TRANSCRIPT OF PROCEEDINGS

PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND

PUBLIC HEARING

THURSDAY,
JULY 19, 1979

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THURSDAY,
JULY 19, 1979

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

The hearing was convened pursuant to notice at 10:11 a.m.

John G. Kemeny, Chairman, presiding.

PARTICIPANTS:

John G. Kemeny
President of Dartmouth College

Bruce Babbitt
Governor of Arizona

Patrick E. Haggerty
Retired President
Texas Instruments

Carolyn Lewis
Associate Professor of Journalism
Graduate School of Journalism
Columbia University

Paul E. Marks
Vice President
Health Sciences
Columbia University

Cora B. Marrett
Associate Professor of Sociology
University of Wisconsin

Lloyd McBride
President
United Steelworkers of America

PARTICIPANTS: (continued)

Harry McPherson
Attorney

Russell Peterson
President of Audubon Society

Thomas Pigford
Professor and Chairman
Department of Nuclear Engineering
University of California at Berkeley

Theodore Taylor
Professor of Aerospace and Mechanical Science
Princeton University

Anne Trunk
Resident of Middletown, Pennsylvania

STAFF:

Stanley Gorinson
Kevin Kane
Win Rockwell
Barbara Jorgenson

George L. Edgar
B&W Representative

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PROCEEDINGS

CHAIRMAN KEMENY: Please come to order. Will the Chief Counsel please swear in the next witness?

Whereupon,

JAMES H. TAYLOR

was called as a witness and, after being first duly sworn, was examined and testified as follows:

CHAIRMAN KEMENY: Could I ask you please to state your full name and your current position within Babcock & Wilcox?

MR. TAYLOR: My name is James H. Taylor. I am Manager of Licensing in Babock & Wilcox Nuclear Power Generation Division.

CHAIRMAN KEMENY: Thank you. Chief Counsel?

MR. GORINSON: Mr. Rockwell?

MR. ROCKWELL: Thank you. Mr. Taylor, the Licensing Section is in the Engineering Department of Babcock & Wilcox?

MR. TAYLOR: Yes, sir.

MR. ROCKWELL: And you head the Licensing Section? Is that correct?

MR. TAYLOR: Yes, I do.

MR. ROCKWELL: How long have you been with Babcock & Wilcox, Mr. Taylor?

MR. TAYLOR: Since 1954.

MR. ROCKWELL: Mr. Taylor, does Babcock & Wilcox have certain reporting obligations to the Nuclear Regulatory

Commission under the Commission's regulations?

MR. TAYLOR: Yes, they do.

MR. ROCKWELL: Is one of those reporting requirements known as 10CFR, Part 21?

MR. TAYLOR: Yes, sir.

MR. ROCKWELL: And is that a regulation published by the NRC?

MR. TAYLOR: Yes, sir.

MR. ROCKWELL: Could you explain to the Commission in lay terms the essential thrust of Part 21?

MR. TAYLOR: 10CFR21 is a regulation which became effective in January of 1978 in a formal manner. Its purpose is to provide a mechanism and to provide requirements for reporting of matters that could potentially be substantial safety hazards and, therefore, could lead to adverse effects on public health and safety. It is -- the spirit of 10CFR21 is to provide visibility for issues and to provide a mechanism whereby issues can be raised in a formal way and documented and that that procedure can then later be audited. The primary thrust of 10CFR21 is to provide visibility to potential safety issues and to provide a mechanism for them becoming known prior to turning into a real problem.

MR. ROCKWELL: Do you carry some of the responsibility within B&W for identifying which issues may be reportable under Part 21 to the Nuclear Regulatory Commission?

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MR. TAYLOR: Yes, I do.

MR. ROCKWELL: And do you have the primary responsibility in that area?

MR. TAYLOR: Yes, the final decision as far as reportability is mine.

MR. ROCKWELL: Is Babcock & Wilcox, Mr. Taylor, required to maintain a procedure in house for identifying issues which may potentially become reportable under Part 21?

MR. TAYLOR: Yes. That is part of the requirement of Part 21, to have a formal procedure.

MR. ROCKWELL: And does B&W have such a procedure?

MR. TAYLOR: Yes, they do.

MR. ROCKWELL: And what is that procedure called?

MR. TAYLOR: It is procedure for identifying preliminary safety concerns, the number of the procedure in our administrative manual is 1707-1.

MR. ROCKWELL: Who within Babcock & Wilcox administers that preliminary safety concern procedure?

MR. TAYLOR: May I ask for clarification?

MR. ROCKWELL: Sure.

MR. TAYLOR: Do you mean administers in terms of following up the process to determine whether the evaluations are taking place, keeping track of the preliminary safety concerns, and then ultimately determining reportability?

MR. ROCKWELL: Yes.

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MR. TAYLOR: I do. In the Licensing Section that is my responsibility.

MR. ROCKWELL: Could you describe, please, the mechanism that the in house safety concern procedure provides?

MR. TAYLOR: Yes. The procedure that I mentioned a moment ago, has an interpretation of the requirements of 10CFR21. It explains the requirements in terms which are more understandable to the engineer than perhaps the legal and formal requirements of 10CFR21 itself. When an individual has identified a concern which he believes is a potential safety concern, he is required to enter the procedure by filling out a form which we refer to, and was mentioned several times yesterday, as a PSC form. That form is sent to me. We then initiate an evaluation of the issue to determine whether or not it is significant; whether or not it is ultimately reportable. That evaluation involves a fairly wide distribution of people. And then the conclusion of the evaluation is ultimately concurred in by the Manager of Quality Insurance and the Manager of Integration. When an issue is determined to be reportable we then notify NRC -- there are proscribed locations where those notifications occur -- and that is the end of the procedure.

Now, the procedure, the notification of NRC sometimes requires follow-up work to fully understand the implications of the matter being reported. But that is in essence the description of the procedure.

MR. ROCKWELL: Mr. Taylor, on a day to day basis do you delegate the responsibility for following through the steps in that procedure to one of the people in your Section?

MR. TAYLOR: Yes, I do.

MR. ROCKWELL: And who is that?

MR. TAYLOR: That is Mr. Kane

MR. ROCKWELL: And is there a proscribed timetable for following through set out in the Babcock & Wilcox procedure?

MR. TAYLOR: Not according to the procedure; not formally in the procedure itself but we have an informal timetable which we use as a guideline.

MR. ROCKWELL: And would you tell us about that?

MR. TAYLOR: This is a measure that was taken a couple of years, or about a year and a half ago, where we decided that in order to place a little greater emphasis on the resolution of some of the issues that had been received through this procedure, that we would set a target for resolving 75 percent of the reported preliminary safety concerns in a period of 30 days.

MR. ROCKWELL: Once you set that informal target, did you find that you were successful in meeting it?

MR. TAYLOR: To a reasonable extent, yes.

MR. ROCKWELL: Do you have a tickler system which helps you focus on the tracking of individual reports on the preliminary safety concern form to make sure that they are being followed through on?

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MR. TAYLOR: Yes, of sorts.

MR. ROCKWELL: Would you describe that?

MR. TAYLOR: The man that I mentioned a moment ago, Mr. Kane, maintains in his office a board, a status board if you will, of each of the open PSC's stating what the issue was, what the date was that it was received, and where it stands.

MR. ROCKWELL: Do you personally follow through on some of the PSC's which come to you initially and then are put into the procedure and followed through on by Mr. Kane?

MR. TAYLOR: Yes, I do.

MR. ROCKWELL: How do you make a judgment as to which ones you personally follow up on?

MR. TAYLOR: The ones that I consider to be very important and particularly those which may have relationship to our operating plants.

MR. ROCKWELL: Was this in house procedure in effect in February of 1978?

MR. TAYLOR: Yes, it was.

MR. ROCKWELL: And had it been in effect for a number of years prior to that?

MR. TAYLOR: Yes, sir.

MR. ROCKWELL: Would it be fair to say, Mr. Taylor, that the filing of a preliminary safety concern form within your organization would be the first step toward a potential Part 21 report?

MR. TAYLOR: Yes but not universally true. It could -- that would be the general answer to the question. There are occasions when an issue will be raised in an informal way and the discussion will lead to the fact, well, we think that is a subject which really should be a candidate for the preliminary safety concern form and that that would then lead to a form being filed after the fact. But that usually is a very short time period between those kinds of discussions and filing the form. But the form is certainly an early part of the process in any event.

MR. ROCKWELL: Mr. Taylor, directing your attention to Commission Hearing Exhibit No. 3, would you review the exhibits in front of you and see if you have it? It is a memorandum from Mr. Taylor -- excuse me, from Mr. Dunn to yourself, dated February 9th, 1978.

MR. TAYLOR: Yes, I have it.

MR. ROCKWELL: You have it before you?

MR. TAYLOR: Yes, sir.

MR. ROCKWELL: Did you receive that at around the date which appears on that memorandum, February 9th, 1978?

MR. TAYLOR: Yes, I did.

MR. ROCKWELL: Did you read it?

MR. TAYLOR: Yes, I did.

MR. ROCKWELL: What was your reaction when you read it?

MR. TAYLOR: My reaction when I read it was that this was an issue which did not imply any inadequacy in the plant design. It was an issue which did not invalidate any of the analyses that had been performed in connection with our licensing activities; and that it was an issue which required some emphasis or clarification of operating instructions.

MR. ROCKWELL: Did you believe it was a procedural matter?

MR. TAYLOR: From the standpoint of operating procedures, yes.

MR. ROCKWELL: Did you arrive at the conclusion that the memorandum that Mr. Dunn addressed to you had been misdirected?

MR. TAYLOR: In the sense that the operating instructions that are issued to the plant do not originate in the Licensing Section, yes.

MR. ROCKWELL: Did you believe that the memorandum raised a concern about safety?

MR. TAYLOR: Yes, certainly.

MR. ROCKWELL: What did you do with the memorandum after you read it?

MR. TAYLOR: As I recall, I spoke within a few days that followed the memo to Mr. Kane and suggested, as I recall, that he talk to someone in the Nuclear Service Section.

MR. ROCKWELL: To you knowledge did he do that?

MR. TAYLOR: I believe he did, yes.

MR. ROCKWELL: Do you know that for a fact?

MR. TAYLOR: I don't know who he talked to but he has indicated to me that he did, yes.

MR. ROCKWELL: Did he tell you at the time that he had done it?

MR. TAYLOR: I don't recall whether he did but certainly the follow-up memo that came within the few days following this indicated to me that that communication was in the right channel and that operating instructions were in the process of being worked out.

MR. ROCKWELL: Was Mr. Dunn's memorandum that came to you around February 9th, 1978 put into the procedure that was then in existence at Babcock & Wilcox for handling preliminary safety concerns?

MR. TAYLOR: No, it was not.

MR. ROCKWELL: What happened after the February 9th memorandum to your knowledge? What was the next thing you knew that occurred?

MR. TAYLOR: The next thing was the writing of the second memorandum, which was the February 16th memorandum, again from Mr. Dunn to me indicating that there had been agreement reached between the Nuclear Services people and himself with regard to the content of the operating instructions clarification.

MR. ROCKWELL: And you received that memorandum?

MR. TAYLOR: Yes, I did.

MR. ROCKWELL: And you read it at the time?

MR. TAYLOR: Yes, I did.

MR. ROCKWELL: Did you ever delegate to anyone in your Section the responsibility for following up to see that action, in fact, took place?

MR. TAYLOR: Not that I recall.

MR. ROCKWELL: Did you personally ever follow up to see that action, in fact, took place?

MR. TAYLOR: No, sir. I was satisfied that it was occurring.

MR. ROCKWELL: From February 16th of 1978 until March 28th of 1979 did the subject ever come up again before you?

MR. TAYLOR: No, sir.

MR. ROCKWELL: Were B&W's untility customers ever notified of the issues raised in either of those two memoranda from the time they first came to your attention until March 28th of 1978?

MR. TAYLOR: To my knowledge, no.

MR. ROCKWELL: Excuse me, March 28th, 1979. I take it you felt when you read Mr. Dunn's memorandum that it did raise a safety issue?

MR. TAYLOR: Yes.

MR. ROCKWELL: Would it have been an appropriate subject for a PSC report or form?

MR. TAYLOR: Yes. There are no real restrictions on the kinds of subjects that can be entered into this process.

MR. ROCKWELL: Had it appeared on your desk, written on a PSC form instead of a memorandum form, would it have been put into the existing procedure for handling PSC's?

MR. TAYLOR: Certainly.

MR. ROCKWELL: If it had been put into that procedure how long do you think it would have taken for final action to have occurred?

MR. TAYLOR: That would be speculation on my part, but I would say that it most likely would have been less than three months.

MR. ROCKWELL: Mr. Taylor, you have indicated that it was your conclusion when Mr. Dunn's memorandum came to you that it was misdirected. If Mr. Dunn had simply typed his concerns on a PSC form instead of a memorandum form, and had you received it in a PSC form in February of 1978, would you then have felt that it was misdirected?

MR. TAYLOR: No. Not in the sense that the PSC form itself is supposed to come to me. This would not have changed my position with regard to what was required at the time and I was not particularly interested really in the procedure, the procedure for the form. And I don't think the matter of

whether this was a candidate for the PSC system really even entered my mind at the time. We have been dealing with safety issues much longer than Part 21 existed and this was a matter which required some action, some action was taken in what I believe to be a prompt period of time. That was what was required. But as far as the form being misdirected if it were on a PSC form, no, that would be proper. But what was required would have been the same in any event in my mind.

MR. ROCKWELL: As the administrator of the preliminary safety concern procedure within B&W, I take it you have a certain amount of authority to use your own judgment in how these things are handled. Is that correct?

MR. TAYLOR: Yes, sir.

MR. ROCKWELL: And in the exercise of that judgment would it be fair to say that you could have in February of 1978 when you read Mr. Dunn's memorandum, simply said, this, in effect, is a preliminary safety concern even though it is not on the right form? And that you could in the exercise of your judgment then put it into the preliminary safety concern procedure?

MR. TAYLOR: Yes, I could but I would like to clarify also that at the time that I read the memo I don't believe the procedure ever entered my mind -- the need for entering into a procedure. This was a safety issue which could be resolved very quickly and simply by changing an operating instruction or

emphasizing an operating instruction.

MR. ROCKWELL: Did you at the Licensing Section ever see to it that, in fact, the operating instruction was changed?

MR. TAYLOR: I did not follow up after the second memorandum from Mr. Dunn, no.

MR. ROCKWELL: Mr. Taylor, in light of the events at TMI-2, have you undertaken a look at the possibility of forming a safety review group within Babcock & Wilcox?

MR. TAYLOR: Yes, we have and we have done more than that also.

MR. ROCKWELL: First of all, could you tell us what is meant by the term safety review group?

MR. TAYLOR: This group would be a group of management personnel who would become involved in safety related issues as an independent group covering a diverse spectrum of organizations and technical backgrounds; and people whose responsibility would be to look over the entire organization on an audit or random sampling basis and determine whether appropriate attention and appropriate handling of safety issues really was occurring; and make recommendations for changes if they found inadequacies in the process. So it would be to examine all activities related to safety, not just those which are required by a particular regulation.

MR. ROCKWELL: At whose direction is the possibility of the formation of the safety review group being done? Or

being examined?

MR. TAYLOR: By, I believe primarily, Dr. Roy who is the Manager of the Engineering Department, and I suspect it also involved some conversation between he and Mr. MacMillan.

MR. ROCKWELL: And Mr. Roy is your immediate superior? Is that correct?

MR. TAYLOR: Yes, sir.

MR. ROCKWELL: Mr. Chairman, I have no further questions.

CHAIRMAN KEMENY: Thank you, Counsel.

Mr. Taylor, may I ask if there is some way you are classifying the subject matters of PSC forms? For example, do most of them deal with equipment issues?

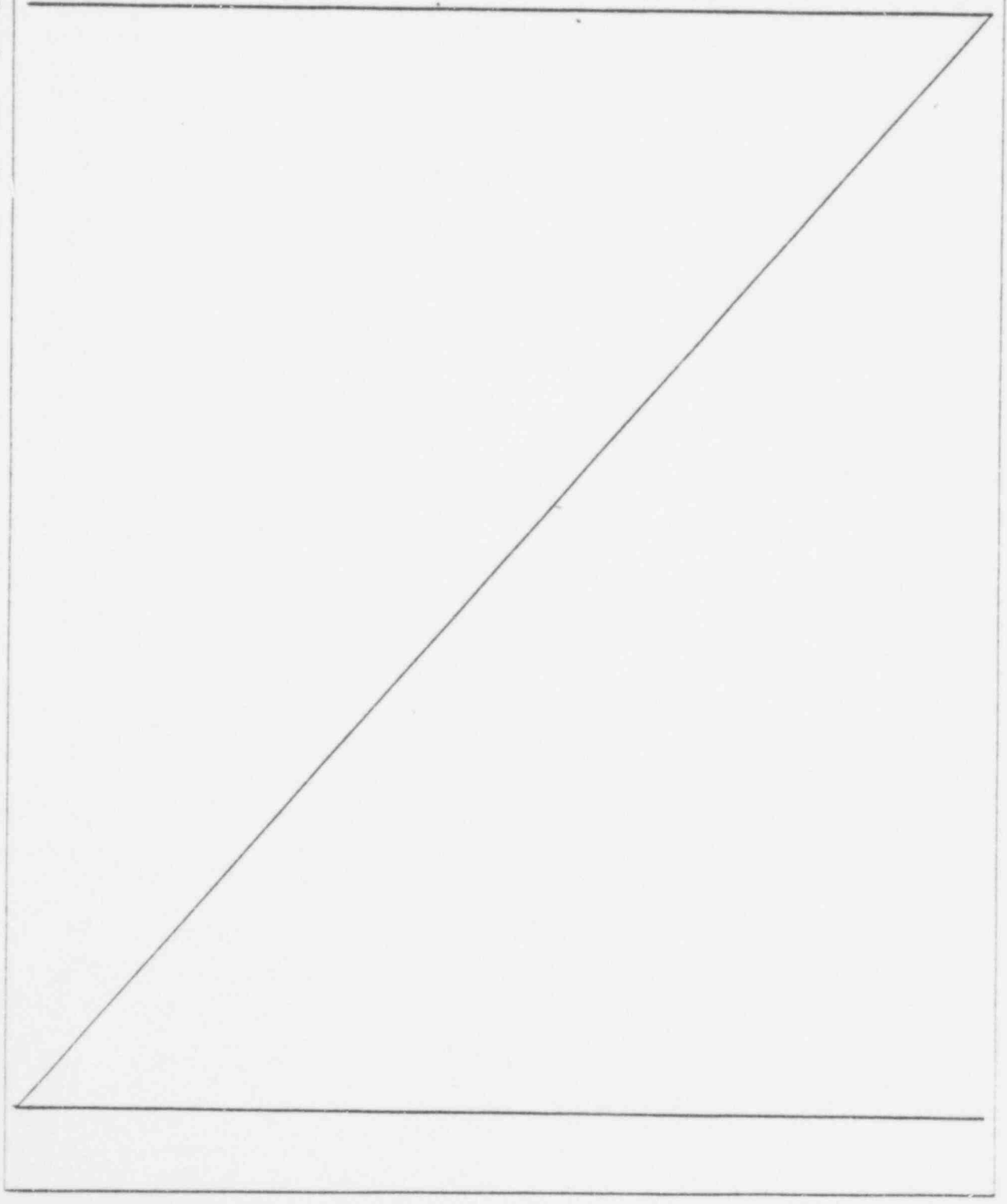
MR. TAYLOR: I don't think there is a good way to classify them in terms of the quantity of them that come in. And there is no limit really to the kinds of issues that can be addressed on a PSC form. We have received them and have handled them with hardware issues; with analytical issues; with structural matters, thermohydrolic matters; so it covers a broad spectrum of activities and there is really no limit to the kinds of issues that can be handled. However, I think as we go back and look at how 10CFR21 came into being, it certainly started with a very strong emphasis on construction testing, hardware oriented matters because its precursor was 10CFR21 -- I mean 10CFR50.55E whose primary interest, or primary emphasis

was on hardware and construction related matters. So as time has gone on, the scope of this particular procedure has been broadened. And that was certainly one of the things that 10CFR21 did. And as time has gone on, the diversity of the matters that have been handled has broadened also.

CHAIRMAN KEMENY: Mr. Taylor, how often would a PSC form have dealt with operator actions to the best of your recollection?

MR. TAYLOR: Very infrequently. There have been some I can think of one recent, well, recent within the past 18 months, preliminary safety concern which ultimately led to the need for some operator action changes but the original issue, which was a reportable item, the original issue was one where we had discovered an inadequacy in the analysis dealing with small breaks, by coincidence, and the corrective action -- this matter was reported to the NRC. As I mentioned earlier, there were a number of follow up evaluations which were required to fully resolve the matter to the Regulatory Commission's satisfaction. The ultimate action did involve a change in operating procedures but as an initiating event, or an initiating activity, the matters that deal with operating procedures have been very few. I think again, this reflects the changing emphasis in this matter of the procedures as it went from the beginning where there was a lot of emphasis on construction and testing and hardware. But I don't mean to convey the impression that that

same emphasis has been throughout the design organization. There has been attention to all of these matters, the matter of design, construction, testing, and operation, within the normal course of doing business; within the normal course of putting a power plant into service.



CHAIRMAN KEMENY: Would it be fair to say that the nature of the NRC regulation that you operate the system under is such that it tends to concentrate your attention on things that come out of design problems rather than operator actions?

MR. TAYLOR: I think that is a fair assessment. Yes.

CHAIRMAN KEMENY: Commissioner Haggerty.

COMMISSIONER HAGGERTY: I would like to clarify something. I believe -- at least I got the impression you said that you were not aware that the failure to act or failure to change procedures by Nuclear Services had occurred because you had assumed that action had taken after the second done memo.

MR. TAYLOR: Yes, sir.

