchburg, Va. 24505
Telephone: (804) 384-5111

April 4, 1979
TMI-79-47

Mr. G. P. Miller
Station Superintendent
Metropolitan Edison Company
P.O. Box 480
Middletown, PA 17057

Subject: Three Mile Island Nuclear Generating Station - Unit 1
TMI-2 Loss of Feedwater Transient

Dear Mr. Miller:

Although details of the causes and course of events of the incident at Metropolitan Edison's TMI-2 plant on March 28, 1979 are still being developed, it appears that the incident was initiated by a loss-of-main feedwater flow (LOFW) and that a distinguishing characteristic of this transient compared to other previous LOFW transients was the securing of the High Pressure Injection (HPI) system. Consequently, all operating plants are advised to implement the following immediately:

If the HPI system has actuated because of low pressure condition, it must remain in operation until either:

1. Both LPI pumps are in operation and flowing at a rate in excess of 1000 GPM each and the situation has been stable for 20 minutes.

OR

2. The HPI system has been in operation for 20 minutes and all hot and cold leg temperatures are at least 50° below the saturation temperature for the existing RCS pressure. If 50° subcooling cannot be maintained, the HPI shall be reactivated.

If the HPI system has been activated and if RC pumps are in operation, at least one RCP pump per loop should be maintained.

This information supplements that previously transmitted. If you have any questions regarding this advisory, please advise.

Very truly yours,

G. T. Fairburn
Service Manager

GTF/hh
cc: RM Klingaman
JF Hilbish
LL Lawyer
JL Seelinger
CR Montgomery
LC Rogers
SL Smith

bcc: JD Phinney
RL Pittman
TM Dixens
GM Olds
HA Bailey
Record Ctr. NSS-5

486 235

T1.2

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

EXHIBIT 7
Page 194

SITE INSTRUCTION NO. 11/11:

DISTRIBUTION

To
R. E. HAM/G. T. FAIRBURN, NUCLEAR SERVICE

RESPONSE REQ'D FROM

From
G. J. BRAZILL, PLANT INTEGRATION

APPROVED

Cust.
DPC, MET ED, FPC, AP&L, SMUD, TECo

File No. or Ref.
T3.35

Subj.
SUPPLEMENTARY OPERATING INSTRUCTIONS FOR HPI

Date
APRIL 17, 1979

This letter to cover one customer and one subject only.

RE: G. T. FAIRBURN TO DISTRIBUTION, SAME SUBJECT, T3.35, APRIL 4, 1979.

THE OPERATING INSTRUCTIONS, GIVEN IN THE ABOVE REFERENCE, FOR OPERATOR ACTION TO OVERRIDE THE ENGINEERING SAFETY FEATURES ACTUATION SYSTEM AND TERMINATE HPI HAVE BEEN REVISED.

THIS REVISION (ATTACHED) ALLOWS THE OPERATOR AN ALTERNATIVE TO THE 20 MINUTE OPERABILITY PERIOD, UNDER CERTAIN CONDITIONS, TO PRECLUDE THE PRESSURIZER FROM GOING SOLID. PLEASE REVIEW AND TRANSMIT THESE REVISED INSTRUCTIONS TO ALL AFFECTED B&W CUSTOMERS.

ENGINEERING DEPARTMENT REVIEW & APPROVAL

THREE MILE ISLAND COMMISSION EXHIBIT: 7
DATE July 18-20, 1979
WITNESS

B. M. DUNN, UNIT MANAGER, ECCS — DATE 4/17/79

E. A. WOMACK, MANAGER, PLANT DESIGN — DATE 4/17/79

REVIEWED FOR ACCURACY — D. H. ROY, MANAGER, ENGINEERING DEPT. — 4/17/79 DATE

ENGINEERING: DATE: 4/17/79
NAR SERVICE: DATE: 4/17/79

J. FINNIN, LICENSING — DATE 4/17/79

LRC:ah
Attach
cc: L. R. Curtin
B. M. Dunn
N. S. Elliott
R. J. Finnin
D. F. Hallman
R. E. Kosiba
D. W. Labelle
D. H. Roy
E. W. Swanson
J. H. Taylor
R. W. Winks
E. A. Womack