COMMISSIONER HAGGERTY: But there is a memorandum of August 3rd, which was copied to Mr. Kane, which clearly indicates that it has not been resolved and which in the second last paragraph says, to date Nuclear Services has not notified our operating plants to change HPI policy and then goes on and says, yet, the references suggest -- and they are the two Dunn memos -- the possibility of uncovering the core if present HPI policies continue. So, there was a clear signal in August of 1978 to your department that it had not been resolved.

MR. TAYLOR: That is correct and I was not aware of that memo.

CHAIRMAN KEMENY: Dr. Marks.

COMMISSIONER MARKS: Do you know who makes decisions about sending someone out to investigate a site where there has been a transient in a B&W reactor?

MR. TAYLOR: There is no one formally designated to make that decision, but the cases that I have been aware of have involved the Engineering Department manager and the Nuclear Service Department manager.

COMMISSIONER MARKS: Would that be Mr. Roy and Mr. Kosiba?

MR. TAYLOR: Well, it would now be Mr. Kosiba and probably one of his sub-department managers, Mr. Olds. The role that Mr. Kosiba has now is a fairly recently established position for him and the person who held that responsibility prior to him would have been Mr. Olds.

COMMISSIONER MARKS: And Mr. Roy.

MR. TAYLOR: Yes. Or his predecessor, Mr. Deddins.

COMMISSIONER MARKS: Do you know of any -- you wouldn't have any idea how many times B&W personnel have been sent to a site to investigate a transient?

MR. TAYLOR: I can think of several. I don't know how many it would actually involve, but the thing that you have to keep in mind that in many cases there is a B&W representative or site who can gather a lot of information and send it back to us. And also it would depend on where in the process of commissioning that power plant the transient had occurred. Because

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if it was during the test program or the startup power escalation testing, the chances are that we would have a number of people on site anyway. So, there would not necessarily be someone sent from the Lynchburg offices, the engineering offices.

COMMISSIONER MARKS: Well, what I am trying to get some feel for is -- maybe, let me put it this way. Do you have any idea how many memoranda have come to your desk in the form of, say, PSCs or memos relating to transients which have suggested a possible safety-related concern about the operation of the reactor?

MR. TAYLOR: It has been not very many.

COMMISSIONER MARKS: So, a memo like Mr. Dunn's would have been a somewhat unusual event?

MR. TAYLOR: Yes, but that is not to say that I didn't consider it an issue that deserved attention. The matters that normally are fed back from the field come through a separate process really and they are usually involving equipment problems and so the majority of the information that comes back from the field deals with hardware-related matters.

Now, I would like to go on and say that this is one of the issues that we as a part of the matter that Mr. Rockwell asked me about earlier -- this is one of the issues that we are focusing a lot of attention on right now; that we see a need to establish a much tighter loop between the key participants in this overall process and we consider those participants to be

the system designers, the system analyists, the procedure writers, the trainers and the operators. And we are taking steps as a part of this action that Mr. Rockwell asked me about to work out with our utility customers an effective way of tightening that loop and more fully exploiting field operating experiences; such that there can be a more wide-ranging investigation into each of the significant transients that occur, both from a safety and an availability standpoint. And also to ask ourselves questions like: Were the operating procedures adequate? Was there some indication of design inadequacy, not only a component by component basis, but in terms of the whole system? Is there anything that implies a training inadequacy in this transient? Did the operators perform as they were predicted to perform? Did the system behave as it was predicted to behave?

And so, we do intend, as a part of this effort that I mentioned earlier, to try to tighten this loop between the designers, the operators and the analyists much more tightly.

COMMISSIONER MARKS: And is there a person designated to coordinate this effort in B&W?

MR. TAYLOR: That has not been done yet and that is one of the things that we are working on right now. The framework that -- we want to try to not reinvent the wheel, so to speak. So, our plan is to outline what we believe is an appropriate mechanism for doing this and then work with each of our

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utilities, which also have activities of a similar nature to some extent already going on and then see how these can be made complementary to each other for an ongoing, longer-term program.

COMMISSIONER MARKS: I still don't have a clear idea as to this process. Are you meeting as a group? Is there a convener of the group?

MR. TAYLOR: This activity with regard to more fully exploiting field operating experiences is in the formative stages and we expect to be meeting with our customers on this within the next two months. We are right now working out the procedure for doing this in-house and trying to decide what is the best way to go about it. It is the planning stage right now.

COMMISSIONER MARKS: Who is in charge of the planning?

MR. TAYLOR: Right now, Dr. Roy has given me the charge to do this and we have just had the first meeting with our customers on this subject during the past week.

COMMISSIONER MARKS: So, you are the convener right now?

MR. TAYLOR: Right now, yes.

COMMISSIONER MARKS: Is training involved in -- did they attend the first meeting? Did representatives from training attend the first meeting?

MR. TAYLOR: No. I want to clarify. The first

meeting that was held was just an exploratory meeting with our customers to see whether they would be interested -- with the utility customers of the operating plants to see whether they would be interested in working with us on this thing. And the interest was positive. So, now, the people who will be involved will be those that I mentioned earlier from this point forward.

CHAIRMAN KEMENY: Mr. Haggerty, did you wish to follow up?

COMMISSIONER HAGGERTY: I want to try to clarify something.

Would it be fair to say that since your relationship with the utilities is primarily a contractual one -- you sell them equipment and you sell them certain selected training hours, which they determine. There is no necessary commitment on their part to use your training -- that an inevitable sort of mind set comes out of this to concentrate what you are especially concerned on on those responsibilities, which are directly related to your contractual responsibilities and the things that were being emphasized by Kelly and Dunn were in a sense external to that, since they questioned a manner of execution of your own HPI philosophy and that, consequently, while it was safety related, it moved out of this direct contractual relationship?

MR. TAYLOR: Yes. I think one of the things that we

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have seen as a result of TMI-2 more clearly is the need to broaden our horizons and to recognize that in order to get to the root cause of some of the transients that occur in the plants it is necessary to go into areas that are normally outside our scope of supply. It also is important for more people to understand the inherent relationship between availability and safety and our emphasis, in terms of improving availability -- and this has been a program that we have had for a couple of years -- has been on the equipment within our scope of supply. And, yet, it frequently is activities or equipment outside of the nuclear steam supply vendors' scope which can cause problems which lead to lost availability or which can lead to a transient which can impose stressful situations on the operators. And such was, indeed, the case at TMI-2, wherein the transient was started by a condensate polisher bypass valve, which is not in our scope of supply and so we recognize more clearly now than we have in the past that in order to get -- to accomplish an objective, which I think is common to everyone, our horizons have to be broadened. And this will require a modification in the thinking of a lot of people and not the least of which is our own customers.

CHAIRMAN KEMENY: Mr. Taylor, may I just follow that up. Would you be willing to give us a very rough estimate of, say, how much of your division's time may have been spent on equipment versus operators, pre-TMI-2 and if you would be

willing to express a guess of how you would wish to see that shifted?

MR. TAYLOR: I have absolutely no basis for guessing. I just don't know.

CHAIRMAN KEMENY: But, would it be fair to say that pre-TMI-2 a very proportion of your section's time was on equipment?

MR. TAYLOR: I am sorry. You are talking about my section?

CHAIRMAN KEMENY: I am talking purely about your section, yes.

MR. TAYLOR: Oh, yes, certainly. I think the thrust of the activities in the licensing arena have most certainly been focused on the machine and not the man.

CHAIRMAN KEMENY: Would you, in the future, expect to have a different division?

MR. TAYLOR: Most certainly.

CHAIRMAN KEMENY: What would the change consist of?

MR. TAYLOR: Wait a minute. Did you say "different division"?

CHAIRMAN KEMENY: I mean between equipment and emphasis on operators.

MR. TAYLOR: Yes. That was what was in back of the comment that I made earlier about the need to tighten the loop between all of the key participants. Absolutely. We think the

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role of the operator is very, very important and there needs to be perhaps a 50-50 balance between the attention paid to the man and the machine as opposed to what would seem to be an unbalanced situation focusing attention on the machine from a licensing and safety point of view.

CHAIRMAN KEMENY: Thank you.

Professor Taylor.

COMMISSIONER TAYLOR: Mr. Taylor, I am interested in a procedure that has been followed since the PSC system was called for under -- or your response to it was called for under 10CFR Part 21. When you do sent to NRC a report on a safety issue that you have identified, have you ever sent either copies of that report or copies that have the substance of that report to any of your customers?

MR. TAYLOR: Yes.

COMMISSIONER TAYLOR: Is that a routine matter or do you do that only when you think, yourselves, that it is called for?

MR. TAYLOR: It is not a routine matter. It depends on the issue that is being reported. In the case that I mentioned regarding small loss of coolant accidents that took place last year, we did and as a matter of fact our procedure -- well, as a matter of fact the procedure for 10CFR21, itself, permits any subcontractor up and down the line to report the matter to the NRC or to their customer. In other words, there

is a stipulation in the regulation that says that it is not reportable by the person who might have identified it if he had knowledge that the NRC is already aware of that concern.

And so in some cases -- and this goes more really to the distinction between what the original procedure was -- 10CFR5055E, wherein the requirement for reporting was strictly laid on the person of the organization or the applicant who had the construction permit. Part 21 is a broader requirement, but if the issue involves a certain group of plants, we will then normally communicate and send that same information to those plants. If it involved a particular valve and that valve had only been supplied to two customers, we would more than likely send it only to those two customers.

COMMISSIONER TAYLOR: Now, in preparing one of these reports, when you decide that you are going to, but before it is actually and you send it off to NRC, have you ever had any discussions with any representatives of any of your customers about the content of the reports?

MR. TAYLOR: Yes, sir.

COMMISSIONER TAYLOR: Is that something which tends to happen in those situations where finally you do, in fact, send a copy directly to your customer, either simultaneously or soon after you send it to NRC? I mean, is that a common occurrence?

MR. TAYLOR: Yes. That is a common occurrence and

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there is a very basic reason for that and that is it is our customers' plants which are being effected and it is very embarrassing for them to find out about something on their plant from the NRC. So, it is very simple and straightforward and we usually communicate, I would say, almost without exception we try to communicate with the customers prior to this and if we have an issue, which we are not certain whether the evaluation will show that it is reportable or not -- because the evaluation is not complete, but we think that it may -- we will then alert the customers as early in the process as we can that the evaluation is going on.

COMMISSIONER TAYLOR: Have there been cases where you reconsidered the content of the report that you sent to NRC, but go ahead and send it on the basis of information that you get from one or more of your customers in the course of the preliminaries before you actually firm up exactly what you are going to send? In other words, do you get feedback from the utilities concerning, in particular, the safety related aspects of what you are sending ultimately to NRC? Do you get feedback and do you use it occasionally?

MR. TAYLOR: I can't think of any where we have decided that something was reportable and the content of the report was changed as a result of information from the customers. No, I can't --

COMMISSIONER TAYLOR: Have there been instances when

you had decided that a report -- that an issue was reportable and then on the basis of discussions with one of your customers decided that, no, it was not reportable and so you didn't report it?

MR. TAYLOR: I can think of an issue recently wherein there was a matter which came to our attention which was one that we processed very quickly in terms of corrective action and we communicated with our customers on this matter and we said that we are not certain whether this even falls within the reportability requirements of 10CFR21, but we believe that it should be made known to the NRC. And we did not end up reporting it. The customers did not universally report it to the NRC, but they did make the local NRC people aware of what had happened. So, this was a case where we said, we are not sure. We can see it was not a safety-related piece of equipment that we were talking about, but we recommended to them that they notify the NRC and to my knowledge, they did not universally do that, but they did it on a local level with the local people. We did not report that particular one and that was one where we more or less passed the responsibility on to them to use their judgment and some of them saw it one way, some of them another. But in any event, the corrective action that was appropriate was taken very promptly by all of the customers.

COMMISSIONER TAYLOR: I understand.

One final question, is there now a mechanism for

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gatherings of people from B&W and other reactor vendors -- Westinghouse, General Election, for example -- and utilities for the express purpose of discussion of safety-related issues that may be important to all of the participants, where the participants include people other than just your customers and your own people at B&W? Is there a mechanism by which this happens?

MR. TAYLOR: It depends on how you want to define that. There are industry meetings sponsored by the American Nuclear Society, for example, where one of the divisions of the American Nuclear Society is the Operating Reactor Division and there are papers presented there with regard to operating experiences, but that and the Licensee Event Reports, which are published by the NRC are the only ones that come to my mind where there is a periodic and frequent gathering together of the people who are operating reactors and talk about day-to-day operating experiences.

COMMISSIONER TAYLOR: How about the Atomic Industrial Forum? Are there cases where under Forum auspices, there is a gathering, which is not really characterized by people standing up and giving papers, but by having discussions, by having something one might call more like a seminar to really get a discourse flowing? In particular, have there been any such gatherings since TMI that you are aware of of people from the supply site of the industry, the user side, which are

characterized more by discussion than by formal presentation of papers?

MR. TAYLOR: I am not familiar with all of the activities that go on within AIF. I am a member of the Safety and Licensing Steering Group for AIF and we characteristically meet about every six weeks, but the thrust of those discussions are primarily with regard to licensing matters, the emergence of new requirements and whether they are realistic, helpful, complicated, etcetera. And from that standpoint, there is a gathering of the vendors, the architect engineers, the utilities, but those are not -- I can't recall a meeting that I have been to where there was any significant discussion about operating experiences. Now, the AIF has -- and I am only becoming familiar with this now -- the AIF has formed within the past two months a new activity, which is under the leadership of the AIF Post TMI Policy Committee, which is made up of managers of utilities primarily, but from the vendors also. And this Policy Committee is to try to -- on an industry basis -- define what actions would be appropriate as we look back on TMI-2. And there have been nine subcommittees formed under that policy committee. They will deal with control room design. They will deal with operating training. They will deal with transient and system behavior and analysis and those are the categories which I can recall right off hand. So, I believe there is recognition on the part of AIF that activities are appropriate

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in a number of these areas.

COMMISSIONER TAYLOR: Thank you.

CHAIRMAN KEMENY: Some of the other Commissioners have asked for the floor: Governor Peterson, Professor Lewis and Professor Pigford.

Governor Peterson.

COMMISSIONER PETERSON: Mr. Taylor, we learned in some earlier sessions here that some of your customers, Met Ed, had relied very heavily on your technology, your information, as illustrated by the extensive use of the simulator at Lynchburg, where they could try out hypothetical situations to see what would be the preferred way to operate the equipment. In view of that, it would seem to me that you have not only an important responsibility to your customers, but also to the safety of the general public. Do you see it that way?

MR. TAYLOR: Certainly. I believe that all of our responsibilities with regard to nuclear power are important and that it certainly has public health and safety implications. Yes, sir.

COMMISSIONER PETERSON: The specific thing I am driving at is because of the tendency, the actions of your customers in relying on you so much for technical information, I would like to know how you would respond today if you received another memo like the Dunn memo. Say, tomorrow morning, you got a memo which came from one of your competent technical

people, which said, we have looked into a problem and our customers are operating in a way which really threatens the safety of the community. How would you respond to such a memo now, in light of the experience you have had with the Three Mile Island accident?

MR. TAYLOR: Well, I would have to say I would spend more time following up on it, certainly.

COMMISSIONER PETERSON: In other words, make sure that somebody did something about it.

MR. TAYLOR: Yes. I think this is a matter where procedures don't make things happen. People make things happen. I certainly wouldn't want to give the impression that I believe it is necessary for a procedure to exist to have things happen that are right. Also, I think it is important to realize that the number of issues that we deal with on a day-by-day basis that have safety significance are by and large, outside the scope of this particular procedure that there has been a lot of discussion on -- there are a lot of decisions made, a lot of actions taken, which don't have anything to do with particular procedure.

So, yes. I think that this is something that is important for all of us to learn; that follow-up action is important, particularly in those areas where there seems to be an interface, an interface between the operators and the procedure writers or between the analyist and the operator,

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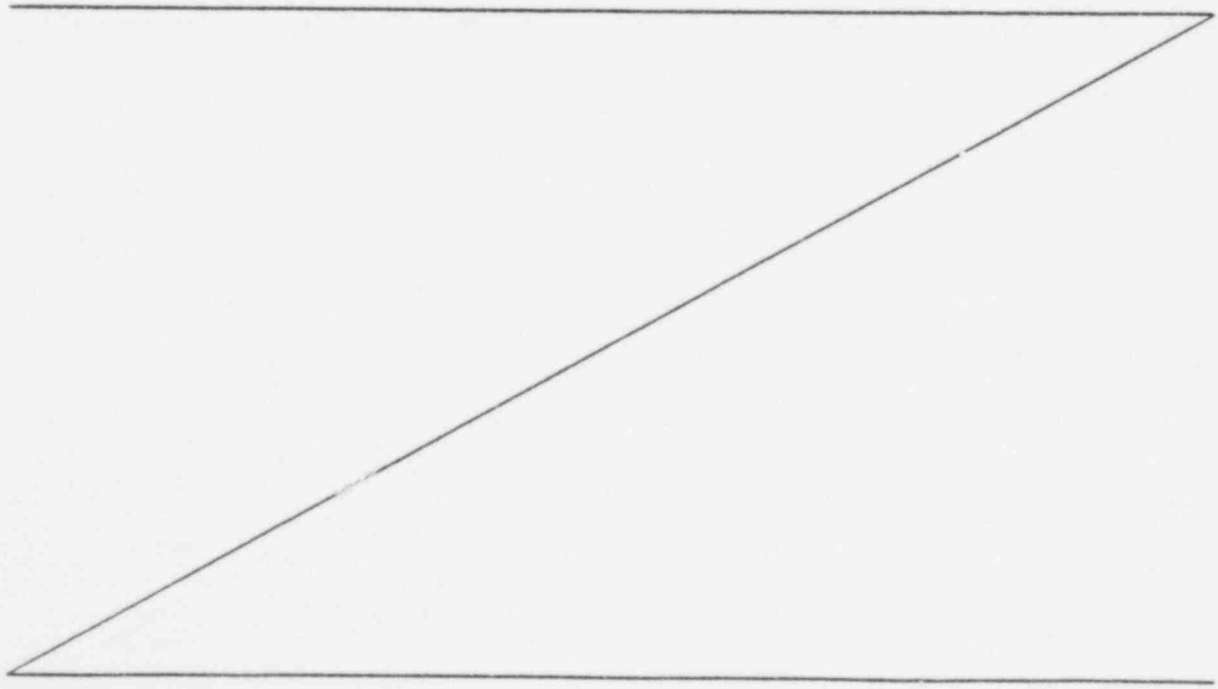
between one department and another department. Yes.

COMMISSIONER PETERSON: Do you feel today that if you had followed up on the previous memo that it might have avoided the Three Mile Island accident?

MR. TAYLOR: Well, that possibility exists, of course. It is uncertain in my mind and it is just a speculated matter. In my opinion there was a lot of very useful information available to the operators that was not used as completely as it should have been. There were procedures that could have avoided that situation, which my understanding is that they were not followed. So, I would have to say that I am uncertain as to whether more procedures would have really avoided TMI-2, but I would acknowledge that that possibility certainly does exist.

COMMISSIONER PETERSON: Thank you, Mr. Chairman.



CHAIRMAN KEMENY: Professor Lewis?

COMMISSIONER LEWIS: Mr. Taylor, I am kind of interested in the relationship between the vendor and the NRC. I presume you are the gentleman who would basically deal with the NRC.

MR. TAYLOR: Yes, ma'am.

COMMISSIONER LEWIS: Okay, who do you talk to normally at the NRC when -- supposing this memorandum had gotten to the point of being considered serious enough. Who would you talk to at the NRC?

MR. TAYLOR: Well, there are a number of people who would be logical candidates to talk to. It could be that I would talk to -- do you want them by name or by title?

COMMISSIONER LEWIS: Both, please. I would appreciate that.

MR. TAYLOR: Okay, I might talk to Dr. D. F. Ross. I might talk to Mr. Novak, N-o-v-a-k, Mr. Rostowzi, Dr. Rostowsi.

COMMISSIONER LEWIS: They are in which branch of the NRC?

MR. TAYLOR: The Division of Systems Safety.

COMMISSIONER LEWIS: Thank you.

MR. TAYLOR: Or Dr. Mattson.

COMMISSIONER LEWIS: All right.

MR. TAYLOR: Now, I answered that question in the

context of this particular subject that we are talking about because they are in a particular area of activity. In another subject, there might have been some different individuals involved.

COMMISSIONER LEWIS: Well, I am interested in the process by which the NRC finds out that there might be a safety problem. I gather that it has to go through the process within an organization like B&W. You have to determine first that it has some potential safety problems, and then you will report it to the NRC, is that correct?

MR. TAYLOR: Well, of course, we are just one of the organizations that deal with the NRC. The customers, the utility customers, deal with the NRC, and there are many -- as a matter of fact, with regard to operating experiences such as the Davis-Besse transient, they would receive the information the same time we would receive it. There is a formal process that requires that.

As far as how we would make something aware -- or make the NRC aware of something, it can be started simply by a telephone call, or it can be started by suggesting that we have a meeting to bring to their attention something that we are uncertain about. It can be a letter, it can be a formal report as required by the regulations, so it can be a spectrum of ways. And in many cases, also, there are activities that come out during the process of licensing a particular plant,

just in the dialogue that takes place between the vendor and the NRC.

A question may be raised about whether there has been proper interpretation of a particular requirement, and from that dialogue there can be the decision on the part of the Regulatory Commission that the interpretation by the vendor has not been the way they interpreted it and therefore there could be some changes, and that would be considered at that time a safety matter.

COMMISSIONER LEWIS: Well, Mr. Taylor, I just wondered whether you were aware of any investigation by the NRC of the Davis-Besse incident and whether you discussed that at all with people at the level that you mentioned at the moment at the NRC.

MR. TAYLOR: Now, I am talking about the September, 1977 --

COMMISSIONER LEWIS: The September 24, 1977, incident.

MR. TAYLOR: Yes. (Pause.) I have to say, I don't recall, I was not personally involved in any discussions of that. There was, of course, the meeting -- let's see, now -- yes, there was a discussion of that -- yeah, there was a discussion, I believe, at the Davis-Besse site, as I recall, which involved some NRC people, at least one, I believe. I am a little bit unclear as to whether it was the September or the November transient. I believe it was the September transient,

at which I believe Mr. Mazetis from the NRC was in that meeting.