SUPPLEMENTAL OPERATING INSTRUCTIONS
FOR HPI SYSTEM OPERATION

ALTHOUGH DETAILS OF THE CAUSES AND COURSE OF EVENTS OF THE INCIDENT AT METROPOLITAN EDISON'S TMI-2 PLANT ON MARCH 28, 1979 ARE STILL BEING DEVELOPED, IT APPEARS THAT THE INCIDENT WAS INITIATED BY A LOSS-OF-MAIN FEEDWATER FLOW (LOFW) AND THAT A DISTINGUISHING CHARACTERISTIC OF THIS TRANSIENT COMPARED TO OTHER PREVIOUS LOFW TRANSIENTS WAS THE SECURING OF THE HIGH PRESSURE INJECTION (HPI) SYSTEM. CONSEQUENTLY, ALL OPERATING PLANTS ARE ADVISED TO IMPLEMENT THE FOLLOWING IMMEDIATELY:

IF THE HPI SYSTEM HAS ACTUATED BECAUSE OF LOW PRESSURE CONDITION, IT MUST REMAIN IN OPERATION UNTIL ONE OF THE FOLLOWING CRITERIA IS SATISFIED:

1. BOTH LPI PUMPS ARE IN OPERATION AND FLOWING AT A RATE IN EXCESS OF 1000 GPM EACH AND THE SITUATION HAS BEEN STABLE FOR 20 MINUTES.

OR

2. THE HPI SYSTEM HAS BEEN IN OPERATION FOR 20 MINUTES AND ALL HOT AND COLD LEG TEMPERATURES ARE AT LEAST 50° BELOW THE SATURATION TEMPERATURE FOR THE EXISTING RCS PRESSURE. IF 50° SUBCOOLING CANNOT BE MAINTAINED, THE HPI SHALL BE REACTIVATED.

OR

3. ALL HOT AND COLD LEG TEMPERATURES ARE AT LEAST 50° BELOW THE SATURATION TEMPERATURE FOR THE EXISTING RCS PRESSURE, AT LEAST ONE RC PUMP IN EACH LOOP IS RUNNING, AND THE ACTION IS NECESSARY TO PREVENT THE INDICATED PRESSURIZER LEVEL FROM GOING OFF-SCALE HIGH. IF 50° SUBCOOLING CANNOT BE MAINTAINED, THE HPI SHALL BE REACTIVATED.

IF THE HPI SYSTEM HAS BEEN ACTIVATED AND IF RC PUMPS ARE IN OPERATION, AT LEAST ONE RCP PUMP PER LOOP SHOULD BE MAINTAINED.

EXHIBIT 7
Page 3 of 4

Babcock & Wilcox

Power Generation Group

P.O. Box 1260, Lynchburg, Va. 24505
Telephone: (804) 384-5111

April 18, 1979
TMI-79-56

Mr. G. P. Miller
Station Superintendent
Metropolitan Edison Company
P.O. Box 480
Middletown, PA 17057

Subject: Three Mile Island Nuclear Generating Station - Unit 1
HPI - Operating Instructions

Reference: Letter, GT Fairburn to GP Miller, TMI-79-47, dated 4/4/79

Dear Mr. Miller:

The operating instructions, given in the above reference, for operator action to override the engineering safety features actuation system and terminate HPI have been revised. This revision (attached) allows the operator an alternative to the 20 minute operability period, under certain conditions, to preclude the pressurizer from going solid.

This information supplements that previously transmitted. If you have any questions regarding this advisory, please advise.