COMMISSIONER LEWIS: Mr. -- could you spell that for me, please?

MR. TAYLOR: M-a-z-e-t-i-s, I believe.

COMMISSIONER LEWIS: Mr. Mazetis of the NRC was there. You were at the Davis-Besse site, were you not?

MR. TAYLOR: No, I was not at the meeting, but I can recall some conversations about that or reading a trip report, and I believe he was at that meeting.

COMMISSIONER LEWIS: Do you recall whether the report that you read referred to the HPI system and the way the operators handled that?

MR. TAYLOR: I don't recall that, no. This was -- no, I don't, sorry.

COMMISSIONER LEWIS: Who from B&W was at the Davis-Besse site for that meeting with the NRC officials?

MR. TAYLOR: I believe Mr Faist, who was the B&W site representative, was there. I believe Mr. Kelly was there, and I believe Mr. Lauer, who was the project manager for Babcock & Wilcox was there, and those are the names that I can recall. I am not sure if there were others.

COMMISSIONER LEWIS: So you are saying that in the -- you would have seen the LER report on that incident, wouldn't you?

MR. TAYLOR: Me, personally?

COMMISSIONER LEWIS: Would you? I mean, who at Babcock & Wilcox would have seen the report on that incident?

MR. TAYLOR: Well, in this particular case, I don't know. The LER's, when they are sent to us, we have not, prior to just the past -- or until recently -- been on distribution for the full LER's from all of the plants. But the LER's that come to us come through the Nuclear Service Organization from the customers.

Now, in this particular case, because of the investigation that B&W made of that transient, we would undoubtedly not have been too interested in the LEW because we had much more information than it contained, I mean in terms of detailed data.

COMMISSIONER LEWIS: That is kind of interesting. I mean, I am curious why the NRC would not have had as much data as you had.

MR. TAYLOR: I don't know that they didn't.

COMMISSIONER LEWIS: Oh, I thought you were just saying that you felt your --

MR. TAYLOR: No, I said if you compare the information that we had as a result of the investigation that B&W made, the formal paperwork that was published in the form of a licensee event report probably contained a lot less information that the paper, than the information we had, because we

had people there gathering data.

But I am not able to say right now the extent to which all of that data was covered at the meeting where the NRC was present. So if you just compared two packages of paper, I think we probably had more information at that early time than they did, but I suspect they had access to -- well, they have, normally, access to all the information from a given plant.

COMMISSIONER LEWIS: So there is no system whereby, when you are doing a separate investigation of a transient, you transmit that information directly to the NRC? In other words, the sifting of the information that you get from Davis-Besse remains with you unless you decide it is a possibly safety responsibility.

MR. TAYLOR: If the -- there is no formal, fixed requirement for that. Some of the transients that have occurred are significant enough that there are issues raised about the condition of the plant: have some of the pressure vessels been overstressed, or so on. In that case, in order to resolve those matters, there is formal documentation required to justify the calculations that we have made and to evaluate the condition of the plant.

In those cases, there would be information sent directly to the NRC, usually through the customer, but some of it could originate with our organization.

COMMISSIONER LEWIS: Which section of the regulations

is that covered by, could you tell me? In other words, which NRC regulation requires or at least describes the terms under which you should transmit that information? Can you name that offhand?

MR. TAYLOR: No, I don't think there's -- I'm not aware of a formal regulation. This is usually handled on an ad hoc basis, based on the particular questions that come up as a result of that transient. It is many times a very localized area of the plant which is involved, and so there will be an evaluation of that activity.

Now, the licensee event report is a part of a formal requirement. That is in the 10CFR-50 -- I believe it is 50 -- regulations. And the technical specifications that govern the operation of each plant have reporting requirements for the utilities which describe very specifically the kinds of things that they are obligated to report, and the frequency and the timing, and so on.

So the overall framework in which evaluation and technical information is provided is based on the requirements of the technical specifications which are a part of the license for each plant.

COMMISSIONER LEWIS: What you are saying, in effect, is that B&W could be doing its own evaluation, coming up with information such as that which evolved through the Kelly and Dunn memoranda, but there is really no requirement for feeding

that basic information or those basic concerns into the NRC unless you determine that that is a safety responsibility. In other words, that information can remain at B&W, is that correct?

MR. TAYLOR: If you are asking me the question, is there anything that requires us to transmit everything that we might investigate as a result of a particular transient to the NRC, the answer is no.

COMMISSIONER LEWIS: Good. Thank you very much.

CHAIRMAN KEMENY: Professor Pigford?

COMMISSIONER PIGFORD: Mr. Taylor, we have been talking mainly about information concerning the interpretation of the level of the pressurizer that came to B&W via the Kelly memo. Are there any other channels by which that same problem was identified to B&W from sources other than Davis-Besse?

MR. TAYLOR: The pressurizer level issue was a subject which was addressed by Professor Michelson, or by Mr. Michelson, I believe, yes.

COMMISSIONER PIGFORD: And was the response to that handled by people within your group, your division or department?

MR. TAYLOR: No, not really. That -- I was aware that the Michelson report had come in. That was handled through the Project Management Organization as a direct contact with the emergency core cooling systems unit.

COMMISSIONER PIGFORD: The Project Management Organization. That's the name of it?

MR. TAYLOR: Yes. That is the organization which interfaces with our customers.

COMMISSIONER PIGFORD: Yes. Did your group have any responsibility for preparing the response or the analysis of t hat?

MR. TAYLOR: No, sir.

COMMISSIONER PIGFORD: Was there any other avenue by which that same issue was raised to B&W?

MR. TAYLOR: Not that I am aware of.

COMMISSIONER PIGFORD: Your group is licensing. Would it be correct to say that you assist, your group assists, the B&W customers in preparing information for the licensing process?

MR. TAYLOR: Yes, sir.

COMMISSIONER PIGFORD: Is Portland General Electric one of the B&W customers?

MR. TAYLOR: Yes, sir.

COMMISSIONER PIGFORD: And the Pebble Springs reactor is a reactor that is a B&W reactor to be built, I think, isn't it?

MR. TAYLOR: Yes, that's one of our larger reactors. That's one of the newer ones, yes.

COMMISSIONER PIGFORD: Now, isn't it possible that in

the licensing history of that, the issue of interpretation of level of the pressurizer was specifically identified?

MR. TAYLOR: I have -- yes, I recall now that there was a question, and I forgot it when I answered the question before. There was a question which I believe was raised at one of the 1977 ACRS meetings or prior to that meeting. I think it was discussed at that meeting in 1977, and I believe the question was originated by one of the ACRS members whom I believe works with Mr. Michelson.

COMMISSIONER PIGFORD: Would that person be Mr. Ebersol?

MR. TAYLOR: Yes.

COMMISSIONER PIGFORD: And that date would predate, would be prior to the date at which TVA sent the Michelson correction questions directly to B&W, then, would it not?

MR. TAYLOR: Yes, I -- yes. October of 1977, yes.

COMMISSIONER PIGFORD: You are now suggesting the ACRS meeting in question was in October of 1977?

MR. TAYLOR: That is what strikes my memory, yes. I think it was the fall of 1977, and I believe it was October. If it is the question I am thinking of, that is when it was, the meeting was held, yes.

COMMISSIONER PIGFORD: Does B&W -- did B&W have a representative at that meeting?

MR. TAYLOR: Yes, we did. I am not recalling --

there were both subcommittee meetings and full committee meetings held on the Portland General Electric plant, and I believe we had representatives -- yes, at both of them.

COMMISSIONER PIGFORD: And did that representative come back and tell you about the issue that had been discussed concerning the pressurizer level, interpretation of the level in the pressurizer?

MR. TAYLOR: I don't recall that, no.

COMMISSIONER PIGFORD: Do you know the names of the individuals who were present?

MR. TAYLOR: No, but I can find out.

COMMISSIONER PIGFORD: Yes. Now, subsequent to that meeting, did the Nuclear Regulatory Commissioner forward to Portland General Electric, to your knowledge, a list of 26 questions raised by the ACRS?

MR. TAYLOR: (Delayed response.) I don't recall them in that context as a grouping of 26 questions.

COMMISSIONER PIGFORD: Yes. I don't know if it got to B&W, but you remember a forwarding to PG&E, Portland General Electric, from NRC a grouping of questions that had been generated by ACRS that they asked to be forwarded. Do you know about that?

MR. TAYLOR: I don't recall it specifically. We had a number of plants going through the licensing process at that time, and that -- I don't recall. If there were some of

the specific issues that were addressed there, I might be able to tell you more clearly whether we ended up on the receiving end of those.

COMMISSIONER PIGFORD: Of course. Then I am going to read out one question. This is question number 6 that accompanied the letter to someone at Portland General Electric from NRC. In question number 6, "Does the applicant know that the time dependent levels will occur in pressurizer, steam generator, and reactor vessel after a relatively small primary coolant break which causes coolant to approach or even partly uncover fuel pins? What does operator do in respect to interpreting level in pressurizer, question mark."

MR. TAYLOR: Yes, I remember the question now, and B&W provided an answer to that question, as I recall, and as I think back on it, that was the same question that was asked of us at a recent ACRS meeting, and I believe the answer did not completely address the question.

COMMISSIONER PIGFORD: Then you are saying first that the answer to this question, which was later forwarded back to NRC by Portland General Electric, was prepared by B&W?

MR. TAYLOR: I believe so, yes.

COMMISSIONER PIGFORD: Was it prepared by your division?

MR. TAYLOR: Well, we would be the ones who would transmit the information back to the customer, but a question

like that I think would probably been handled in the ECCS unit. The technical information for it would have been handled --

COMMISSIONER PIGFORD: Yes, but your group -- I'm sorry, what shall I call your division group?

MR. TAYLOR: Licensing Section.

COMMISSIONER PIGFORD: Licensing Section --

MR. TAYLOR: Yes.

COMMISSIONER PIGFORD: -- would have the responsibility of collecting information and forwarding the answer to PG&E?

MR. TAYLOR: Yes, sir.

COMMISSIONER PIGFORD: And as you have just a moment ago said, you didn't answer all of the question. Did you answer the question concerning pressurizer level interpretation?

MR. TAYLOR: As I recall, I have looked at that matter in the past couple of months. I believe not.

COMMISSIONER PIGFORD: And why not?

MR. TAYLOR: I just don't have an answer to that. I don't know why that was not done.

COMMISSIONER PIGFORD: Okay, thank you.

Excuse me -- one more question: In your responses to TVA on the questions forwarded to you by them, did you comment on that part of the Michelson report which had a specific statement questioning the interpretation of

pressurizer level during a small break loss of coolant accident?

MR. TAYLOR: I don't recall.

COMMISSIONER PIGFORD: Yes, but I remember now you told me earlier your section did not prepare that response.

MR. TAYLOR: That's right.

COMMISSIONER PIGFORD: Thank you.

CHAIRMAN KEMENY: Dr. Marks?

COMMISSIONER MARKS: I would just like to turn to a response you made to Governor Peterson when you said that you felt that the operators of TMI II had information which I believe you said was not used as completely as possible. Does this imply that you have done an analysis of the information provided the operators, identified specific information provided the operators which, if used properly, could have avoided the accident?

MR. TAYLOR: There has been no formal analysis made of that particular type. The information I was referring to when I made that statement was the fact that the emergency feedwater valves were closed and they should not have been closed; the operators were aware that the relief or safety valves had been leaking; the procedure for -- well, let me back up.

In a loss of feedwater transient, one of the things that the operator can certainly expect is that the pilot

operated relief valve would lift. This transient most often leads to a reactor vessel, a reactor scram, on the basis of high pressure, and the way the pilot-operated relief valve was set with relationship to the scram set point prior to TMI II, in order to reach a high pressure scram set point you had to have gone through the pilot-operated relief valve set point.

And so the information that is available to him indicates that that valve would lift in a loss of feedwater transient. The information which is very baffling to me and to a lot of people is the fact that this is a pressurized water reactor, and one of the very primary parameters, if not the most important parameter, is pressure, and there seemed to be a lack of attention to the fact that the pressure was going down, and that information was certainly available to the operator.

A loss of feedwater transient, having gone through the pilot-operated relief valve set point, I think the operators should have expected that the relief valve would lift and that if there is a component on any kind of a power plant which is likely to lead to a leak in the system, it is the relief valve, particularly after it lifts.

The procedure for dealing with a relief valve leaking is very clear. It says to close the pilot-operated relief valve block valve, and that was not done for over 2 hours, and so that is another piece of information which was available

to the operator. There seemed to be, as I said, a lack of attention to the pressure gauges, which in our opinion are very important, particularly in a period of time after the high pressure injection system has been actuated. Babcock & Wilcox made a very conscious decision 10 years ago to actuate the emergency core cooling system on pressure alone, not on pressure and level, and yet the attention seemed to be not on pressure but rather on level.

The thing that is also very baffling to a lot of people is why there would be a concern with going solid for a long period of time when the pressure is down to half its normal value, and that is where it was, around 1,000 psi, for a long period of time.

And so there was information in the form of procedures with regard to emergency feedwater valve positions, block valve closure requirements, pressure, information that would enable him to confirm that he had a leak from the safety valves in the form of quench tank parameters. That was what led me to make the statement in response to Governor Peterson's question with regard to whether or not additional prescriptive information would really have prevented TMI II.

COMMISSIONER MARKS: Thank you.

CHAIRMAN KEMENY: Let's see, Professor Pigford, then Ms. Trunk.

COMMISSIONER PIGFORD: Mr. Taylor, with regard to

that list of questions concerning the Portland General Electric Pebble Springs plant, B&W plant, question 26 dealt with a calculated transient, with the assumption of loss of auxiliary feedwater, and it was brought up yesterday when we were questioning Mr. Dunn, did B&W supply the material on which the answer to that question was based?

MR. TAYLOR: I'm sorry, I really don't recall.

COMMISSIONER PIGFORD: Well, does anyone know? I thought maybe it would be resolved by today as to whether this was a B&W answer or not. If I were to show you the answer, would you krow it? Would you recognize it?

MR. TAYLOR: I don't know, but I could get you the answer by this afternoon. I haven't done that yet.

COMMISSIONER PIGFORD: But if I were to show you the answer, would it resolve it right now? Could you tell me if B&W supplied it?

MR. TAYLOR: I'm not sure. It may.

COMMISSIONER PIGFORD: Shall we try it?

MR. TAYLOR: Sure.

(Whereupon, a document was shown to the witness.)

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MR. TAYLOR: I can't be absolutely sure, but I would say this was an answer which was prepared jointly with Portland General Electric. But I suspect the information contained on page 52, with the chronology of events, came from us, yes.

COMMISSIONER PIGFORD: All right. I'm not going to ask more questions about it, because I promised the Chairman yesterday I'd deal with it as a follow-up written question.

CHAIRMAN KEMENY: Trunk?

COMMISSIONER TRUNK: You mentioned the PORV before. I'm under the impression that that valve got stuck open. The operators did not know it was stuck. They sent out a signal and the signal came back saying that it was shut. Did you ever tell them that this had a habit of staying open, so they were prepared for it in this emergency?

MR. TAYLOR: I can't answer your question directly whether we ever told them that. To my knowledge, there have been four instances where the pilot operated relief valve has stuck open. In each of those four instances, there was corrective action taken, and I believe there was information transmitted to the customers with regard to follow-up actions that should be taken, with regard to maintenance of the valve, in order to preclude its sticking open. I can't be more specific than that.

But I can say, again, that, in this particular

transient, it is -- it was, prior to the TMI-2 incident, with the set points that existed for the system at that time, a normal occurrence for that valve to lift. And it is also, any time a safety valve does lift, you could expect that it might -- even though it would reseat, it might leak. That's just an unfortunate characteristic of safety valves. And when the pressure is down in the system and after the valve has lifted, the procedure is very clear, with regard to calling for the closing of the block valve, upstream of the PORV.

COMMISSIONER TRUNK: Because the valve has a habit of sticking, why didn't you give operators a direct indication of valve position in the control room?

MR. TAYLOR: We are doing that now. A number of tests have been run just recently, and different techniques for determining the condition, or the position of this valve have been tested. And this particular valve -- and it's a very unusual valve. It's not uncommon as far as an industrial application is concerned, but its design is unusual. And it is difficult to get the kind of position indication system that you have on a normal valve, because the stem of the valve, which moves up and down, is not exposed so that you could put an indicator on the stem position.

But we have come up with some alternate ways, as

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a result of some tests that have been made, and these various systems for positive position indication are now being discussed with the customers to determine which of the alternatives they would prefer, which would suit their system best, and they will be installed.

COMMISSIONER TRUNK: Well, why didn't you tell them before TMI happened?

MR. TAYLOR: I believe -- and this is only my opinion -- that it was considered sufficient to have taken prompt action immediately following these occurrences when the valve stuck open. We believed we had corrected the problem and that the operating procedures calling for closure of the block valve were sufficient to provide the operator with the safe situation.

A safety valve is installed to prevent over-pressure in the system. And it's just, as I said, an unfortunate characteristic that sometimes they can leak after they have served that function. And independent of whether or not the valve would be indicated to be completely closed, it can still leak. And so the information that was available to the operator to tell him whether or not the valve was leaking was in the form of thermocouples on the discharge pipes of the safety valves. And we felt that the combination of those thermocouples, the procedures, and the prompt corrective action that was taken for each of these

valves was adequate.

COMMISSIONER TRUNK: In yesterday's testimony, Mr. Dunn stated that there were 20 of these incidents, about 20.

MR. TAYLOR: That was an incorrect number. We spoke after the meeting, and he was recollecting a different matter. But there have been -- I'm of the opinion that it is four, and it may have been three. But the number is four, and it's certainly not 20.

CHAIRMAN KEMENY: Mr. Taylor, just before excusing you, I would like to establish some continuity with the previous witnesses and the following witnesses. And therefore let me go over ground you have already covered on two points. One is on the two memoranda from Mr. Dunn. I understood you to testify that you felt, after the second memorandum, that that issue had been resolved satisfactorily. Is that correct?

MR. TAYLOR: Yes, sir, I believed that the action that was appropriate had been taken.

CHAIRMAN KEMENY: Yes.

MR. TAYLOR: Or was underway.

CHAIRMAN KEMENY: Yes, and you assumed that, then, appropriate follow-up action would have taken place. That's why you did not do anything more yourself.

MR. TAYLOR: Yes, sir.

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CHAIRMAN KEMENY: And you have testified about the August 3 memorandum from Dr. Hallman that you did not become aware of that particular memorandum.

MR. TAYLOR: Until later, that's right.

CHAIRMAN KEMENY: Until much later, yes. If you had become aware of it, may we assume that you would have taken further action?

MR. TAYLOR: Yes, sir.

CHAIRMAN KEMENY: Thank you very much. The witness is excused, subject to recall.

Will the chief counsel call the next witness, please?

MR. GORINSON: Mr. Karrasch, please.

Whereupon,

BRUCE A. KARRASCH

was called as a witness and, after being first duly sworn, was examined and testified as follows:

CHAIRMAN KEMENY: Would you please state your full name and current position within Babcock and Wilcox, please?

MR. KARRASCH: My name is Bruce A. Karrasch. I am manager of a unit called Plant Integration in the Engineering Department at Babcock and Wilcox.

CHAIRMAN KEMENY: Chief Counsel?

MR. GORINSON: Mr. Kane?

MR. KANE: Thank you, Mr. Gorinson.

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Mr. Karrasch, how long have you been employed at B&W?

MR. KARRASCH: 12 years.

MR. KANE: And would you generally explain your duties in the position of unit manager in Plant Integration?

MR. KARRASCH: The Plant Integration group is responsible for achieving a consistency between the analysis, the licensing requirements, and the design of the hardware within our scope of supply of the nuclear steam system. We do this through preparation of various amounts of documentation, various types of documentation, which is used to tie down the communication between the analysis of the plant and the design of the hardware that is shipped to the field.

We also are charged with a review responsibility of various documentation prepared within the other sections within Engineering. So through the preparation of our documentation and the review of others, we have a primary focal point to assure that the communication channels within Engineering are well-established and controlled.

MR. KANE: And would those duties include channels of communication with the ECCS Analysis Unit?

MR. KARRASCH: Yes, they do.

MR. KANE: In 1977, Mr. Karrasch, did you become aware of a transient at Davis-Besse which occurred on September 24th, 1977?

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MR. KARRASCH: Yes, I did.

MR. KANE: When did you first become aware of that?

MR. KARRASCH: I became aware of it shortly after the transient occurred -- I believe it was within a day or two -- through a communication with Joe Kelly and his immediate supervisor, Eric Swanson, both of which who report to me in Plant Integration. They came to me, said that a loss of feedwater occurrence had happened at the Davis-Besse unit and that the Nuclear Service Department had requested that Joe travel to the site to assist Nuclear Service in reducing data and trying to explain what had occurred.

MR. KANE: Did you concur in the request that Mr. Kelly be sent to the site in order to investigate the facts of the incident?

MR. KARRASCH: Yes, I did.

MR. KANE: All right. And after that, did you attend a meeting at which Mr. Kelly presented the facts that he had discovered in connection with that transient?

MR. KARRASCH: Yes, I did.

MR. KANE: Was there a discussion at that meeting of operator interruption of the high pressure injection?

MR. KARRASCH: I really don't recall the details of what was presented in the meeting, with the exception that it was an abnormal occurrence at Davis-Besse, involving a

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loss of feedwater. I recall that some portion of the system hardware had failed. I don't recall whether the discussion of the HPI pump or the power operated relief valve or what element in the secondary system had caused the loss of feedwater. But I do know that those discussions took place and the conversations were focused upon the fact that we had discovered, through Joe Kelly and the other people at the site, what had happened at Davis-Besse and that corrective action was indeed underway so that the plant could be restarted.

MR. KANE: Mr. Karrasch, do you recall that you may have heard of the HPI interruption at that meeting and failed to appreciate the significance of that event at that time?