Very truly yours,

G. T. Fairburn
Service Manager

GTF/hh
Attachment

cc: w/attachment
RM Klingaman
JF Hilbish
LL Lawyer
JL Seelinger
CR Montgomery
LC Rogers
SL Smith

bcc: GM Olds
JD Phinney
Record Ctr. NSS-5/T1.2

EXHIBIT 7
page 4 of 4

SUPPLEMENTAL OPERATING INSTRUCTIONS

FOR HPI SYSTEM OPERATION

REV. 01 - 4/17/79

Although details of the causes and course of events of the incident at Metropolitan Edison's TMI-2 plant on March 28, 1979 are still being developed, it appears that the incident was initiated by a loss-of-main feedwater flow (LOFW) and that a distinguishing characteristic of this transient compared to other previous LOFW transients was the securing of the high pressure injection (HPI) system. Consequently, all operating plants are advised to implement the following immediately:

If the HPI system has actuated because of low pressure condition, it must remain in operation until one of the following criteria is satisfied:

1. Both LPI pumps are in operation and flowing at a rate in excess of 1000 gpm each and the situation has been stable for 20 minutes.

OR

2. The HPI system has been in operation for 20 minutes and all hot and cold leg temperatures are at least 50° below the saturation temperature for the existing RCS pressure. If 50° subcooling cannot be maintained, the HPI shall be reactivated.

OR

3. All hot and cold leg temperatures are at least 50° below the saturation temperature for the existing RCS pressure, at least one RC pump in each loop is running, and the action is necessary to prevent the indicated pressurizer level from going off-scale high. If 50° subcooling cannot be maintained, the HPI shall be reactivated.

If the HPI system has been activated and if RC pumps are in operation, at least one RC pump per loop should be maintained.

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

EXHIBIT 8
page 1 of 8

APPEAL BOARD EXHIBIT
DATE July 18-20, 1979
WITNESS

BDS 6613

To: Distribution

From: J. T. Willse, Licensing (2208) JTW

Cust.: Toledo

File No. or Ref: T4.2.3

Subj.: Loss of Pressurizer Level Indication

Date: March 9, 1979

This letter is cover one customer and one revised copy.

Distribution:

R. L. Reed
R. C. Luken
J. T. Janis
G. T. Fairburn
C. D. Russell
J. H. Taylor
E. R. Kane
R. W. Winks
L. R. Cartin
E. A. Womack
D. Mars
J. O. Howard
J. D. Agar
F. R. Faist

A meeting to discuss the loss of pressurizer level indication at DB-1 was convened February 14, 1979 at the B&W offices in Lynchburg. Those in attendance were:

J. E. Kohler	NRC Region III
J. H. Foster	NRC Region III
D. Anderson	NRC/OIE/LCVIP
Sushil Jain	Toledo Edison
J. F. Hilbish	Metropolitan Edison
R. A. Dietrich	SMUD
M. D. White	Arkansas
J. T. Enos	Arkansas
E. R. Kane	B&W
R. C. Luken	"
S. H. Klein	"
F. R. Faist	"
B. M. Dunn	"
L. R. Cartin	"
R. W. Winks	"
J. T. Willse	"

This meeting was requested by the Region III inspectors. The purpose of this meeting was thought to be to discuss the loss of pressurizer level indication on all B&W plants. The utilities were present to discuss incidences where loss of level indication occurred at their plants.

Mr. Foster of the NRC opened the meeting by stating that the purpose of this meeting was to investigate an allegation by an NRC inspector that B&W had not responded in a timely manner to resolve the loss of pressurizer level indication concern at DB-1. He apologized to the utilities for his method of requesting information from them; not realizing that the utilities would feel compelled to send

representatives to this meeting. Mr. Foster next asked the utilities to respond to the questions he had submitted (letter attached). The questions were:

(1) What previous experience of loss of pressurizer level have occurred?
(2) The facility where the event(s) were experienced.
(3) The dates of occurrence.
(4) Whether the NRC was informed of the event.
(5) What evaluation of the event was performed?

Duke Power and Florida Power did not send a representative to the meeting because they have not experienced a loss of pressurizer level indication.

Mr. Hilbish stated that TMI #1 had not experienced any loss of pressurizer level indication. TMI #2 had two such events (4/25/78 & 11/7/78) both of which were reported to the NRC in LER's. Both of these events were thoroughly evaluated.