MR. KARRASCH: That is possible.

MR. KANE: Was there any determination at that meeting of what steps would be taken as a result of the transient and Mr. Kelly's investigation of it?

MR. KARRASCH: I believe there was, because I do recall that the action to be taken as a result of the transient was defined in the meeting. But the details of that action I do not recall.

MR. KANE: Do you recall anything about what the action was that was to be taken as a result of the transient?

MR. KARRASCH: Not specifically, I do not.

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MR. KANE: Do you recall generally?

MR. KARRASCH: No, sir, I do not.

MR. KANE: All right. Mr. Karrasch, we've had placed on the table before you a number of documents that have been previously marked as hearing exhibits in connection with these proceedings. I'd like you to look at a document that's been marked Hearing Exhibit No. 1. It's a memorandum dated November 1, 1977, from Mr. Kelly to several other B&W personnel. Your name appears on the distribution list for that document. Did you ever see that document before March 28, 1979?

MR. KARRASCH: I do not recall if I saw it or not.

MR. KANE: Is it possible that, although your name appears on the distribution list, you would not receive that document?

MR. KARRASCH: Would you please repeat that?

MR. KANE: Is it possible that, although your name appears on the distribution list for that document, that you would not have received that document before March 28, 1979?

MR. KARRASCH: That certainly is possible. I would guess that it is not very probable.

MR. KANE: Has that kind of situation ever occurred before, to your recollection, that documents in which you are on the distribution list do not reach you within the

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B&W organization?

MR. KARRASCH: I don't believe that that is a normal occurrence at B&W. I suspect that I did get this memo, although I do not recall. And I suspect that I handled it in a very routine fashion, as I do much of the documentation which crosses my desk.

MR. KANE: Did you talk to Mr. Kelly about that document at all?

MR. KARRASCH: I do not believe that I did.

MR. KANE: Did you have any oral communications with anyone at B&W about that document prior to March 28, 1979?

MR. KARRASCH: Again, I do not recall.

MR. KANE: All right. I'd like you to look at documents that have been marked Hearing Exhibits 2 and 3. Number 2 is a handwritten memorandum dated November 10, 1977, from Mr. Walters to Mr. Kelly of B&W. And Number 3 is a memorandum dated February 9, 1978, from Bert Dunn to James Taylor of B&W. Again, your name appears on the distribution list for Exhibit No. 3, the February 9, 1978 Dunn memorandum. Did you receive either one of these documents before March 28, 1979?

MR. KARRASCH: I'm quite sure that I did not receive Exhibit No. 2.

MR. KANE: The handwritten memorandum.

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MR. KARRASCH: The handwritten memorandum. And the situation is the same on Exhibit No. 3, as I explained it on Exhibit No. 1. I do not recall.

MR. KANE: And again, do you have any explanation for why a document on which your name appears on the distribution list would not have reached you within the B&W organization?

MR. KARRASCH: I'm not saying that the document did not reach me. In all probability, it did. But my memory does not recall my reading the memorandum or taking any action on it.

MR. KANE: And by any action, you would include, for example, drafting any follow-up memorandum based on that document?

MR. KARRASCH: That is correct.

MR. KANE: All right. I'd like you to look at a document that's been marked Hearing Exhibit No. 4, which is a memorandum dated February 16, 1978, from Bert Dunn to James Taylor. And again, I'd like to know if you've ever seen that memorandum before March 28, 1979.

MR. KARRASCH: I believe I would have to say the situation is similar to Exhibits 1 and 3.

MR. KANE: I see. You have examined these documents prior to today, have you not?

MR. KARRASCH: Yes, sir.

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MR. KANE: Do you agree with the safety concerns that are raised by Mr. Dunn in the memorandums dated February 9, 1978, and February 16, 1978?

MR. KARRASCH: No, sir, not in total.

MR. KANE: Do you agree with them in part?

MR. KARRASCH: Yes.

MR. KANE: What part of those safety concerns that are set forth in those memoranda do you agree with?

MR. KARRASCH: I agree that the concern that Mr. Dunn is raising is a significant issue, that being a possibility for uncovery of the core. But the impression that I have about the system design and analysis that preceded this memorandum was such that that possibility was very, very remote, due to the design of our plant and my perceived knowledge of what the operator procedures look like.

I feel that what Mr. Dunn is saying in the letters is, I have a concern and I believe some clarification should be provided to the operators, in addition to the instructions that they already have. So I guess the part I would disagree about is the very specific sentence which points out that we have not supplied sufficient information to reactor operators in the area of recovery from LOCA. I don't believe that to be a correct statement.

MR. KANE: And you don't believe that to be a correct statement notwithstanding the events which occurred

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at Davis-Besse on September 24, 1977. Is that correct?

MR. KARRASCH: That is correct.

MR. KANE: On September 24, 1977, there was operator interruption of the high pressure injection. Is that correct?

MR. KARRASCH: Yes.

MR. KANE: And that interruption of the high pressure injection was based upon operator reliance upon the level and pressurizer at that time, was it not?

MR. KARRASCH: I believe that's correct. I don't know that for sure. I haven't examined the situation at Davis-Besse in great detail, but that's my understanding.

MR. KANE: I see. And, in fact, those same events occurred on March 28, 1979, at TMI-2, did they not?

MR. KARRASCH: Yes.

MR. KANE: I'd also like you to look --

MR. KARRASCH: But might I point out that is not to say that the procedures that were there were, as Bert has stated in his letter, insufficient.

MR. KANE: Why do you feel that that would not necessarily be the case, then? We have two incidents in which it has occurred, September of '77 and March of '79. Is that right?

MR. KARRASCH: Yes, sir.

MR. KANE: Why do you feel, then, that Mr. Dunn's

A 14 conclusion that the operator instructions being -- the operator information being disseminated by B&W was not insufficient?

MR. KARRASCH: Well, there are two parts to disseminating information to the operator. One is writing the procedure. And the second is the operator has to follow it. Mr. Dunn has only addressed one of those, and I don't believe he did it correctly.

MR. KANE: Mr. Dunn has only directed one of the procedures by which the operators are --

MR. KARRASCH: No, he has only addressed one of the two issues at hand that I just mentioned previously.

MR. KANE: That is operator procedures?

MR. KARRASCH: Right. As opposed to proper response of the operator to his procedures.

MR. KANE: All right. Mr. Karrasch would you also look at a document that's been marked Hearing Exhibit No. 5, which is a memorandum dated August 3, 1978, from Donald F. Hallman to you? Do you recall reading this memorandum?

MR. KARRASCH: Yes, I do.

MR. KANE: When do you recall reading that?

MR. KARRASCH: I believe I read it within a week following the date of August 3rd.

MR. KANE: What did you do about this memorandum?

MR. KARRASCH: I recall glancing over it very quickly and keying on the two specific questions. I do not

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recall reading it very carefully at the time, but I do remember looking at the specific questions that Mr. Hallman was asking me. I remember thinking that they were rather routine questions from the Nuclear Service Department to the Engineering Department and that they could be answered in a routine fashion. I then am quite sure that I placed a note on top of the memorandum to one of two people who report to me in Plant Integration, with a message to him to please follow up on this and take any action that you seem appropriate, or something like, please answer the questions and get back with Mr. Hallman.

I then, just that quickly, disposed of this piece of paper crossing my desk.

MR. KANE: Who were those two persons, one or the other of whom you sent this memorandum to?

MR. KARRASCH: Their names are Eric Swanson and Arthur McBride.

MR. KANE: Do Mr. Swanson or Mr. McBride recall ever receiving this memorandum of August 3, 1978, from you?

MR. KARRASCH: No, sir, they do not.

MR. KANE: Was your reaction at that time, to that memorandum, simply forget it and to proceed with higher priority work?

MR. KARRASCH: Yes.

MR. KANE: Did you feel, in reading over that

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memorandum that Mr. Hallman was asking you for answers to specific questions in the memorandum?

MR. KARRASCH: Yes, sir.

MR. KANE: And after receiving the memorandum, did you have any further contact with Mr. Hallman concerning this subject matter?

MR. KARRASCH: Yes, sir, I did.

MR. KANE: Would you describe those contacts?

MR. KARRASCH: I can remember two informal contacts with Mr. Hallman, some time between August 3rd and the end of the year, 1978, in which, either on a telephone conversation or a passing in the hallway at work, Don asked me if I had received the letter and if I had taken any action on it. My response back to him on both of those occasions was, yes, I had passed it on to somebody else in the Plant Integration Unit, and hopefully he would be receiving a response in the near future.

MR. KANE: Did you personally follow up with any action after these contacts with Mr. Hallman?

MR. KARRASCH: I did not personally follow up with any action until after the first of the year, 1979.

MR. KANE: Yes, let's come to that. After January 1st, 1979, and before March 15th, 1979, did you have any further contact with Mr. Hallman concerning the subject matter of the memorandum?

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MR. KARRASCH: Yes, I did. Again, it was informal, conversation as opposed to documentation or letter writing. And again, Don asked me if I could please take some time and address his questions. At that time, I recall finding a copy of this letter. I don't know exactly how I did get it, but I recall that I did look over the letter and read it. And I recall just a brief discussion about the implications of going solid in the pressurizer and water relief through the safety valves.

Again, I can specifically recall talking to somebody about another work effort going on at B&W where that situation occurs, in a different type of event. And the response I got back is that we had been looking at solid system and water relief through the valves and that in this other analysis, that had been evaluated and was acceptable.

That occurred probably some time early in February. I then followed up with Don and merely, again informally, told him that the direction that Bert, in his memorandum, was trying to give to Nuclear Service was correct and that I had followed up and looked at the negative aspects of following Bert's direction, as Don had asked me, and I told him that, in my opinion, he should follow up and take the action that Bert had suggested.

MR. KANE: And this conversation occurred in the

A 18 hallway at B&W, at some time before March 15, 1979?

MR. KARRASCH: All I can tell you is that it was not planned, and informal. I don't know exactly where the location was.

MR. KANE: And it did occur before March 15, 1979, to your recollection.

MR. KARRASCH: Yes, sir.

MR. KANE: All right. After reviewing this memorandum of August 3, 1978, did you feel certain that operating procedures for the B&W plants needed to be clarified to satisfy Mr. Dunn's concerns?

MR. KARRASCH: No, sir, I did not. When I read the memorandum, the routine manner in which I handled it tells me that I did not really agree with what was in Bert's -- agree isn't the word. I didn't really feel the significance of it. That's quite obvious. Otherwise, I believe I would have taken more positive action.

MR. KANE: Do you recall your deposition being taken in connection with this Commission's proceedings, on July 16th, 1979, Mr. Karrasch?

MR. KARRASCH: Yes, sir.

MR. KANE: Can I arrange to have a copy of the transcript of that deposition placed in front of you?

(A transcript of the deposition of B. A. Karrasch dated 16 July 1979 was given to the witness.)

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MR. KANE: Let me ask you to turn to page 35 of that transcript, Mr. Karrasch. Do you recall being under oath at the time this deposition was taken?

MR. KARRASCH: Yes, sir, I do.

MR. KANE: All right. Directing your attention to the bottom of page 35 of the transcript, the following statement appears in the context of the discussion of the August 3rd, 1978 memorandum, and I'm quoting from an answer you gave --

MR. KARRASCH: Excuse me a moment, I can't seem to find page 35. Oh, there it is.

MR. KANE: All right. Do you have that reference in front of you? Page 35, at the very bottom.

MR. KARRASCH: Yes, I do.

MR. KANE: The following statement appears, as a portion of your answer: "When I finally got around to studying this" -- and "this" is a reference to the August 3rd, '78 memorandum -- "it was quite clear to me that additional clarification to the procedures that were already in place is something that we ought to do and that the two concerns were not significant compared to further clarification to the operator and that he should leave the high pressure injection system on."

Is that an accurate transcription of you answer at that time, as you recall it, Mr. Karrasch?

MR. KARRASCH: Yes, I believe it is.

MR. KANE: And does that statement accurately reflect your feelings today about this matter?

MR. KARRASCH: I think that's right.

MR. KANE: What was Mr. Hallman's response to this position on your part that he should take whatever action was necessary, in this conversation you had in 1979?

MR. KARRASCH: I do not recall anything more than an acknowledgement from Mr. Hallman that he had heard me.

MR. KANE: All right. And prior to March 28, 1979, did you take any further action at all on this matter?

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

MR. KANE: All right. I have no further questions, Mr. Chairman.

CHAIRMAN KEMENY: Mr. Karrasch, could I direct your attention to Hearing Document No. 6, which is a post-TMI-2 document from Babcock and Wilcox? It's an April 4th memorandum. Do you have that in front of you? The subject is supplementary operating instructions for HPI systems.

MR. KARRASCH: Yes, I have it in front of me.

CHAIRMAN KEMENY: Did you or any member of your section participate in developing those instructions?

MR. KARRASCH: Yes, sir, I believe we did. Mr. George Brazill, whose name is on distribution, is a member of the Plant Integration Unit.

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CHAIRMAN KEMENY: In that case, can you reconstruct for us why, in April of 1979, it was decided that such supplementary operating instructions should be sent out?

MR. KARRASCH: I believe it was a direct result of the incident at TMI-2 and the lesson that we had learned there, that the operator indeed did require the additional clarification.

CHAIRMAN KEMENY: In view of that statement, would you, in retrospect, now say that such action should have been taken as a follow-up to the September 24, 1977 incident at Davis-Besse?

MR. KARRASCH: Would you please repeat that?

CHAIRMAN KEMENY: Yes. Would you now, in retrospect, since after TMI-2, such action was taken, feel that some such action should have been taken as a follow-up to the Davis-Besse incident of September 24, 1977?

MR. KARRASCH: That's a very difficult question to answer. If you are alluding to the fact that if such action were taken, prior to March 28, 1979, that the incident would not have occurred, then I cannot answer the question yes.

CHAIRMAN KEMENY: No, I did not make that assumption. I simply asked if after TMI-2, it seemed important -- and this document comes out very quickly after TMI-2 -- to send out such instructions, would it, in retrospect -- and I know this is Monday morning quarterbacking -- but would it, in

retrospect, have been appropriate or important to send out some such follow-up instructions after the September '77 incident?

MR. KARRASCH: Yes, I think I agree with that.

CHAIRMAN KEMENY: Therefore would you now, in retrospect -- and I do realize this is in retrospect -- feel that perhaps your taking of the matter of Dr. Hallman's memorandum perhaps have been too light?

MR. KARRASCH: Yes, sir.

CHAIRMAN KEMENY: Thank you. Other commissioners? Dr. Marks.

COMMISSIONER MARKS: Mr. Karrasch, I'm struck by the fact that there seems to be a failure within your division of communication, in the sense that Mr. Kelly, who reports -- who is a member of your division, writes a memorandum and follow-up memorandums on the same issue from Mr. Dunn, come to your desk, and you don't recall having received them, nor apparently, in the case when you kicked it to some of your subordinates, do they recall having received it from you.

Have you made any effort to investigate what breaks down in the communication within your division, that could account for these events?

MR. KARRASCH: No, sir, I have not yet made an investigation.

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COMMISSIONER MARKS: You have not yet. You don't feel any urgency about having done this, for concern that something like this can happen again?

MR. KARRASCH: I believe the issue, sir, is not so much one of lack of communication. I believe the issue is more one of the priorities which were placed upon this issue at the time it occurred. It did happen. The communication channels did break down. And to say, I was busy doing something else, is really an excuse, but it's a fact. And I believe that that fact is probably one of the most important issues, as a result of the TMI-2 incident. And it's not one of communication. It's one of the priorities that have in the past been placed upon an issue such as this.

My job in the Engineering Department is one of design control and assuring that the licensing, documentation, the analysis that is done, and the hardware that we deliver is a good product, a safe product, and meets all the current requirements, as dictated to us by the NRC.

And what we have found ourselves doing in the past is responding to those requirements to do specific plant analysis and take steps to assure a safe design, as a result of that analysis. And when I say priorities here, I have to say that my priorities, prior to TMI-2, were placed on the issues at hand. The NRC sets a lot of the priorities at the Babcock and Wilcox Company. And at the time that these

memos were being circulated and, as you've all discovered, very slow action was taken at that time. We were addressing issues like the anticipated transient without scram issue. We were doing a complete reanalysis of all our operating plants for a new seismic and set of requirements for LOCA. We have very high priority commitments to our customers to tell them what to do about an NRC requirement to go a cold safe shutdown immediately following any incident.

And all I can tell you, sir, is that my priorities, prior to TMI-2, were in those areas. And I think we're all aware that the lesson to be learned here is that the priorities and what we look at need to be shifted somewhat, as a result of the event. And Mr. Taylor alluded to them when he talked about tying this knot, if you will, tighter between the operators and the analysts. And I believe B&W will take the lead to see that that happens in the future.

COMMISSIONER MARKS: Are you involved in this safety procedures committee that Mr. Taylor is charged to implement?

MR. KARRASCH: I am not at this time.

COMMISSIONER MARKS: You're not.

CHAIRMAN KEMENY: Professor Marrett?

COMMISSIONER MARRETT: To continue along the lines regarding changes, post-TMI, are there any specific changes

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you've made within your section? You mentioned changing priorities. But organizationally or structurally, are there any changes you've made?

MR. KARRASCH: Since TMI, I have not made any formal changes in organization in the Plant Integration Unit. But I have assigned people to focus on three primary areas of the aspects of my duties and responsibilities.

COMMISSIONER MARRETT: Would you indicate those?

MR. KARRASCH: Yes, those three primary areas are now going to be, number one, the operating plants and the communications with our Nuclear Service Department. That would be one subgroup or one responsibility I've assigned to a group of people. The second would be a focus on the priorities as they were before TMI-2, and that's specifically those jobs, or those contracts that we have that are in the construction stage or application of construction program, prior to operation. That's where most of the work in my unit has resided in the past, in obtaining construction permits and operating licenses for our newer plants. And the third element of my group is going to focus very specifically on those systems required for plant protection. In the past, it's been spread among the various elements of the old organization. And now I very much want to focus a group specifically on plant protection system design and analysis.

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COMMISSIONER MARRETT: Mr. Taylor indicated that the broadening of horizons, I believe he called it, would include issues in the human-machine interface area. Does any of this come within the kind of changes in priorities that you're referring to?

MR. KARRASCH: One other specific change has been made within the section that I work, which is called the Plant Design Section. And that's been to form a new unit which is at the same level as the Plant Integration Unit. It's called Power Systems and Controls. And that unit has been assigned the responsibility to take the initiative to find out what's happening in the field on our operating plants and, from an engineering standpoint, assist the customers, our operating plant customers, in improving both the operations and the design of those plants and then also feeding lessons learned from the operating plants into our future designs.

COMMISSIONER MARRETT: You indicated a while ago that much of your time had been spent, pre-TMI, in responding to NRC guidelines and a number of other issues from NRC. Now in terms of reorienting priorities, what role should NRC play? Is there anything that the Nuclear Regulatory Commission can do to facilitate some of the kind of broadening, the closing of the loops, and the other changes we've heard about from both you and Mr. Taylor?

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MR. KARRASCH: Yes, ma'am. What I alluded to as a change in priorities is not just a change that would occur at the Babcock and Wilcox Company. It won't work unless that change in priorities occurs both with utility customers, the NRC, and ourselves.

COMMISSIONER MARRETT: Concretely, is there anything you would recommend that would be essential at the NRC level to facilitate again the kind of broadening?

MR. KARRASCH: Yes, ma'am. I believe that the action that the NRC has taken as a result of TMI-2, that being to define new analysis which would focus more upon a normal expected sequence of events, such that occurred at TMI-2, and then to follow up and train the operators. That thinking is going on in the NRC concurrently with ours right now.

And the only action that I personally think we should recommend is that these things happen very quickly. Wehave a tendency to, sometimes, study a problem too long. And I'm still waiting to really start doing -- I guess I'm waiting for direction from NRC and our utility customers to change the priorities I was talking about earlier.

COMMISSIONER MARRETT: Well, as you may recall, there has been some comment that a great deal of responsibility has to be taken by the manufacturers, by the utilities. And, in other words, one of the problems that

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may occur, or may have occurred, is a tendency for so much to be in terms of regulations that there may be simply a waiting for the directions to come down, rather than a great deal of independent action. And I just wondered whether you'd want to respond to that. To what extent are the changes dependent upon or likely to be simply responsive to NRC actions or regulations?

MR. KARRASCH: I think, prior to TMI-2, that indeed was the emphasis. We were in a responsive mode. But the NRC doesn't know as much about the design and operation of the plants as the vendors and the utility customers do. And in order to really develop good meaningful regulations which will provide direction on how to analyze a plant for expected events and then take that information and make sure the operators are properly trained, I believe everybody has to get together. I don't think we can rely on one of the three elements I've been discussing.

CHAIRMAN KEMENY: Professor Lewis.

COMMISSIONER LEWIS: How often do you do business in hallways? Is that a regular practice? I mean, do you often just decide, meeting somebody at a drink machine or just in a hallway, to do this or do that? Or is there a regular procedure?

MR. KARRASCH: I would say it's an infrequent way of doing business at B&W.

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COMMISSIONER LEWIS: Is this a breach of basic procedure? Aren't decisions supposed to be put into some sort of memorandum form?

MR. KARRASCH: Yes, ma'am.

COMMISSIONER LEWIS: So you did not go through the normal procedures on the HPI injection. Is that correct? You said you told Mr. Hallman in the hallway, just by the way, very casually.

MR. KARRASCH: The information that had been previously documented in Mr. Dunn's February 16th memo correctly gave the direction to be taken by Nuclear Service. Nuclear Service was merely asking me my opinion or for some clarification. And I guess my normal course of doing business is to follow up with documentation, either a quick letter, which isn't required by our procedures. There are many other forms of papers required by our procedures for different elements of the design and analysis. But this particular one, in retrospect, I suspect should have been followed up by a piece of paper. It was not.

COMMISSIONER LEWIS: What in Mr. Hallman's remarks indicated to you that he understood precisely what you were talking about?