Mr. Enos stated that ANO-1 had experienced 2 transients during which pressurizer level indication had been lost. Neither event had been officially reported to the NRC although their inspectors were aware of both events. Both events were evaluated by B&W and the ANO safety committee. As a result of those evaluations ANO believes that loss of pressurizer level indication is only as operational inconvenience and that RC pressurizer is sufficient to determine if the pressurizer has gone "dry".

Mr. Dieterich acknowledged that SMUD has had approximately 38 trips during which loss of level indication occurred on 5 to 10 of those transients. These events were not officially reported to the NRC although their inspectors were aware of the loss of pressurizer level indication. SMUD also had experienced two rapid cooldown transients during which pressurizer level indication was lost, these transients were evaluated and reported to the NRC.

Mr. Jain described the one transient where loss of level indication had occurred at Toledo. This transient was evaluated and reported to the NRC in an LER. He further described the discussions that had occurred between Toledo, the NRC, and B&W. The remainder of the morning was spent discussing the consequences of loss of level indication, the differences between DB-1 and the other B&W plants, and the dual level set point for the steam generator at Toledo.

Mr. Foster closed the morning meeting by thanking the utilities for their cooperation. He stated that as far as he was concerned loss of pressurizer level indication was merely an operational inconvenience and that the loss of pressurizer level was not a safety concern. He was recommending that this issue be closed. He agreed to send copies of his report to all utilities in attendance.

Messrs. Foster and Kohler spent most of the afternoon reviewing the Toledo correspondence file pertaining to the overcooling transient. As a result of this review and the morning discussions Messrs. Foster and Kohler were convinced that B&W had responded in a manner consistent with the magnitude of the problem.

Mr. Foster summarized the days meeting by stating that he believed B&W had been exonerated of the charge that they had not responded in a timely manner, that the loss of pressurizer level indication was only an operational inconvenience, and that the loss of pressurizer level was not a safety concern. The only item that remained open was a review of the DB-1 operating instructions to insure that Toledo was operating the plant in the manner prescribed by B&W.

Copies of Arkansas, SMUD and Met. Ed. written responses to the NRC questions are attached.

JTW/fw
Attachment

EXHIBIT B
page 4 of 8

METROPOLITAN EDISON COMPANY . A SUBSIDIARY OF GENERAL PUBLIC UTILITIES CORPORATION

POST OFFICE BOX 542 READING, PENNSYLVANIA 19603 TELEPHONE 215 - 929-3601

February 8, 1979
GQL 0200

Mr. Joel T. Janis
Service Manager
Babcock & Wilcox
P.O. Box 1260
Lynchburg, Virginia 24505

Dear Mr. Janis:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Loss of Pressurizer Level Indication

In response to your letter of February 2, 1979 concerning loss of pressurizer level indication, the following answers to the questions referenced in the NRC letter of January 31, 1979 are provided:

1. Two occurrences have taken place following reactor trips which resulted in loss of pressurizer level indication.

2. Metropolitan Edison Company

3. Three Mile Island, Unit 2

4. a. April 28, 1978

   b. November 7, 1978

5. Yes - a. Inspection Report 78-17, dated May 31, 1978
   LER 78-033/1T, dated May 8, 1978
   Special Report, dated July 24, 1978

   b. Inspection Report 78-23, dated November 30, 1978
   Special Report 78-65/99X, dated January 30, 1979

6. Following each of these two events an evaluation was made to determine the effect on the Reactor Coolant System.

   a. In the April 28, 1978 event, although the pressurizer level indication had gone below zero, evaluations demonstrate that the core remained covered throughout the transient.

EXHIBIT 8
page 5 of 8.

b. In the November 7, 1978 event, although the pressurizer level indication had gone below zero, a volume of 840 gallons of water remained in the pressurizer. The core remained covered throughout the transient.

No events concerning loss of pressurizer level indication have occurred at Three Mile Island Unit 1 during operation.

As currently scheduled, I will attend the strategy meeting on Tuesday, February 13, 1979 at Lynchburg.