MR. KARRASCH: It was really no more than an acknowledgement, a very informal yes, or a nod of the head, or thank you for finally getting around to it, something like

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that.

COMMISSIONER LEWIS: You're sure that you both were talking about the same thing? That he understood this was the issue that you were referring to?

MR. KARRASCH: I believe he did, yes.

COMMISSIONER LEWIS: And his acknowledgement was in what form? Do you recall the words that he said, or was it a nod?

MR. KARRASCH: I do not recall.

COMMISSIONER LEWIS: He did not ask you for a memorandum to that effect?

MR. KARRASCH: No, ma'am, he did not.

COMMISSIONER LEWIS: Okay. Do you think this may be hell of a way to run a railroad?

MR. KARRASCH: Yes.

COMMISSIONER LEWIS: Okay, thank you.

CHAIRMAN KEMENY: Governor Peterson was next.

COMMISSIONER PETERSON: Mr. Karrasch, I want to follow up on your comment about priorities. It would appear to me that if you had the foresight that none of us had, that this failure to respond to the Dunn memo, for example, would have led to a major threat to safety of a community, to hundreds of millions of dollars of costs, to the establishment of a Presidential commission, that you probably would have given this pretty high priority, and the

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chairman of the board and the president and all of you would have been burning the midnight oil to respond to it. It's easy in hindsight to be critical and to be a Monday morning quarterback. But it appears to me when I read that memo today, coming from one of your key people with major responsibility, saying this was a serious threat, it's kind surprising that it wasn't given high priority. But I realize that's in hindsight.

My question is could it be that all of the atomic energy industry's efforts to tell everyone how safe nuclear energy is could have provided a mind set so it kind of downgraded any threats to safety and give priority instead to fulfilling some requests of the Nuclear Regulatory Commission.

MR. KARRASCH: I think so. My earlier remarks on shifting now our priorities, I think answer that question. We have been studying, for many years, and spending many millions of dollars in analysis and design of those features of a plant which are very, very improbable. And we have been designing -- And these are the major events which are documented in the safety analysis reports. We haven't really thought much about the operator and his role, because we've been designing the systems to automatically keep the plant safe for those very unlikely events. And when I talk about changing priorities, I believe what I really mean is that

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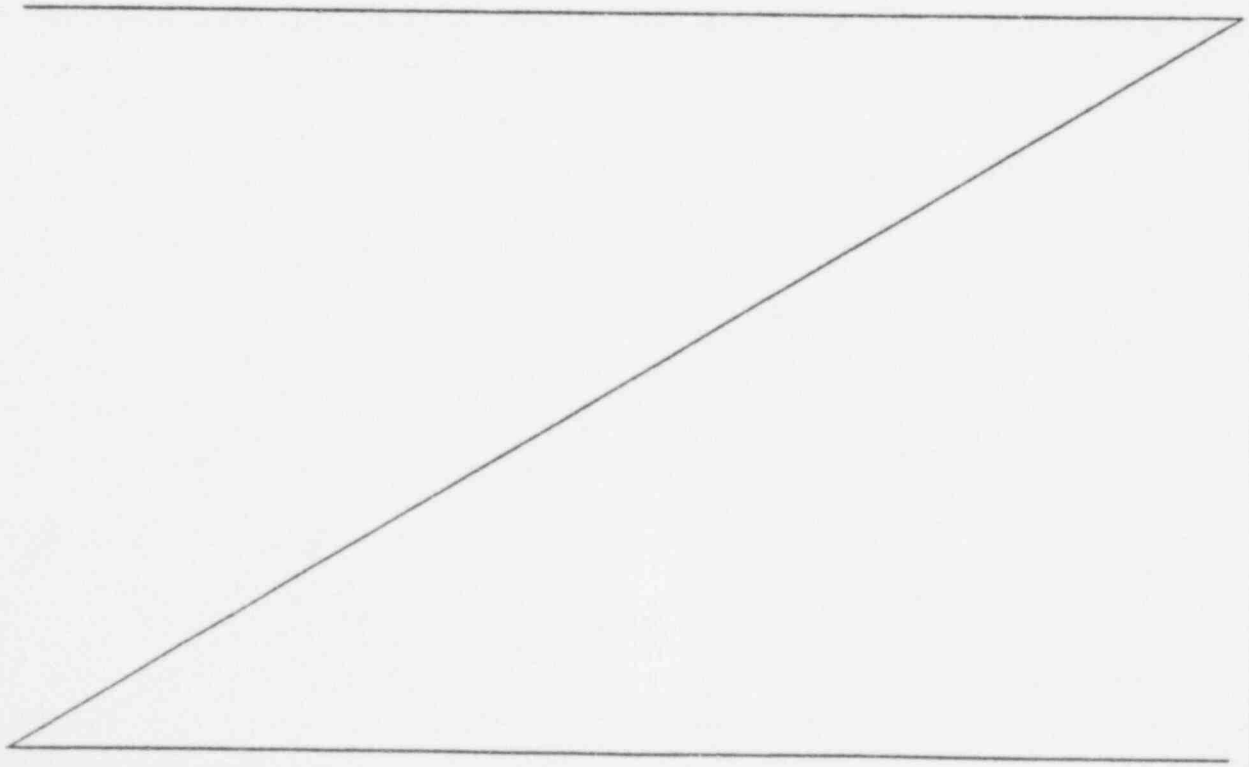
the emphasis should now be changed to one of first having the analysts, the Bert Dunns, the guys who really know how this plant works, focus more upon looking at a sequence of events that can really happen on an operating reactor, and then making sure that the operators can handle the abnormal.

I don't believe we can design nuclear power plants to handle an infinite number of different scenarios, or different event trees, if you will. There's too many things in that very complex system, not only in the NSS, but in the whole plant, which you could never guess would happen and try to analyze and then give the operator a cookbook or a recipe on what to do in the event of. And I believe the lesson to be learned here is that the operators have just got to understand more about the plant.



COMMISSIONER PETERSON: Does that mean that it is likely that there will be other Dunn memos coming on other issues as the weeks and months go by?

MR. KARRASCH: Absolutely. There are many other events which we can postulate, you know, the what if's that you can ask yourself about other features of a nuclear power plant that could have serious consequences.

COMMISSIONER PETERSON: Are you aware -- it is a silly question to ask but are you aware of how much the operators appear to depend upon you for their knowledge of how to operate? I noticed the people from Metropolitan Edison when they were here talking about the importance of your simulator and how they got a lot of information on how to operate under potential conditions --

MR. KARRASCH: Yes --

COMMISSIONER PETERSON: Are you aware that that carries a pretty big responsibility, doesn't it?

MR. KARRASCH: I am aware of the process and I regret to say that I am not as aware as I would like to be as to exactly how that training goes on.

CHAIRMAN KEMENY: Commissioner McBride.

COMMISSIONER MCBRIDE: I notice in the November 1, 1977 memorandum from Mr. Kelly that your name is at the top of the list. As I recall, you were not overly concerned when you received it and really didn't recognize the impact of what, or

did not give it the kind of importance that Mr. Kelly felt that it warranted when he wrote the memorandum. He raised a very serious question. I wonder if you could explain why your name was at the top of the list of distribution?

MR. KARRASCH: I suspect it is just because I was unit manager.

COMMISSIONER MCBRIDE: And is there any particular reason why the Dunn memorandum of February 9th had your name third from the top? Is there any reason for that?

MR. KARRASCH: No, sir. I am sure there is not. I believe it was -- I can't really speak for Bert but I suspect he was just mentally in his mind going through the names that he thought should receive the memorandum and popped them out as they came to his mind, with no order to them.

COMMISSIONER MCBRIDE: When a memorandum comes out with seven names and left pretty much without rhyme or reason as to what order they would appear, is there anything in the system that would pinpoint responsibility? Here is a situation which had been experienced more than once, a matter of concern to engineers who have a sense of responsibility and are looking to avoid a repeat of these kinds of incidents and they pinpoint certain errors that have been experienced, and raise the question of how to prevent them and how to notify the operators and the people on the scene, of the proper sequence and the proper condition to maintain, to avoid a serious problem. This goes

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to a number of people then. Is there anything in the B&W organization that would pinpoint responsibility or dealing with this question that raised, for example -- raised in the Kelly memorandum? Does anyone have responsibility for saying you are right, you are wrong, we will follow your approach, or we reject it? Is there anyone who had that responsibility?

MR. KARRASCH: I would say on this particular memorandum there was no assignment of specific action to be taken. Joe asking for some opinions and some thoughts on this matter. In the normal course of business at B&W when we write documentation, for the most part action will be assigned, a commitment will be made, and things will happen. And the memorandums will be directed either to a distribution which has assigned action or to a single person who has the action follow up. On this particular memorandum, it was sort of a feeler from Joe to find out --

COMMISSIONER MCBRIDE: As I recall, he said specifically, I recommend the following guidelines be sent. That seems to me a concrete course of action, a specific, and he is now recommending to seven people "I recommend the following guidelines be sent" and then he listed a) and b). And apparently no one then felt called upon to either adopt his recommendation or to reject it. Am I right about that or am I wrong?

MR. KARRASCH: I think you are right.

COMMISSIONER MCBRIDE: I don't have any other questions.

CHAIRMAN KEMENY: Commissioner McPherson.

COMMISSIONER MCPHERSON: I will follow up on Commissioner McBride's question, Mr. Karrasch, your responsibility, as I read it in your deposition, is to make sure that people talk to each other.

MR. KARRASCH: Yes, sir.

COMMISSIONER MCPHERSON: Is that all?

MR. KARRASCH: That was a rather informal way to put it in ten words or less. The duties of plant integration are very broad and complex. But in a nutshell, it is to assure the unity of effort within the Engineering Department at B&W. The Engineering Department is made up of between four and five hundred engineers, all with various duties and responsibilities. An integration concept was developed five or six years ago to provide a focal point for communication channels among those many engineers. So making sure people talk to each other is a very informal cliche of describing my duties.

COMMISSIONER MCPHERSON: Mr. Kelly works for you?

MR. KARRASCH: That is correct.

COMMISSIONER MCPHERSON: So he was talking to you in this memo?

MR. KARRASCH: He was communicating to me, yes, sir.

COMMISSIONER MCPHERSON: Right. And you don't recall what you did with what he said to you?

MR. KARRASCH: That is correct. I guess, as my

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deposition stated, when I look at mail like this with no assigned action to myself, I will try to do a couple of things with it because I do handle a very large volume of mail, I will try to make sure that the right people are getting informed and that there is, what in my opinion is, a competent group which has some action to do something. I can only guess what I would have done with this but I suspect I would have looked at the distribution list, convinced myself that the proper people were getting communicated what Joe Kelly was trying to communicate, and that because it is a rather competent group of people I would assume that action would take place without my involvement.

COMMISSIONER MCPHERSON: Where would you have expected that action to take place? Who would be responsible for responding to your employee's two recommendations?

MR. KARRASCH: What I would expect to come out of this would be --

COMMISSIONER MCPHERSON: Specifically who in the Company would have said that is a good idea or that is a bad idea? Who would have carried that can? The difficulty that we are all having here, in reading your organizational chart and trying to figure out who has got the responsibility is pinning the tail on the donkey.

MR. KARRASCH: I think the way this series of memorandums went is an example of how this should have gone. And

what I believe happened here was that the right people got together, that being Joe Kelly and Bert Dunn and Nuclear Service, and came to an agreement on how to implement Joe's suggestion. That is exemplified in the two memos from Bert Dunn.

COMMISSIONER MCPHERSON: Well, let us take the time sequence on that: The Davis Besse accident occurred in September, 1977; two months later Mr. Kelly wrote a memorandum about it and said I think this accident raises some very serious safety questions. I take it you don't have any quarrel with the fact that uncovering the core is a high priority?

MR. KARRASCH: No, sir. I agree with that.

COMMISSIONER MCPHERSON: Then five months after the accident -- five months after the accident Mr. Dunn wrote a memorandum which also went to a number of people. You don't know what your own response to that was at the time. Finally, six months after that Mr. Hallman wrote a memorandum and raised some objections, almost a year after Davis Besse. Then about four months after that, four or five months later, you had a conversation with Mr. Hallman in the hallway, in which you said something will be done along the lines of Bert Dunn's memo. Finally, March 28th, TMI. A week after that action with respect to the HPI procedure. As I read it, that is a total of 19 months after Davis Besse; 17 months after the Kelly memorandum. And your Company has a large number of utilities which have bought your systems and to which the Kelly memorandum, I

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assume, would have applied. That strikes me as verging on the irresponsible in so far as the action of the vendor company having this information and this concern with respect to its utilities. Would you like to comment on that?

MR. KARRASCH: I believe that the timing that you allude to as being long is correct. This issue is something that if it had the proper attention could have been resolved within several months at most. I don't know for sure but my impressions, as I stated earlier, are that we have designed our system and given operators proper training on how to handle this type of event. I think, as Mr. Taylor stated, the procedures were in place for him to recover from the TMI-2 incident.

COMMISSIONER MCPHERSON: Do you think the April, 1979 memoranda in that event were -- those April 4 and April 17 memoranda were superogatory, were not required then because the procedures were already in place?

sic

MR. KARRASCH: I believe that the procedures that were in place should have allowed the operator to recover from TMI-2. I believe that what Bert and Joe Kelly were writing about was the result of experience at Davis Besse which showed that the operators could probably use more additional clarification on this subject. But the event at TMI-2 is a very, very complex sequence of events. I think this issue of the HPI is just a very small part of that.

COMMISSIONER MCPHERSON: One last question, Mr. Chairman

I was unclear, Mr. Karrisch, as to why you told Hallman in the early part of this year, sometime in January or February, to go ahead with Bert Dunn's recommendations. You had previously had concerns about them and, in fact, disagreed with them in part?

MR. KARRASCH: Would you say that again?

COMMISSIONER MCPHERSON: My understanding from your testimony this morning was that you told Mr. Hallman sometime in January or February of this year, when you met him in the hallway, to go ahead with Bert Dunn's recommendations.

MR. KARRASCH: That is correct.

COMMISSIONER MCPHERSON: But you had had trouble accepting those recommendations earlier. What caused you to say go ahead?

MR. KARRASCH: It is not correct that I did not agree with Bert Dunn's earlier recommendations. The correct way of stating it is that I was asked by Don to answer to specific questions related to the pressurizer going solid and water discharge through the relief valves in the quench tank. The issue was the answering of those questions. It was not whether or not I agreed with Bert. I did agree with Bert.

COMMISSIONER MCPHERSON: Thank you.

CHAIRMAN KEMENY: Mr. Karrasch, I understand that you have requested that you be excused at the end of this questioning and we will accommodate you on that. In order to make it

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possible I need one more line of inquiry from you to have to anticipate something: May I request that the witness be provided with a sworn deposition of Dr. Hallman?

MR. KARRASCH: I might add, Mr. Kemeny, that I am willing to stay. I do not have to leave.

CHAIRMAN KEMENY: Oh, very good. But we were trying to be cooperative. Would you be good enough to turn to page five of that sworn deposition? I will read a portion of it out loud and let me put it in context: This is a portion of Dr. Hallman's sworn deposition that refers to this informal conversation sometime early this year that you have referred to, which Dr. Hallman acknowledges did take place. I direct your attention to roughly line 11. Question, "And what did he" -- he being you, yourself, Mr. Karrasch, "what did he inform you at that time"? Answer, "again, to the best of my recollection, he informed me that there was no problem". Question, "and what did his response mean to you"? Answer, "that response was confusing. I did not realize at the time whether he meant there was no problem with action or there was no problem with operator inaction and I did not ask him for clarification at that time of our conversation". I would like very much to hear your reaction to those statements by Dr. Hallman.

MR. KARRASCH: The message I was trying to convey to Don was that I could answer both of his questions affirmatively, that being, that there was no problem with the pressurizer

going solid, or with water relief through the safety valves. I can only say that the informality of the conversation and the lack of follow up documentation -- I guess I can understand Don's confusion.

CHAIRMAN KEMENY: I would like to return to your statement that Commissioner McPherson quoted that the major role of your Section is to make sure that people talk to each other. It would be reasonable to assume that that would include making sure that people understood each other when they were talking?

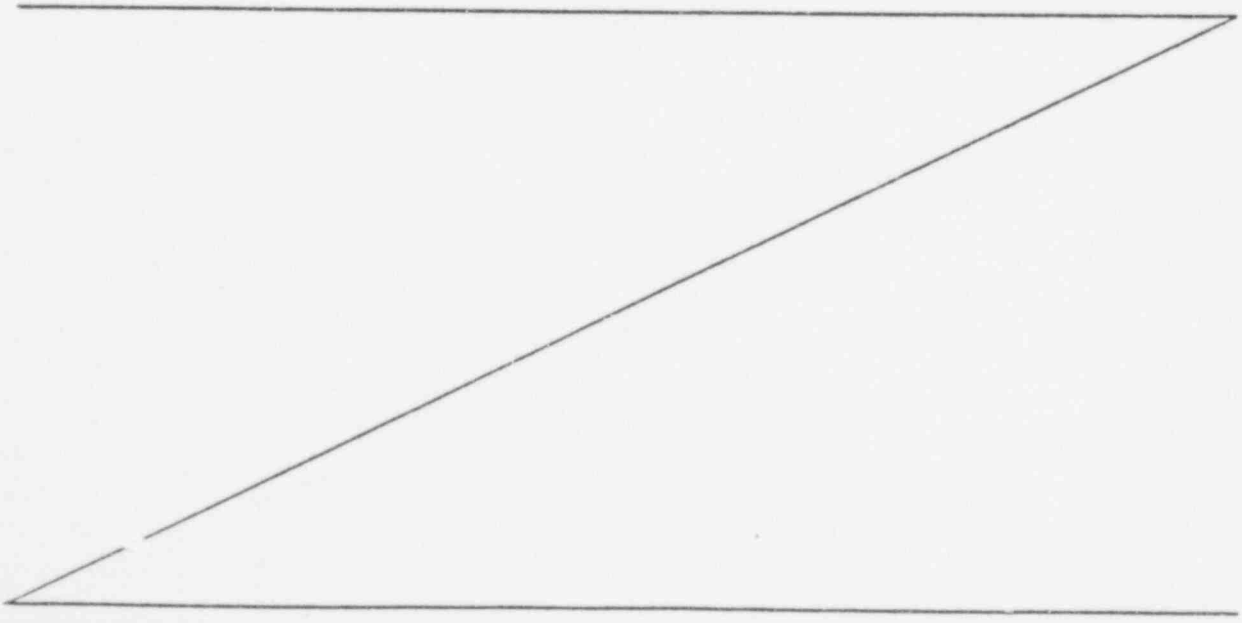
MR. KARRASCH: Absolutely.

CHAIRMAN KEMENY: Would it be fair to say that there may have been a major lack of communication even though people were talking to each other in this particular incident?

MR. KARRASCH: That is possible.

CHAIRMAN KEMENY: Thank you. The witness is excused.

Would Chief Counsel please call the next witness?



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CHAIRMAN KEMENY: May I ask counsel, would it be helpful if we declared a brief recess at this point?

MR. EDGAR: Yes.

CHAIRMAN KEMENY: I would be happy to commentate. We will recess for 10 minutes.

(Brief recess.)

CHAIRMAN KEMENY: Mr. Edgar, I understand there was an issue you wished to raise to the Commission.

MR. EDGAR: Yes. We have Mr. Kelly and Mr. Walters on standby, subject to recall. As the Commission is proceeding, we would like to request at this point that they be allowed to return to lunch break.

CHAIRMAN KEMENY: Yes. We asked them to standby depending on what further testimony brought out, but in view of the way that the questioning went, the two witnesses are hereby excused.

MR. EDGAR: Thank you.

CHAIRMAN KEMENY: Would the counsel please swear the next witness?

MR. GORINSON: Raise your right hand, please.

Whereupon,

DONALD F. HALLMAN

was called as a witness and, after being first duly sworn, was examined and testified as follows:

CHAIRMAN KEMENY: Would you please state your full

name and your current position with B&W, please.

MR. HALLMAN: My name is Donald F. Hallman. I am Manager of the Plant Performance Services Section.

CHAIRMAN KEMENY: Chief Counsel, who will question?

MR. GORINSON: Mr. Kane.

MR. KANE: Thank you, Mr. Gorinson.

Mr. Hallman, how long have you been employed at B&W?

MR. HALLMAN: Since 1972.

MR. KANE: And would you briefly describe your duties in the position of Manager of the Plant Performance Service Section?

MR. HALLMAN: Yes. The Plant Performance Service Section is responsible for both initial and post-refueling test programs, from fuel loading onward, supplying the paper-work to describe the tests to be done, acceptance criteria, etcetera. We are also responsible for providing certain operating guidelines and also emergency guidelines, dealing with systems as opposed to specific pieces of equipment.

MR. KANE: Mr. Hallman, this Commission has already heard a great deal of testimony concerning a transient at Davis-Besse on September 24, 1977. When did you first hear of that transient?

MR. HALLMAN: I don't recall exactly. I am sure I heard of it the same date that it happened.

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MR. KANE: All right.

When did you learn that this transient involved an interruption by the operator of the high pressure injection system?

MR. HALLMAN: To my knowledge, that was with the Joe Kelly memo.

MR. KANE: And that is a document which we have previously had marked as Hearing Exhibit No. 1, a memorandum dated November 1, 1977, from Mr. Kelly. Is that correct?

MR. HALLMAN: That is correct.

MR. KANE: Did you look at that memo in November of 1977?

MR. HALLMAN: Yes.

MR. KANE: What did you do after you reviewed that memorandum?

MR. HALLMAN: Per my memory, I sent it to Frank Walters with a notation, what do you think, to solicit his opinion as to whether this was an issue that should be addressed immediately or a technical evaluation of the issue raised.

MR. KANE: Did you discuss that memorandum thereafter with anyone else before March 28, 1979?

MR. HALLMAN: I don't recall that particular memoranda. I do recall discussing the Bert Dunn memoranda which will come later and this may or may not have been a part of the discussion.