Sincerely,

L. W. Hurding

for J. F. Eilbish
Supervisor-Generation Licensing

JFE:LWH:tas

EXHIBIT 8
page 698

February 9, 1979

8.12 79 FB

Mr. J. T. Janis
Service Manager
Babcock and Wilcox Company
P. O. Box 1260
Lynchburg, Virginia 24505

Rancho Seco Nuclear Generating
Station, Unit No. 1
Loss of Pressurizer Level Indication

Dear Mr. Janis:

Your letter of February 2, 1979 requested information concerning the loss of pressurizer level indication at Rancho Seco Unit 1. Our design incorporates three separate level transmitters making it highly improbable for us to experience a loss of level indication due to instrument malfunction.

Direct readout of pressurizer level was lost during the loss of non-nuclear instrumentation power and resulting transient on March 20, 1978. During this event, the power to the indicator was lost; however, a computer readout provided level information to the control room operators.

It is also possible for the pressurizer level to fall below the bottom level tap for short periods during the cooldown following a reactor trip. 2,000 gallons of water still remain in the pressurizer at this point however, and initiation of high pressure injection returns the level to the instrument range. Details of these transients can be provided during our meeting with you in Lynchburg on February 13, 1979. Since a large volume of water remains, and the reactor is subcritical during these conditions, the District does not consider this an item with safety significance.

Sincerely yours,

D. B. Keesch, Manager
Generation Engineering Department

EXHIBIT 8
Page 798

ARKANSAS POWER & LIGHT COMPANY

February 20, 1979

DONALD A. RUETER
DIRECTOR
TECHNICAL AND
ENVIRONMENTAL SERVICES

NDC 8770

Mr. Ray Luken, Service Manager
Babcock & Wilcox Company
Nuclear Power Generation Division
P. O. Box 1260
Lynchburg, Virginia 24505

Subject: Pressurizer Level Indication
(File: 3740)

Gentlemen:

The following is provided in response to your letter of February 2, 1979 (ANO-79-13).

Item 1: What previous experiences of loss of pressurizer level have occurred?

Response: ANO-1 has never lost pressurizer level due to normal operational transients. We have, on a few occasions, lost pressurizer indication; however, pressurizer level was maintained in each instance.

Item 2. The name of the involved utility for these events.

Response: Arkansas Power and Light Company.

Item 3. The facility where the event(s) were experienced.

Response: Arkansas Nuclear One - Unit One.

Item 4. The dates of occurrence.

Response: Specific dates are not readily available. They were in late 1974 and 1975.

Item 5. Whether the NRC was informed of the event.

Response: NRC was not formally informed, however at least two Region IV inspectors were aware of the occurrences.

EXHIBIT O
page 8 of 8

Item 6: What evaluation of the event was performed?

Response. The occurrences were related in detail by the Plant Safety Committee (PSC), Safety Review Committee (SRC) and B&W. The conclusion of the reviews (to the satisfaction of the I&E inspectors) was that the occurrences were not of safety significance and that the public health and safety was not endangered.

If we can be of further assistance, please contact us.

Very truly yours,

Donald A. Rueter

DAR:JTE:vb

cc: Messrs. M. L. Pendergrass
R. D. Lane
J. S. Grisham
W. C. Phillips
B. A. Tenwilliger
J. Griffin
J. O'Hanlon

Babcock & Wilcox

B&W Memo 7/19/79
7:30 P.M.

EXHIBIT 9
page 1 of 9

Michelson Story Comments

C. Michelson, of TVA, provided B&W with a critique of small breaks for the B&W RCS in May of 1978. Also a follow up letter was provided in February of 1979. In these critiques Mr. Michelson makes the following major points.

1. The HPI may bypass the reactor core and exit the RCS directly via the break thus not providing core cooling.

2. The steam generator must remove significant portion of the decay heat for certain sizes of small breaks.

3. Pressurizer level is not a measure of RCS liquid inventory.

4. In later parts of the analysis the heat source effects on the steam generator must be included in the analysis.

5. Natural circulation may be interrupted by formation of voids in primary system and if natural circulation

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is terminated repressurization will occur before loop draining sufficient to establish steam condensation.