MR. KANE: All right. Let's come to that memorandum. I would like you to look at a memorandum that has previously been marked as Hearing Exhibit No. 3, which is a memo from Bert Dunn to James Taylor, dated February 9, 1978. When did you first see that memorandum?

MR. HALLMAN: Per my memory, it was in the February-early March time frame of 1978.

MR. KANE: Did you agree at that time that the contents of that memorandum should be looked into as a significant concern?

MR. HALLMAN: I agreed that it should be looked into. It is not my recollection that I shared Bert's expression of being a serious concern, but since Bert was the engineering expert in that area I took steps to see that it was looked into.

MR. KANE: What did you do with that memorandum?

MR. HALLMAN: I asked Mr. Walters to handle it for me.

MR. KANE: Did you ask him to follow up to determine what actions, if any, Plant Performance should take?

MR. HALLMAN: Yes.

MR. KANE: After that time and before August of 1978, did you make any determination as to what Plant Performance should do about the concerns referenced in that memorandum?

MR. HALLMAN: Not per my memory.

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MR. KANE: All right.

I will ask you to look at a memorandum that has previously been marked as Hearing Exhibit No. 5. It is a memorandum from you to Bruce Karrasch, Plant Integration, dated August 3, 1978. And I will ask you, did Mr. Walters prepare that memorandum for your signature?

MR. HALLMAN: Yes. I may have made some word changes, but it was essentially Mr. Walters' preparation.

MR. KANE: And did you review that memorandum and then sign it?

MR. HALLMAN: Yes, I did.

MR. KANE: Why did you send that memorandum to Mr. Karrasch?

MR. HALLMAN: We were considering what actions should be taken as a result of the technical issue raised. And while the action that was recommended was straightforward for the situation recommended -- namely, a loss of coolant accident -- there are other incidents, which in our opinion could occur in a power plant, where those actions taken inadvertently may not have been the correct actions to take. So, we wanted an evaluation of, if this is done out of sequence are we doing more harm than good, essentially.

MR. KANE: After sending that memorandum to Mr. Karrasch, did Frank Walters remind you to contact Mr. Karrasch for a response to the memorandum?

MR. HALLMAN: Yes.

MR. KANE: When was that?

MR. HALLMAN: I don't recall the exact time. I recall it being frequently.

MR. KANE: In terms of the time frame from the time you sent the memorandum, was it days, weeks, months?

MR. HALLMAN: It was on the order of weeks, I believe. Frank was -- per my memory, at that time -- out at one of the sites for some period of time, on the order of weeks. When he got back, I believe, he asked me what had happened and to get something going.

MR. KANE: After Mr. Walters reminded you to pursue a response from Mr. Karrasch, did you then succeed in contacting Mr. Karrasch?

MR. HALLMAN: Yes.

MR. KANE: When was that?

MR. HALLMAN: Per my memory, it was on the order of two months, which would have been two months after the initial memo, which would have been the October --

MR. KANE: That is October of 1978?

MR. HALLMAN: Yes.

MR. KANE: What did you tell Mr. Karrasch at that time and what did he reply?

MR. HALLMAN: I don't remember the direct conversation. The intent of the conversation was to say, do you have

DO7

an answer yet? What should we do? When can we get an answer?

MR. KANE: What was the general tenor of Mr. Karrasch's response?

MR. HALLMAN: It was responsive, but did not have an answer yet and the tenor was that I could expect an answer coming.

MR. KANE: Did you then have any further contact with Mr. Karrasch in 1978 concerning this matter?

MR. HALLMAN: Per memory again, I recall two contacts and one was, I believe by telephone and I believe one was walking back to his desk.

MR. KANE: And both of those were in 1978?

MR. HALLMAN: Yes.

MR. KANE: And what was the general tenor of the response there from Mr. Karrasch?

MR. HALLMAN: The general tenor was, yes, we are getting on it and we will have something back to you.

MR. KANE: Did Mr. Karrasch, in those conversations, agree that something should be done about this matter?

MR. HALLMAN: Yes, he agreed that it was an issue that should be looked at. He did not indicate whether, in those conversations, there was a correct action to take or an incorrect action to take.

MR. KANE: All right.

Did you receive any written response from Mr.

Karrasch after these two discussions in 1978?

MR. HALLMAN: I have received none, to my knowledge.

MR. KANE: Did you have any discussion in 1979 with Mr. Karrasch concerning this matter?

MR. HALLMAN: Per my memory, we had a discussion in the late February-early March time frame. This was a meeting in the hallway, where the only part that I really remember about the conversation was at the end I don't think there was a problem, in other words.

MR. KANE: You recall Mr. Karrasch stating to you that in his view there was no problem.

MR. HALLMAN: Words to that essence, yes.

MR. KANE: You did not understand in any sense at that time that Mr. Karrasch was telling you to take whatever action you deemed necessary pursuant to the concerns in that memorandum?

MR. HALLMAN: That is correct. I did not interpret that conversation as, okay, the matter is finished. Let's get on with it. After walking away, I recall arriving at the question of what does the communication mean to me. Does it mean to proceed exactly as Mr. Dunn has recommended or does it mean that there is no need to proceed as Mr. Dunn has recommended? It was not clear in my mind following the hall conversation.

MR. KANE: Did you ask Mr. Karrasch, at the time you

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had this conversation in 1979, for any clarification of his statement that there was no problem?

MR. HALLMAN: I don't recall asking him. No.

MR. KANE: Well, your testimony has been to the effect, both here and in your prior deposition, that you were in a confused state of mind as a result of that response. Why didn't you request any clarification?

MR. HALLMAN: Why did I not or why did I?

MR. KANE: Why did you not?

MR. HALLMAN: Oh. Per memory, I tried to contact Mr. Karrasch, via telephone, after that. But as Mr. Karrasch has testified, he is sometimes fairly busy. I did not put a priority on it at that time to go back and sit at his desk until he appeared. I put a priority of, we have to get back together to decide what it was that he was telling me.

MR. KANE: And so prior to March 28, 1979, you did not succeed again in speaking with Mr. Karrasch about this subject. Is that correct?

MR. HALLMAN: That is per my memory. Yes.

MR. KANE: And after this last contact with Mr. Karrasch in February or March of 1979 and before March 28, 1979, did the concerns reflected in your August 3, memo simply go unresolved while you were awaiting further response from Mr. Karrasch?

MR. HALLMAN: Yes.

MR. KANE: Prior to March 28, 1979, did you or, to your knowledge, did anyone else at B&W, notify any B&W customers of the concerns raised in any of these memoranda we have been discussing?

MR. HALLMAN: Did you ask per my knowledge?

MR. KANE: Yes.

MR. HALLMAN: The answer is "no".

MR. KANE: That is all of the questions that I have, Mr. Chairman.

CHAIRMAN KEMENY: Thank you.

Dr. Hallman, is it the section that you have that is responsible for notifying customers of any concerns that B&W may have?

MR. HALLMAN: Not all concerns, sir. Those concerns which fall into my scope, which is -- as I stated before -- the test programs, the post-fuel load and also certain operating and emergency instructions -- within that scope, yes, it is my responsibility.

CHAIRMAN KEMENY: So, certainly the issue we are discussing now would fall within that scope?

MR. HALLMAN: That is correct.

CHAIRMAN KEMENY: And we do recognize that you did write the memo asking for clarification on that and that you followed up on it a number of times. But let me ask you the following -- what is a normal timetable in your mind for

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resolving this kind of issue?

MR. HALLMAN: For that kind of issue, sir, considering the priority that I placed on it personally at the time, I would consider three or four months.

CHAIRMAN KEMENY: And, yet, in spite of that, you testified that although a significantly longer time elapsed, it didn't quite reach the priority to sit down with Mr. Karrasch and talk it out in detail?

MR. HALLMAN: Yes, sir. That is correct.

CHAIRMAN KEMENY: I would like to get some feeling of how informal that contact was and all of us have in our own organizations been involved in informal contact, but I mean was it just accidentally passing in the hall? I think in your deposition you said it was conversation by the drink machines.

MR. HALLMAN: The last conversation, that is correct. Let me see if I could frame the information. There was a desire on my part to contact Mr. Karrasch.

CHAIRMAN KEMENY: Yes.

MR. HALLMAN: I considered a telephone conversation sufficient, at least early in the procedure. As time went on I cannot recall if I considered that -- I cannot recall my priority accelerating drastically as time went on. But this conversation in the hall was phrased that I had been trying to establish contact with Bruce. Maybe not telephoning him every

day, but occasionally trying to reach him. He was there. I was there. It was on my mind and so, we chose that opportunity to discuss when can we resolve this issue which has now been around for a long time. I believe Bruce was on the way to a meeting. I may have been also, which may have cut the conversation short. It was not a see in the hall and oh, yeah, here is this unresolved issue. It was, I have been trying to get in touch with you Bruce; now, we are in touch, let's discuss the situation.

CHAIRMAN KEMENY: The only thing surprising in that is when you finally caught up with him, you didn't make more of an attempt to try to resolve the issue at that point. Was that for lack of time or what do you attribute it to?

MR. HALLMAN: Per my memory, it was for lack of time at that specific context, without either he or I had something else that we were due to be at or go to and we parted before we had completely finished the conversation.

CHAIRMAN KEMENY: In the normal course of events, how often might you see Mr. Karrasch? Once a month, once a year, once a day -- I don't know the physical layout of B&W.

MR. HALLMAN: Correct. It would be on the order of once every two months, say.

CHAIRMAN KEMENY: So, you would not have frequent contact?

MR. HALLMAN: Unless there were some issue that

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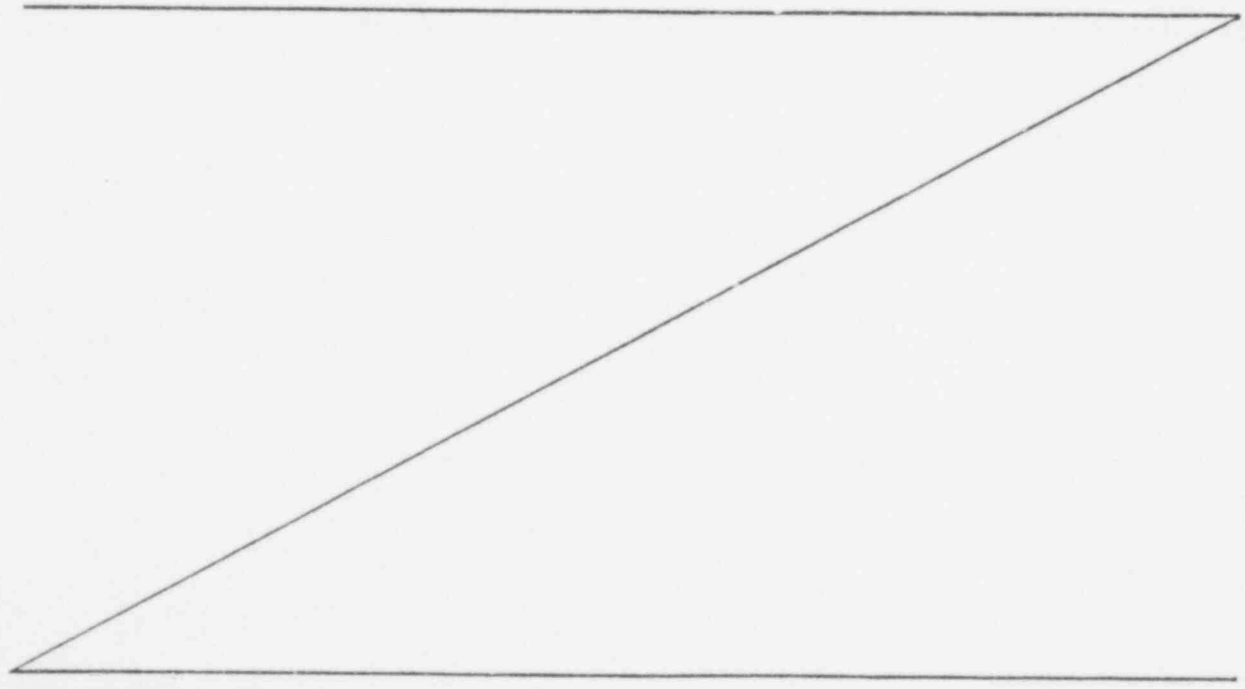
dictated that we should contact each other.

CHAIRMAN KEMENY: Yes.

Dr. Marks.

COMMISSIONER MARKS: Mr. Hallman, do you believe on the basis of what you now know that the priority that you placed on the follow up on this issue of HPI and the contact with Karrasch reflects an error in judgment?

MR. HALLMAN: On the basis of what we now know, which is that Three Mile 2 happened for whatever reason, I wish I had acted sooner. However, had I acted sooner, I am still not sure of the consequences, what it would have affected. As a general term, I can say that a memo that lays around for six months without either resolving that it is not an issue or escalating it up higher to get the issue resolved is not something that I wish to repeat.



COMMISSIONER MARKS: Well, do I interpret your answer, then, correctly to indicate that you do believe, on the basis of what you know now, that it was in error in judgment?

MR. HALLMAN: To let the memo lay out for 6 months?

COMMISSIONER MARKS: Right.

MR. HALLMAN: I believe that regardless of whether Three Mile II happened or not, yes, sir.

COMMISSIONER MARKS: Right. Okay, now what efforts have you made, if any, to analyze why that error in judgment was made?

MR. HALLMAN: About a month after March 28, after I had gotten off the schedule involved with the recovery of the plant, I went back to make an attempt to trace the trail, a "lessons learned" effort, as it were.

COMMISSIONER MARKS: Right.

MR. HALLMAN: I reviewed that, and my initial impression is that the responsibility for not following up was mine. I had the responsibility for the section, and whatever the various section members do is ultimately my responsibility.

I determined that it was a lack of a tickler system. One thing that would help me improve my performance was such. And, as a result of that, I have issued or instituted a tickler system with a simple calendar behind my desk where I can, as memos cross my desk and a decision is reached that some action

is needed, direct those memos outward to the proper place or else reserve them for my action, and write on this calendar a message that I will understand as I turn the various pages: it's time to get something going.

COMMISSIONER MARKS: Well, one thing that has emerged from yesterday and today's testimony is the suggestion that within B&W there is a very high priority orientation toward perfecting the equipment in terms of its operation, but that there is a -- it is less clear whether the same priority is placed on the interface between equipment and the operators; in other words, between man and machine.

Is this a fair evaluation, do you think?

MR. HALLMAN: Sir, in hindsight, and given that Three Mile II happened and there was some reason why it happened, I would agree with that, that maybe we all have been less aware than we should have of this man-machine interface.

However, I guess it is still a judgment call as to how much information and in what format should be placed at an operator's disposal, and that is something that the various parties in the industry -- the vendors, the architect-engineers, the utilities themselves and the NRC -- are addressing, I believe, now, and it will be resolved.

COMMISSIONER MARKS: I am not clear on one thing. You say what is being addressed, specifically, the man-machine interface issue?

MR. HALLMAN: I am not sure what you mean by man-machine. If you mean the information that is present to the person who is required to take an action to make something happen, that is my understanding of man-machine, and yes, that is being addressed.

COMMISSIONER MARKS: Can you tell us how it is being addressed? Has any sort of new expertise in this whole area of human behavior in relation to this kind of machinery been brought to bear on this, or is it the personnel who have been dealing with this all along who have a heightened awareness of this issue?

MR. HALLMAN: Of course, I can speak only for what I know personally. Many things may be going on with the AIF, et cetera, that I am not aware of. But let me answer that --

COMISSIONER MARKS: I'm sorry, AIF is what?

MR. HALLMAN: Atomic Industrial Forum.

Let me answer that with a few more words than just a direct answer. Prior to Three Mile II, I had assumed that we had adequate information in the operator's hand to allow him to analyze an incident such as what happened, given the time that the system gives you to perform this analysis, and to recover the plant with no particular damage.

There was information in his hands which gave him an operating limit to be within. The plant, as I understand the sequence of events, got into the, quote, forbidden area,

forbidden region, of this limit quite early and stayed there for some length of time. I was frankly surprised that the information was inadequate.

Given that, and some Monday morning quarterbacking, personally, we have prepared some more direct guidelines, as you were, to say to the operator, look at this and do this; also, don't look at just this, look at other things such that you can build a picture of what is going on in the plant, rather than focusing on one parameter or two parameters. And then, based on your knowledge, experience, and the procedural guidance which you have available, specifically, here is what you should do.

So we have given, I believe, some more attention to, as you were, the man-machine interface.

COMMISSIONER MARKS: But --

CHAIRMAN KEMENY: Dr. Hallman, excuse me. I will return to you after one question. I was just curious, have you also followed that up by giving instructions to the training section of B&W on the training of operators?

MR. HALLMAN: Sir, I have not specifically given instructions to the training section, but as part of the group which we are formulating and which we used to straighten out, say, the first operating procedure, we had training people involved. With their experience in operating reactors in general and also in training operators, we feel that it is

another way of getting at this man-machine interface.

We had not ignored training before, but the level at which we conducted business with them was maybe lower than, in retrospect, in hindsight, it should have been. I think there is valuable expertise there that they bring to the table and that we intend to utilize in the future.

CHAIRMAN KEMENY: Yes. I am only trying to understand the communication within the company here, and we are going to hear from the manager of training in a while, but would, for example, when new instructions went out following TMI II -- the 2 April memoranda here, which I assume you played a part in sending those out -- would have at that time an explanation have come to the training section about the importance of emphasizing that in training?

MR. HALLMAN: Sir, could I examine that 2-A memoranda?

CHAIRMAN KEMENY: Excuse me?

MR. HALLMAN: The memoranda that you referred to?

CHAIRMAN KEMENY: Yes. They are Exhibits No. 6 and 7, I believe.

MR. HALLMAN: Which one is it?

(Whereupon, the witness examined the exhibit referred to.)

MR. HALLMAN: I was not involved in the memoranda dated Exhibit No. 6 because of the responsibilities I had at

time on the Three Mile II recovery. I believe I have been involved in subsequent memoranda, and per my indirect knowledge, I believe the training department has been intimately involved in all such memoranda.

CHAIRMAN KEMENY: Thank you. Dr. Marks?

COMMISSIONER MARKS: I was going to turn to a -- explore just another issue. At the time of the Three Mile Island accident, you were in charge of communications with the site?

MR. HALLMAN: That was on the second day after the accident where we split up into shifts, essentially, for 24-hour coverage, and I pulled half a day shift as being responsible.

COMMISSIONER MARKS: Oh, I see. Okay, thank you.

MR. HALLMAN: Yes, sir.

CHAIRMAN KEMENY: Commissioner McPherson?

COMMISSIONER MCPHERSON: Mr. Hallman, once again I may be addressing questions to the wrong fellow, but maybe you can help me with this.

There are regulations of the Nuclear Regulatory Commission, Part 21, which require, in Section 21.21, that anybody subject to this act shall adopt procedures to inform the licensee or purchaser of a deviation -- of the deviation -- in order that the licensee or purchaser may cause the deviation to be evaluated, unless the deviation has been corrected.

And a deviation, in the definition section, means a deviation in a basic component delivered to a purchaser for use in a facility or an activity, subject to the regulations of this part, if, on the basis of an evaluation, the deviation could create a substantial safety hazard.

I have two lines of questions. One of them has to do with this pilot-operated relief valve --

MR. HALLMAN: Yes, sir?

COMMISSIONER MCPHERSON: -- which has either stuck open four or 20 times, according to different testimony we have received, in the past. I recognize that there is a block valve that can be instituted and can cut off the flow through that safety valve.

Had B&W's purchasers been informed that that valve might stick open and that certain procedures should be taken to respond to it if it did?

MR. HALLMAN: Sir, through my section, I have no recollection of any such thing, but let me add more, if I may.

I, by the division of responsibilities, do not get involved with specific pieces of equipment, but I do have some awareness specifically of the PORV by discussing it with people.

I believe there were four instances of opening, including the March 28 Three Mile -- whoops, excuse me, four instances of opening and failing to close at the proper time, one of them being the March 28 incident at Three Mile II. Per

my memory after Davis-Besse in September, 1977, I attended a meeting at which it was brought out the valve misoperated, and per my memory again, it was because of an electrical problem within the valve.

I believe that after that, instructions were sent out to all our customers stating there here is something you should look for because it was found at one site.

There was another incident, and I don't recall the date, where again the failure, per my memory, was traced to something considered abnormal, and instructions were sent out to all customers warning them that this abnormality may occur and to correct it.

CHAIRMAN KEMENY: Excuse me, Commissioner McPherson. May I put in a request for copies of those documents for the Commission, please?

MR. HALLMAN: I will -- yes, sir.

CHAIRMAN KEMENY: In due time.

COMMISSIONER MCPHERSON: One of the unhappy features of this valve apparently is that a signal will record in the control room showing that an impulse has been sent to the valve to close, but there is no -- at least at present -- there is no signal to show that that has been accomplished. Would that be considered a deviation, something that a plant, an operating plant, should know about?

MR. EDGAR: Mr. McPherson, are you asking for a

legal interpretation of the regulations, within the meaning of the regulations?

COMMISSIONER MCPHERSON: I am asking him for the practice within B&W, if they are aware that a purchaser should know that the signal would not be -- would not necessarily show that the valve was closed; would it be their practice to inform? Is that a deviation, or is that something that is unusual? I am not really asking you for a legal interpretation of the word "deviation" but --

MR. HALLMAN: You are asking --

COMMISSIONER MCPHERSON: Would you send a signal to your utility purchaser that, watch out there; you might not be getting a clear, a true picture of whether the valve has been reseated or not?

MR. HALLMAN: In the post-Three Mile II environment where we are asking ourselves, I think everyone, what could have been done better to prevent that, I would personally say yes, we would be more aware of that type of a problem. But, sir, the utility, I am sure, had that information because they had the design documentation, the blueprints, et cetera.

Now, whether it got to the operators and whether we, B&W, should have been more specific in pointing out this particular aspect, that is judgment and really hard to say.

COMMISSIONER MCPHERSON: That valve, I believe, was made by another company to your specifications, is that correct?