In addressing these points it is important to note that the criticism and concerns raised by Mr. Michelson are based on the assumption that the RC pumps are tripped or not pumping. The discussion here relates to pumps off. B&W has performed analyses with pumps on and off in order to determine the worst case. Although significantly different results are obtained between pumps on and off and system performance is very different the pumps off case is the worst condition.

All of Mr. Michelson's concerns are included in B&W evaluation model results.

2) For smaller breaks the steam generator must remove a significant portion of decay heat. The limit between a small break and a large break is the point at which all energy must be removed by the steam generator. This definition is effectively made in our analysis.

3) Pressurizer level is not a good indicator of primary liquid inventory. No operator action should be based on that signal alone. It is quite possible to have a smaller break causing a slow loss of RC inventory and water drop out of the core while maintaining a full pressurizer if HPI is terminated prematurely. The only positive indication that

Key the points we include the effects as follows.

1) Because HPI may bypass the core B&W chose break location to maximize that possibility. All breaks are modeled at the R.C. pump discharge between the HPI injection points and the reactor vessel. Water injected in the broken cold leg runs directly at the break. Water injected in the intact legs can bypass by entering the downcomer and flowing out the break via the broken cold leg prior to flowing through the core. The point is well made and has been allowed for in our analysis

EXHIBIT 5/1 9
Page 5 of 9

liquid inventory is a subcooled indication on all RCS pressure and temperature indicators except those in the pressurizer.

4) The heat contained in the steam generators severely alters the course of events for those breaks large enough to depressurize below the control pressure for the steam generators. This source exists and is considered in our analyses.

5) Natural circulation will be interrupted during the small break; a repressurization is probable for smaller breaks and it would be shown in our evaluation. The only disagreement with Mr. Michelson is his inference

48625 2

that natural circulation ends when the vessel head starts putting steam into the hot leg. The escape ratio of steam and water is such that natural circulation will continue for a considerably longer period based on froth flow in the hot leg.

B & W provides bounding small break evaluations in its SAR material. The spectrum of evaluation is based on the following:

1) The CFT line accident,

2) one break for which LPI CFT and HPI help mitigate consequences.

3) one break for which only CFT and HPI help mitigate consequences,

4) one break which is solely dependent on HPI, and

5) additional breaks to confirm that the above have provided bounding evaluations.

Babcock & Wilcox

EXHIBIT 9
pg 7 of 9

From the very small leaks no evaluation is made for the following reasons.

1) Because of the vent valves and the once through nature of the steam generator steam condensation in the generator occurs before the reactor core is uncovered.

2) If ~~steam~~ steam condensation is happening the RCS pressure will be at or around 1200 psi.

3) The existing larger leaks (HPI only mitigating system) arrive at lower system inventory and 1200 psia earlier and at higher decay heat levels. ~~[illegible]~~ This evaluation showed that at this time 1 HPI prevented core uncovery.

4) At the [illegible]

POOR ORIGINAL

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also be able to prevent core uncovery because decay heat levels are lower.

5) System superpressurization to code safeties is expected and of no known consequence. This condition and possible system oscillations during transition to code safeties pose no safety concerns. The condition can be avoided if desired by:

1) increasing steam generator levels and depressurizing the generators.

2) bumping or starting and RC pumps to mix primary steam with cold water, and

3) transition to decay heat removal system.

EXHIBIT 9

However, the operator has at page 9 of 9 Section 2 have a note of the BWST and core recirculation from the sump even after that so there is no concern about operating on the wide safeties.

Mr. Michelson addresses some 29 other issues in his report. Discussion of each issue would require extensive interchange and be best accomplished in an open and limited scope meeting. We believe allowance has been made for each of these issues within our design and design verification. The report is well thought out and although confrontation may exist on some minor points, it describes fairly well the course of events during very small breaks.

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