MR. HALLMAN: It was made by another company and, I believe, to our specifications.

COMMISSIONER MCPHERSON: Thank you.

CHAIRMAN KEMENY: Governor Peterson?

COMMISSIONER PETERSON: Since you are manager of Plant Performance Service for a vendor that deals with a number of plants, you may be able to help me with a question that has been bothering me since we visited Three Mile Island. I was told by one of the key people there, who had been involved in the start-up of Plant II, that one of the problems which plagued them was the need to procure alternate equipment than they had used in Plant I because vendors had come in with lower bids and that that plagued them, and as a result, they had had many problems before they replaced such equipment with replicas of what they had in Plant I.

I am just wondering, is this a problem which goes on frequently among the plants?

MR. HALLMAN: I am not really aware. Again, specific equipment is not my responsibility, and I don't mean to duck the question. I should be -- maybe everyone should be -- aware of everything, but I don't think that is possible, and I think the best way we can do this job is to divide it up into manageable sections and each one have a clear understanding of what his responsibilities and authorities are, and then handle that.

So I guess I will have to duck your question because I think I am not expert enough to answer it.

COMMISSIONER PETERSON: Do you know whether one of the people coming up on our schedule would be well qualified to answer that?

MR. HALLMAN: No, I don't.

COMMISSIONER PETERSON: Okay, thank you.

CHAIRMAN KEMENY: Professor Pigford?

COMMISSIONER PIGFORD: Mr. Hallman, a moment ago you answered that with regard to the communications with Met. Ed. during the accident, you handled the communications on March 29, is that correct?

MR. HALLMAN: Let me think, sir. I believe it was March 29, starting at about 8:00 p. m. at night until 8:00 a. m. the next morning, in shifts like that for a couple of weeks.

COMMISSIONER PIGFORD: I see. So that would have gone on into March 30, then, is that right?

MR. HALLMAN: Yes, sir, I am sure it would have.

COMMISSIONER PIGFORD: It was a 24-hour --

MR. HALLMAN: There was 24-hour coverage, of which I had 12.

COMMISSIONER PIGFORD: I see. Can you describe the kinds of questions posed to B&W by Met. Ed., simply a summary of the kinds of questions?

MR. HALLMAN: Could you give me a moment to think? I hadn't really thought about that before I came up here.

In general, I believe we were saying the plant was stable; it is in a position that we want it to be at the moment, but let's do some "what-iffing." Like, what if a particular piece of instrumentation fails on it; what alternatives do we have, and start developing those thoughts before t he fact, or et cetera.

As far as specific questions, I don't recall them, but we had, oh, extensive records that we tried to log these things through, that if I reviewed those for a moment I could probably dig out a few specifics.

COMMISSIONER PIGFORD: Were there any questions posed to you relevant to core damage or to the extent of core damage?

MR. HALLMAN: Along the way there was. That early, I just don't recall. We were trying to make an evaluation of what was the extent, what was the availability of various pieces of equipment, and core damage reflected in the amount of radioactivity that we had to deal with. So I believe we would have addressed the effect on March 30 rather than the origin.

COMMISSIONER PIGFORD: Rather than what?

MR. HALLMAN: I believe we would have addressed the effect, which is handling the radioactivity and the damaged

core, rather than the origin about how did the core get damaged. In the order of priorities, let's solve the problems that we see as more immediate, and later on we can go back and find out how much real core damage is there.

COMMISSIONER PIGFORD: And did B&W supply some answers to Met. Ed. on March 29?

MR. HALLMAN: Some what?

COMMISSIONER PIGFORD: Answers.

MR. HALLMAN: On which question, the core damage?

COMMISSIONER PIGFORD: On the questions that were raised.

MR. HALLMAN: Yes, sir.

COMMISSIONER PIGFORD: Are they written?

MR. HALLMAN: Yes, sir.

COMMISSIONER PIGFORD: There are documents available on those, are there?

MR. HALLMAN: Yes, sir.

COMMISSIONER PIGFORD: Were answers supplied -- were questions -- I'm sorry, let me start again. Were you involved in the communications with Met. Ed. on March 30?

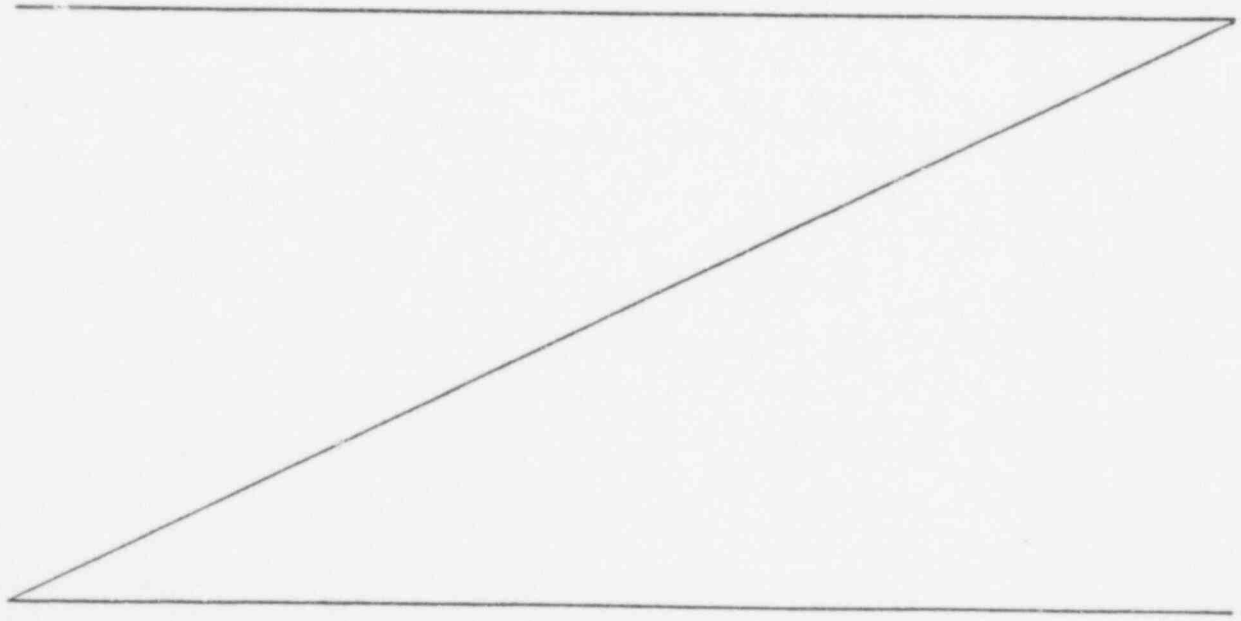
MR. HALLMAN: Yes. Maybe I should add that I was involved with communication specifically with the site. I believe there were things going on other than directly with the operations, of personnel, et cetera, at the site that I would not have been involved in.

COMMISSIONER PIGFORD: Who was asking the questions of you from the site?

MR. HALLMAN: From the site, it was people which we had up there, had sent up to help in the emergency, that were stationed in the control room, assisting in the advice and consultation of what to do next, or it would have been the people that were not in the control room but B&W personnel.

COMMISSIONER PIGFORD: Did you also receive some requests for information from the Nuclear Regulatory Commission on March 30?

MR. HALLMAN: I don't believe I did. I was generally aware that that was going on, that B&W was being requested some information by the NRC, but I was not involved in it, except to the extent where we were taking some thermacoupler readings and passing them back and forth. I may have talked with the NRC concerning specific data.



COMMISSIONER PIGFORD: Do you know of any requests for information from NRC on March 30, concerning the supposed hydrogen bubble and its explosion potential?

MR. HALLMAN: I know of no requests from the NRC, and I'm well-aware of the topic as being one that was raised during the communication. But specifically from the NRC, I'm not aware.

COMMISSIONER PIGFORD: From Met. Ed.?

MR. HALLMAN: From Met. Ed., there was discussions of how do we evaluate how big the bubble is, what do we do about it, et cetera.

COMMISSIONER PIGFORD: Was there a question on the amount of oxygen?

MR. HALLMAN: I don't recall that particular question.

COMMISSIONER PIGFORD: And the name of the group that you're in is which?

MR. HALLMAN: Plant Performance Service.

COMMISSIONER PIGFORD: Which group is Mr. Finnin in?

MR. HALLMAN: Mr. Finnin?

COMMISSIONER PIGFORD: Yes.

MR. HALLMAN: At which point in time? At this time, he is in the licensing group. Prior to maybe a year ago, he was in Plant Performance Service, reporting directly

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to me.

COMMISSIONER PIGFORD: But during the time of the accident, he was not in your group.

MR. HALLMAN: That's correct, sir.

COMMISSIONER PIGFORD: Thank you.

CHAIRMAN KEMENY: Any other questions from commissioners?

If not, we're at this point prepared to excuse all the witnesses we have called till this time, because it finishes one line of questioning.

Thank you, Dr. Hallman.

MR. HALLMAN: Thank you, sir.

CHAIRMAN KEMENY: Would chief counsel please call and swear in the next witness?

MR. GORINSON: Mr. Elliott.

Whereupon,

NORMAN S. ELLIOTT, JR.

was called as a witness and, after being first duly sworn, was examined and testified as follows:

CHAIRMAN KEMENY: Would you please state your full name and your present position in B&W?

MR. ELLIOTT: My name is Norman S. Elliott. My position is manager of the Training Services.

CHAIRMAN KEMENY: Mr. Chief Counsel?

MR. GORINSON: Mr. Rockwell?

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MR. ROCKWELL: Thank you. Mr. Elliott, Training Services is contained within the formerly Nuclear Service, now Customer Service Department. Is that correct?

MR. ELLIOTT: Training Services is currently assigned to Customer Service Department, and it was previously a section in the Nuclear Service Department.

MR. ROCKWELL: All training done by B&W is done from your group. Is that correct?

MR. ELLIOTT: Yes. This is training for customer personnel. Internal training of the B&W employees is done by the personnel department.

MR. ROCKWELL: Mr. Elliott, would it be accurate to say that your training program offers courses to operating and management personnel of B&W's utility customers?

MR. ELLIOTT: Yes.

MR. ROCKWELL: That is its purpose, is it not?

MR. ELLIOTT: Yes.

MR. ROCKWELL: Would it be fair to say that the courses focus on plant operation during normal and emergency operations?

MR. ELLIOTT: Yes.

MR. ROCKWELL: And that B&W training is done equally in the classroom and in the simulator, which you have there in Lynchburg?

MR. ELLIOTT: Let me correct that. For the moment,

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training is done sometimes solely as classroom, other courses are done part simulator, part classroom.

MR. ROCKWELL: Would it be fair to say that the training focuses primarily on first training of new operators, whether that be hot or cold licensing, and secondly, on the requalification of existing operators? I'm talking about a primary focus, Mr. Elliott.

MR. ELLIOTT: Please combine those two. Those are our primary focus.

MR. ROCKWELL: Your training is a commercial service, which B&W provides, which utilities may elect to purchase, at their option, correct?

MR. ELLIOTT: That is correct.

MR. ROCKWELL: And when a utility purchases training services from B&W, do you then provide all training for the personnel that come and attend your courses? And by all training, I mean all training necessary to their qualification as an operator.

MR. ELLIOTT: No.

MR. ROCKWELL: Did you train the TMI-2 operators?

MR. ELLIOTT: We provided training to TMI-2 operators. Our portion of the training was for some of them, as little as two weeks out of a total training program that was approximately two years in length.

MR. ROCKWELL: And taking those TMI-2 operators as

an example, is that characteristic of the amount of training offered by B&W, in comparison to the total amount of training? The two weeks versus two years?

MR. ELLIOTT: That is representative of the involvement of B&W in the utility training program.

MR. ROCKWELL: I would like to sketch briefly the training that you at B&W provided to the TMI-2 operators. Would it be fair to say that, during 1976 and 1977, you provided cold licensing training, which is training for operators who have never been trained before?

MR. ELLIOTT: Yes. Please allow me to qualify that. We provided the eight-week simulator training portion. That is only a part of the cold license training program. The entire training program is defined for TMI-2 in American National Standard 18.1 of 1971. That document may be referred to as a new revision of American National Standard Institute document ANSI ANS 3.1, 1978. For the cold license programs, these documents are essentially similar.

MR. ROCKWELL: Yes. Having in mind, Mr. Elliott, that the training you provide is not the total training in any one area, let me continue. Would it be also accurate to say that in the summer of 1977 B&W provided an operating review course to TMI-2 personnel?

MR. ELLIOTT: That is correct.

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MR. ROCKWELL: And in the summer of 1978, you provided a hot licensing program, which again is a program designed to train new operators?

MR. ELLIOTT: I believe so.

MR. ROCKWELL: And again in March of 1979, or possibly starting in February of 1979, B&W provided requalification training to TMI-2 operators.

MR. ELLIOTT: That is correct.

MR. ROCKWELL: In broad outline, is that a fair summary of the training that B&W has provided to TMI-2 operators, up to the time of the accident on March 28th?

MR. ELLIOTT: Yes, that is correct.

MR. ROCKWELL: Could the training that you provided at B&W to those TMI-2 operators have been done at the site?

MR. ELLIOTT: As facilities exist now, no, because they did not have a simulator at Three Mile Island site. We have the simulator that represents the B&W product that has a 177 fuel assembly plant. And it is located in Lynchburg, Virginia.

MR. ROCKWELL: Would the B&W simulator be the only simulator that would be available to a utility with a B&W nuclear steam supply system for training its operators, in the sense that it matches and is similar to the control room at TMI-2?

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MR. ELLIOTT: Yes. There has been a simulator purchased by another B&W customer, Washington Public Power. That simulator is being delivered, I believe, about this time.

MR. ROCKWELL: It's safe to say that it's not been available to date.

MR. ELLIOTT: It has not previously been available.

MR. ROCKWELL: Directing your attention to the staff of the training program, Mr. Elliott, could you describe briefly how that staff is composed?

MR. ELLIOTT: The staff that conducts training in the nuclear training center, the Training Services section, is primarily composed of individuals with extensive nuclear experience. Most of them have previously obtained a Nuclear Regulatory Commission senior operator's license. Those who do not have senior reactor operator's licenses, are new employees and they are preparing to ultimately go to a site and complete licensing as a senior reactor operator. Those individuals are primarily ex-military people with four or greater years of experience operating reactor plants for the U. S. Navy.

MR. ROCKWELL: What minimum requirements do you impose for hiring of an instructor in your program?

MR. ELLIOTT: An instructor's qualification. And we have three classifications of instructors. We have an

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associate instructor. This is a non-licensed individual. He must have extensive nuclear experience, a minimum of four years operating of a nuclear power plant, essentially a military reactor. A instructor, which is the next senior grade, must have at least four years experience, plus hold a NRC senior reactor operator's license and be judged a good instructor. That also applies to the previous level. And for a senior instructor, he must also have extensive nuclear experience, three years -- a minimum of three years instruction in experience and also hold a Nuclear Regulatory Commission senior reactor operator's license.

MR. ROCKWELL: An associate instructor would not necessarily have any experience on a B&W plant, in fact, probably would not. Is that correct?

MR. ELLIOTT: That is correct.

MR. ROCKWELL: Does an associate instructor ever obtain any experience on a B&W plant, once he joins your training staff?

MR. ELLIOTT: Yes, he does.

MR. ROCKWELL: How?

MR. ELLIOTT: He would gain that experience through site visits to various plants, experience working with our simulator, which very accurately represents the dynamic performance of a B&W power plant, plus ultimately he will be assigned to a site to learn a specific reactor.

MR. ROCKWELL: How long would it take for an associate instructor to become licensed while he's on your training staff?

MR. ELLIOTT: The minimum possible time is one year. The normal time is two years.

MR. ROCKWELL: Once your instructors have a Nuclear Regulatory Commission operating license, are they able to maintain it current?

MR. ELLIOTT: No, they are not.

MR. ROCKWELL: Why not?

MR. ELLIOTT: Licenses are issued by the Nuclear Regulatory Commission for a specific reactor. To maintain that license current, the individual must participate in the watch organization at that site and stay current with the day-to-day operations of that site. And therefore it just does not fit into being able to run our business and do that. It's not particularly desirable from a point of view that we, as a vendor, do not allow our individuals to operate the customers' equipment, which would also be required in maintaining his license.

MR. ROCKWELL: It's fair, then, to say that, of the people on your training staff, probably none of them have current NRC licenses. Is that correct?

MR. ELLIOTT: That's correct.

MR. ROCKWELL: Mr. Elliott, does B&W design the

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training courses that it offers?

MR. ELLIOTT: Yes.

MR. ROCKWELL: Each course, I take it, is basically a standard package?

MR. ELLIOTT: Each course is essentially a standard package. We have standard definitions of each of our courses. The courses that we provide are then tailored to the specific needs of our customers.

MR. ROCKWELL: How does that occur?

MR. ELLIOTT: There are many ways. Particularly the management courses, I might modify the subjects taught by my staff, in association with the members of the utilities' management, for their interests. The courses involving operating personnel, we have an instructor who would be assigned to that particular utility, prepare a proposed course and obtain agreement from the utility that that course, as we outlined it, met his needs. If it did not meet his needs, or his recognized needs, we would modify that course to perform the service that he felt he needed.

MR. ROCKWELLL: The departure point in terms of your basic course design for each of the utilities is the same, though. Is that correct?

MR. ELLIOTT: Yes, sir.

MR. ROCKWELL: Taking the requalification training that you were giving to TMI-2 operators in March of 1979 as

a reference point, what proportion of the training package or the training materials that were given to those operators in that course would be your standard package and what proportion would have been modified at the request of Metropolitan Edison?

MR. ELLIOTT: Please allow me to qualify. I did not make modifications to that course.

MR. ROCKWELL: To the best of your knowledge.

MR. ELLIOTT: I would suspect that 90 percent of that course and the material covered would have been as suggested by the B&W training staff, with 10 percent contributed by Metropolitan Edison through our negotiations and contact with them.

MR. ROCKWELL: In the course of the training, how would your training program incorporate real world transients, in the training instruction?

MR. ELLIOTT: We make an effort to keep track of events that have happened to our various plants and incorporate those in training programs, if they lend themselves to an evolution that we can perform through the simulation, and present those to the people or give them to them as problems in the simulator, that is, set the students up in the condition of equipment that causes them to have to respond to an event that may have occurred in the outside world.

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MR. ROCKWELL: Who in your department reviews real world transients and makes a decision as to which ones should be included in the training?

MR. ELLIOTT: The content of these training programs are primarily the responsibility of the lead instructor, who is currently Mr. Lind. It has been other people prior to him. And we have collected that set of events from our personal contact with the operating people at each of the stations, plus review of the licensee event summary reports, which the training center gets.

MR. ROCKWELL: Up until March 28th of 1979, was the training program getting a full copy of the licensee event reports that B&W utilities were filing with the Nuclear Regulatory Commission?

MR. ELLIOTT: No.

MR. ROCKWELL: You were receiving only summaries.

MR. ELLIOTT: That's correct.

MR. ROCKWELL: Has your training program ever trained operators to respond to a failed open PORV?

MR. ELLIOTT: Yes.

MR. ROCKWELL: Has it trained operators on the Davis-Besse transient of September 24th, 1977?

MR. ELLIOTT: Not specifically. We have discussed that with trainees.

MR. ROCKWELL: But it has not been done to date.

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Is that correct?

MR. ELLIOTT: No. That particular transient involved a set of individual actions that if I instructed a student to go through them, he'd say we were absurd.

MR. ROCKWELL: Before TMI-2, had your training program ever conducted instruction with respect to a loss of all feed?

MR. ELLIOTT: Yes.

MR. ROCKWELL: That is, main feed and auxiliary feed.

MR. ELLIOTT: I don't believe we isolated auxiliary feed.

MR. ROCKWELL: Had you conducted instruction involving voiding in the reactor's coolant system core?

MR. ELLIOTT: Not prior to the TMI-2 incident of March of '79.

MR. ROCKWELL: As of the time of the TMI-2 accident, could your simulator have simulated the accident sequence, through T plus 120, 120 minutes?

MR. ELLIOTT: No.

MR. ROCKWELL: Why is that?

MR. ELLIOTT: The simulator, as originally devised, did not provide for voiding in the primary system. The simulator model is for fluid volume and expansion, divided into two components. One is the pressurizer, which does

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allow voiding and maintaining of a steam space and a water space. The reactor, which is the remaining volume in the system, was modeled as a compressed water. The minimum density allowed there was the density for water at saturation.

MR. ROCKWELL: In your training program, Mr. Elliott, do you conduct simulator training for unlicensed management personnel who might be called upon in an emergency to direct emergency action?

MR. ELLIOTT: Yes.

MR. ROCKWELL: Do you know whether Mr. Miller has ever taken such a course, Gary Miller?

MR. ELLIOTT: Yes, Mr. Miller did.

MR. ROCKWELL: How many others from Metropolitan Edison have taken a course of that nature?

MR. ELLIOTT: Let me clarify, first of all, Mr. Miller was, when he took the course that we are discussing, an employee of General Public Utilities and was a part of the start-up staff for unit one. There have been, or was a training program for other General Public Utility employees involved in the start-up for unit one at Three Mile Island, and a similar course was conducted for General Public Utility start-up engineers for the unit two start-up. This involved a two-week training program -- correction, a three-week training program. It was one week of classroom,

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plus t o weeks on the simulator. It was a devised program that was put together in support of the unit one start-up at Three Mile Island, and the same course was repeated for the unit two start-up engineers.

The simulator part of that course was plant operations for the first week. And the second week, we were involved with a start-up physics course.

MR. ROCKWELL: When would Mr. Miller have taken that course?

MR. ELLIOTT: My guess is that Mr. Miller would have taken that in late 1973 to early '74. There are records, which I previously supplied you -- or B&W supplied you.

MR. ROCKWELL: Has Mr. Miller made a practice of taking that course on a regular basis?

MR. ELLIOTT: Please let me explain. Mr. Miller ultimately transferred to Metropolitan Edison Company, then took our two-week start-up training course, and then was licensed, at least on unit one of TMI. So he was a licensed senior reactor operator on unit one. Whether or not his license was current at the time of the incident, I don't know.

MR. ROCKWELL: Mr. Elliott, I would like to take you back to a discussion we had at the time of your deposition. And just for your reference, I'd ask that you be provided with a copy of your deposition.

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(A Transcript of the deposition of Norman S. Elliott, Jr , dated 16 July 1979 was given to the witness.)

MR. ROCKWELL: The page is 147, Mr. Elliott. I think you will find it in the third volume that you have before you.

MR. ELLIOTT: 147. Is that correct?

MR. ROCKWELL: Yes. That is correct. Do you have page 147 before you?

MR. ELLIOTT: Yes. Page 147 is before me.

MR. ROCKWELL: Do you recall that we had a discussion during the deposition about operating instructions with reference to going solid and that we referred you, during that deposition, to a set of operating instructions that had been reviewed by a Babcock & Wilcox site engineer, containing the following instructions and I am quoting from page 147, line 9. "The pressurizer must not be filled with water to indicate its solid conditions -- that is 400 inches -- at any time, except as required for system hydrostatic tests." Do you recall our reviewing that procedure in your deposition?

MR. ELLIOTT: Yes, I do.

MR. ROCKWELL: And do you know of any exceptions to that instruction to your knowledge?

MR. ELLIOTT: No, I don't know.

MR. ROCKWELL: Do you recall also that we reviewed --

MR. ELLIOTT: Before we leave this, Mr. Rockwell --

MR. ROCKWELL: Yes.

MR. ELLIOTT: I would like to bring up the point that

DO2

related to Three Mile Island. At that event, we ended up with an apparently full pressurizer; that is, an indicated level of 400 inches, but we did not or the plant did not end up with an indicated solid condition. The plant had significant voiding in the system during the period of time when the pressurizer appeared full.

MR. ROCKWELL: Yes. I understand, Mr. Elliott.

MR. ELLIOTT: I wanted that to be clear in the individual's mind because there could be misunderstandings here because if the system was solid, we would see a very, very rapid rise in pressure with any change in the injection of water to the system.

CHAIRMAN KEMENY: Mr. Rockwell, may I interrupt for one moment.

Mr. Elliott, since your department has trained so many operators, what would you think a typical operator would mean by the phrase, "the system is solid"?

MR. ELLIOTT: That we would get a very rapid rise in pressure with adding water or likewise if we operated the letdown valve which allows water to come out of the system into the makeup tank, we would see a very rapid drop in pressure. Those are the indications of solid.

CHAIRMAN KEMENY: You do not think that the typical operator would think of the system being solid as the pressurizer being full of water?

MR. ELLIOTT: He would recognize that he had the possibility of being solid with the pressurizer full.

CHAIRMAN KEMENY: Did your training program, to your knowledge, explain the difference between those two facts?

MR. ELLIOTT: I am not sure, sir.

CHAIRMAN KEMENY: Thank you.

Mr. Rockwell.

MR. ROCKWELL: Referring you also, Mr. Elliott, to page 146 of your deposition at the bottom of the page, line 23, did we also review an operating instruction which was another version of the one we just referred to, which had the following caveat: "Absolute maximum pressurizer level at any time reactor is critical is 385 inches." Do you recall that we reviewed that?

MR. ELLIOTT: Yes.

MR. ROCKWELL: And did you know of any exceptions to that instruction?

MR. ELLIOTT: No, I do not. If we back up into time, this is one of the things that happened in the TMI -- correction, the Davis-Besse incident. The pressurizer level was taken to a very high level approaching this 385 inches and the reactor operator then shut down the reactor, tripped it, on an indicated high level.

MR. ROCKWELL: Mr. Elliott, having the two instructions

DO4

which I have just read to you, in mind and assuming -- I am asking you to assume that they were in effect and that they were the operating instructions which the TMI-2 operator would have had to rely on at the time of the accident, can you tell me would those simple -- and I think they are strongly worded operating instructions in mind -- do you know what in the emergency instructions that those operators had before them would permit them to set aside those imperatives which we have just read during an emergency?

MR. ELLIOTT: First of all, the imperative listed on page 146 does not apply because the reactor is not critical. Trip had occurred.

MR. ROCKWELL: Okay.

MR. ELLIOTT: Okay.

MR. ROCKWELL: Referring to the other statement, let me reread it. "The pressurizer must not be filled with water to indicate its solid conditions at any time except as required for system hydrostatic tests." Do you know what in the emergency procedures would enable an operator to understand that that should be set aside during an emergency?

MR. ELLIOTT: I believe we should, at this time, refer to the operating emergency procedures that the Three Mile Island people would have followed.

MR. ROCKWELL: But do you know, as you sit here right now, what an operator would have looked to in an

emergency procedure to set aside that instruction?

MR. ELLIOTT: The condition that existed at that time was to us, in retrospect, a loss of coolant accident and he should have been using the loss of coolant/loss of coolant pressure procedure and the only piece that I can refer to immediately is the procedure that we reviewed, which applies to the B&W simulator. It is probably similar to that which Metropolitan Edison Company had, requiring that the operators gain pressure control. This was an emergency condition. I believe that all personnel would have gone to those instructions rather than these that are contained in other documents. I believe the emergency instructions would take precedence.

MR. ROCKWELL: Is there anything in those emergency instructions which you know of which specifically tell an operator that the prohibition on going solid, which appears in the operating instructions, is no longer in effect, in simple language, that an operator can understand.

MR. ELLIOTT: I do not believe that it says that these are not in effect. It says, to follow this procedure if they find themselves in that particular condition.

They should have utilized the loss of coolant procedure.

MR. ROCKWELL: Mr. Elliott, does B&W play a direct role in the reviewing and approving of operating procedures and emergency procedures?

D06

MR. ELLIOTT: No. Those plant operating and emergency procedures are prepared by the plant staff. They are reviewed by the plant safety committee and then ultimately approved by the superintendent of the plant.

MR. ROCKWELL: You have heard Mr. Taylor testify this morning and I imagine that you are aware that Mr. MacMillan has stated publicly on other occasions that the TMI-2 operators had procedures available to them that they could have and should have followed in the course of the emergency, which might have prevented the accident. Are you aware of that?

MR. ELLIOTT: Yes.

MR. ROCKWELL: How can B&W know that those procedures that the operators had available to them were adequate when B&W has not participated in the formulation, review or approval of those procedures?

MR. ELLIOTT: The owner, in this particular case, Jersey Central Power and Light, and the operator, Metropolitan Edison Company, was charged with the responsibility for preparation, approval and that those procedures were correct. Babcock & Wilcox did not have contractually, nor regulatorally a requirement or implied authority to review Metropolitan Edison Company's procedures.

MR. ROCKWELL: In other words, Babcock & Wilcox in making its judgment is relying on the review and approval of

Metropolitan Edison exercised over those procedures. Is that correct?

MR. ELLIOTT: Yes. And it is Metropolitan Edison Company's responsibility that their procedures be complete and adequate.

MR. ROCKWELL: Let me give you an example, Mr. Elliott. Let's take the procedure for identifying a fail to open PORV. That has been a matter of some discussion since the accident, has it not?

MR. ELLIOTT: Yes.

MR. ROCKWELL: The PORV has a history on some occasions of leaking or weeping and on other occasions failing open, is that correct?

MR. ELLIOTT: There are incidents in which the PORV has remained open after actuation.

MR. ROCKWELL: And the procedure for identifying a failed open PORV has a number of steps to it. Is that correct?

MR. ELLIOTT: Yes.

MR. ROCKWELL: Identifying tailpipe pressure, -- temperature, quench tank pressure and temperature and reactor coolant building pressure. Is that correct?

MR. ELLIOTT: I would imagine. I am not and do not have in front of me that procedure which you are referring to. I can only postulate the answer.

MR. ROCKWELL: Is it your understanding that those

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are among the indicators that an operator would look at?

MR. ELLIOTT: They should have been. Yes.

MR. ROCKWELL: That procedure, Mr. Elliott, is made necessary because B&W did not have a direct indicator of valve position in the control room. Is that correct?

MR. ELLIOTT: No. I do not believe that is correct.

MR. ROCKWELL: If there were a direct indicator of valve position in the control room, would it be necessary to look at those indirect indications to determine the valve's position?

MR. ELLIOTT: Yes.

MR. ROCKWELL: Can you explain?

MR. ELLIOTT: Well, particularly a valve position -- and those of you who have been involved with mechanical equipment, particularly relays, microswitches and so forth, they are not 100 percent reliable and relying on those as the sole indication would be -- might lead one to a serious condition.

MR. ROCKWELL: But nonetheless, if you had a direct indication and it were functioning and it showed the PORV open, clearly the operator would not have to look at indirect indications. Is that correct?

MR. ELLIOTT: Yes.

MR. ROCKWELL: Now, did B&W ever test the procedure for determining whether a PORV is open, the procedure using indirect indication, to see whether it worked, to see whether

an operator could understand it and implement it in the heat of an emergency?

MR. ELLIOTT: First of all, I don't believe that B&W carefully examined or examined that procedure on our simulator under the heat of an emergency. The indication that we used and we used for training of the individual for a code relief or a PORV being stuck open or leaking on the simulator is similar to that and the students would be familiar with it.

MR. ROCKWELL: But the specific question is, had B&W ever tested that procedure for adequacy in neat of an emergency?

MR. ELLIOTT: The absolute answer to that is "no", to the best of my knowledge. Nobody ever did it, that I knew of.

MR. ROCKWELL: And, in fact, that procedure is a procedure which would probably be only called upon in the heat of an emergency.

MR. ELLIOTT: Yes. That procedure or use of those indications were those which were used by the Davis-Besse operating staff in recovering from the incident of -- I believe it is September, anyway, it is '77.

MR. ROCKWELL: But would it be fair to say in light of the discussion that we have just had that in a sense the question of operators following procedures available to them

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at TMI-2, in a sense, comes full circle. The procedure for identifying a failed open PORV by indirect indications is in a sense made necessary by the design that B&W provided.

MR. ELLIOTT: No.

MR. ROCKWELL: The design did not have a direct indicator with the PORV, did it?

MR. ELLIOTT: The design of the valve as provided to customers did not permit direct measurement and indication of the valve position.

MR. ROCKWELL: Therefore, the procedure that was in effect for identifying a failed open PORV by indirect indications was made necessary by that design aspect.

MR. ELLIOTT: Had we had direct indication of that valve, that procedure would have had one more indication in it, in the line of symptoms and that would be the light fails open after pressure had gone below the set point. There would have been one addition. The procedure would have been essentially the same with one added step, to say, check the light.

MR. ROCKWELL: And all of the other indirect indications would have been unnecessary had an operator looked at his control panel and observed that he had a failed open indication on his control panel. Correct.

MR. ELLIOTT: I would not agree that they are unnecessary. They are other confirming indications. Many of our procedures that are used in the plant have confirmatory

symptoms that may or may not be true or observable to implement that particular procedure.

MR. ROCKWELL: And, yet, to the extent that you look at your control panel and see that you have a failed open PORV, an operator knows he has to act. He does not have to take the time to look at the indirect indications. Correct?

MR. ELLIOTT: That would have been helpful in this situation.

MR. ROCKWELL: Do you maintain a syllabus for the courses that you teach in your training program, Mr. Elliott?

MR. ELLIOTT: Yes.

MR. ROCKWELL: Showing you what has previously been marked as Hearing Exhibit No. 10 -- could we have that placed before Mr. Elliott? Do I correctly identify that, Mr. Elliott, as a schedule of training that the training department has used in the same general format for its training course?

MR. ELLIOTT: Yes. That is typical of the training schedule used by the training department.

MR. ROCKWELL: Is there any explanation of the subjects covered in that syllabus? Is that what you refer to as a syllabus, by the way.

MR. ELLIOTT: What I believe you were discussing as a syllabus was our training catalog, which has general descriptions of the particular courses that we might conduct at the request of a utility. This represents a very detailed schedule

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of what we were going to do for one group of requalification students.

MR. ROCKWELL: This is a more detailed schedule than your catalog, correct?

MR. ELLIOTT: Yes.

MR. ROCKWELL: Is there any elaboration of the contents of the courses that you teach in this syllabus, Hearing Exhibit 10.

MR. ELLIOTT: Referring to Hearing Exhibit 10, some of these lectures and I am referring to the left hand column titled "Classroom Schedules" would be covered by a detailed outline to assist the instructor in providing that particular lecture information.

MR. ROCKWELL: Do you have a standard outline for every course?

MR. ELLIOTT: No. We do not have a standard outline for every course. Some of the more complex ones that involve hardware do have specific outlines. If we refer to the second day, Tuesday, it says, ICS Review. That is a lead discussion by the instructor of a review of the as-built -- or as we believe built -- integrated control system diagrams, which are digital and analogic diagrams and that would not have a specific outline telling the instructor exactly what to cover. That is a part of the course and the instructors cover that as a group discussion.

MR. ROCKWELL: Do you maintain a record of attendance of students at tne courses?

MR. ELLIOTT: In a general sense, yes. The completion of a course is reported on a quasi-form, which says the number of hours that individual attended lectures and those evolutions in the simulator that he participated in.

MR. ROCKWELL: Do you have any record of whether, in fact, a particular student was at a particular session of a course?

MR. ELLIOTT: We do, if it was in the simulator, because his presence would have been noted. The attendance in a classroom session -- on occasions a student would not be present, but we try to be very, very honest and report only what he did.

MR. ROCKWELL: Did you use training manuals in the training of TMI-2 operators?

MR. ELLIOTT: Yes, we used training manuals. They were primarily the documents that are associated with the operation and licensing of that particular plant and their operating procedures.

MR. ROCKWELL: We referred to a three volume set of training manuals that had been prepared for TMI-1 operators --

MR. ELLIOTT: Yes.

MR. ROCKWELL: When we were in Lynchburg talking to you.

MR. ELLIOTT: That is correct.

MR. ROCKWELL: Has any such manual been prepared for TMI-2 operators?

MR. ELLIOTT: No, it was not.

MR. ROCKWELL: Do you maintain a complete set of TMI-2 operating procedures, emergency procedures in the training department?

MR. ELLIOTT: We are at this time --

MR. ROCKWELL: Before TMI-2?

MR. ELLIOTT: No, we did not.

MR. ROCKWELL: Were you on the distribution for revisions of TMI-2 training procedures before TMI-2?

MR. ELLIOTT: I would like to correct that. I believe you mean the operating and emergency procedures for the plant?

MR. ROCKWELL: Yes.

MR. ELLIOTT: No, we were not.

MR. ROCKWELL: Did you use some TMI-2 procedures in your simulator training?

MR. ELLIOTT: Yes, we did.

MR. ROCKWELL: How did you know they were current?

MR. ELLIOTT: The procedures that we use in our training program on a specific plant are obtained by one of our instructors who makes a visit to that plant prior to us beginning training. That visit is made to assure that we understand the requirements, what their intentions are, and that we understand the conditions there, and also that we can best serve them -- and we try to get the latest documents that are available there. There could have been a revision since the time the visit was made and training starts. Usually the trainees will tell us if we have got the wrong one.

MR. ROCKWELL: So your maintaining of current procedures is done on an ad hoc basis by your individual trainers? Is that correct.

MR. ELLIOTT: Yes, in a sense.

MR. ROCKWELL: In your simulator training, do you use a mix of B&W and TMI-2 procedures?

MR. ELLIOTT: Yes.

MR. ROCKWELL: How do the students know, once they return to their home control room, how do they distinguish between the procedures that they used which are B&W procedures during their training and the procedures they used which are TMI-2 during their training?

MR. ELLIOTT: Well, the most obvious way is that the B&W procedures are typed in a relatively simple format and does not have a lot of complications associated with the pages so

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it is very obvious to the students whether they are using his or ours at the simulator. We are concerned with operating a pressurized water reactor, there were sometimes differences in the implementation of the instrumentation and fluid systems. Primarily the fluid systems because these were designed by the architect engineer who built the entire plant. On occasions some of their procedures don't match up with the simulator and we need to use our own there.

MR. ROCKWELL: Is the --

MR. ELLIOTT: The student is responsible for reviewing his own procedures when he returns.

MR. ROCKWELL: Is the design of the simulator identical to the design of the TMI-2 control room?

MR. ELLIOTT: No, it is not.

MR. ROCKWELL: Do you make any specific effort to point out the design differences so that students are clear about what they have in mind when they return home?

MR. ELLIOTT: Our prime concern is that we get the student oriented to the simulator so that he may learn and use this tool effectively. If his instructors happen to be thoroughly familiar with the control room from which the student comes, he may point out that this instrument on the front is not here in your control room -- it may be on a back panel, or some place else. We cannot absolutely assure that they know the differences. You have to recognize that they have spent on the order of years

in their control room and two weeks with us.

MR. ROCKWELL: Do you make a systematic effort to point out the differences between the simulator and the TMI-2 control room?

MR. ELLIOTT: I don't believe we make an absolute systematic effort.

MR. ROCKWELL: Do you assign homework during training?

MR. ELLIOTT: No.

MR. ROCKWELL: Why not?

MR. ELLIOTT: This is not a practical item to handle, for us to assign homework. The major portion of our students are bargaining unit individuals. They are hourly employees as defined by the federal labor rules. If we assigned homework, they would have to do that homework on a overtime basis, as to my understanding of the labor laws, and in general, the utilities do not instruct students to spend overtime -- or their employees to spend overtime doing homework.

MR. ROCKWELL: Have you ever suggested to Metropolitan Edison management that it would b desirable for them to be available to do work in the evenings? The operators, that is?

MR. ELLIOTT: We have not taken that point up with them.

MR. ROCKWELL: During the work on the simulator, are students given written evaluations of their performance?

MR. ELLIOTT: Yes.

MR. ROCKWELL: Are those evaluations sent to the utility?

MR. ELLIOTT: Please let me explain about the evaluations. The evaluations that we do are sent to the utility and those evaluations are also provided to the Nuclear Regulatory Commission. In evaluations -- I am using it in the sense of examinations. We conduct examinations at the end of the cold license simulator program that is generally equivalent to that provided by the Nuclear Regulatory Commission and it is a part of our program that we have, and it is approved by the Nuclear Regulatory Commission Operator Licensing Branch.

MR. ROCKWELL: Does that hold for requalification training?

MR. ELLIOTT: It does not hold for requalification training. The licensee, in the particular case of Metropolitan Edison Company is responsible and conducts what evaluations are done.

MR. ROCKWELL: If, during requalification training, a student made repeated errors on the simulator, would the utility have any way of knowing that?

MR. ELLIOTT: Yes.

MR. ROCKWELL: How?

MR. ELLIOTT: They would know that by the observations of the supervisory and management individuals who are contained in a course. I might refer you to Hearing Exhibit 10 again. If

we look at the names at the top right, Mr. Mike Ross, he is the operating supervisor for unit 1 at Metropolitan Edison Company and he would have the responsibility for observing the performance of those individuals.

MR. ROCKWELL: So it would be up to him to report it back to the utility?

MR. ELLIOTT: Yes.

MR. ROCKWELL: Do you have a clear understanding that he, in fact, does that?

MR. ELLIOTT: I believe that they do do that. And they make a report of performance.

MR. ROCKWELL: Do you know that?

MR. ELLIOTT: I have not seen their reports.

MR. ROCKWELL: Mr. Elliott, directing your attention to Hearing Exhibit No. 1, which should be on the table there before you.

MR. ELLIOTT: Yes, I have it.

MR. ROCKWELL: Let me identify that as a November 1st, 1977 memorandum from Mr. Kelly to a number of individuals, including yourself. Do you recognize that exhibit?

MR. ELLIOTT: Yes, I recognize the exhibit.

MR. ROCKWELL: Did you receive it at the time it was distributed at about November 1st, 1977?

MR. ELLIOTT: I do not remember.

MR. ROCKWELL: When did you first see it?

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MR. ELLIOTT: The first time I remember seeing it -- and this is my current recollection -- was just prior to the depositions taken in Lynchburg.

MR. ROCKWELL: And directing your attention to Hearing Exhibit No. 3, do you have that before you?

MR. ELLIOTT: Yes, I do.

MR. ROCKWELL: Do I correctly identify that as a February 9th, 1977 memorandum from Mr. Dunn to Mr. Taylor and a number of other individuals?

MR. ELLIOTT: I believe it is dated February 9, 1978.

MR. ROCKWELL: Yes. Did that memorandum come to your attention before March 28th of 1979?

MR. ELLIOTT: No, it did not.

MR. ROCKWELL: Mr. Chairman, I have no further questions.

CHAIRMAN KEMENY: Thank you. I now direct that Hearing Exhibit 10 be made part of the record of this meeting.

(The document previously marked for identification as Hearing Exhibit 10 was received in evidence.)

Mr. Elliott, since you are on an educational program to operate this and I happen to have some interest in education, one of your comments so far has me slightly troubled -- about homework -- as the minutes of this meeting become a matter of public record I am worried about our students asking for overtime if we ask them to do homework. I do not ask you to answer

that. I am trying to get some feeling of the nature of the educational program and your philosophy in it. I understand that when you took over as Manager of training you made -- not immediately but over a period of time -- you made a number of changes in that educational program. Is that correct?

MR. ELLIOTT: Yes. My concern was to make this program as responsive to the utilities and serve their needs as possible. I was concerned with the performance of the students in being able to operate their plant correctly and safely. And also with the further propagation of business and being looked at as a supplier of quality service on which they could rely.

CHAIRMAN KEMENY: Could you describe the nature of the changes, generally, the nature of the changes that you made?

MR. ELLIOTT: The nature of the changes are primarily an upgrade of the staff or instructors. At the time I arrived we had one instructor who had been previously licensed by the Nuclear Regulatory Commission. He had arrived in the order of a couple of months prior to my arrival. We have now gone to essentially all of our instructors who are conducting examinations and judging the performance of others being previously licensed by the Nuclear Regulatory Commission, in addition to all our previous nuclear experience.

The second item was to make the program consistent and responsive to the utilities and not be what B&W thought ought to happen but be a course and programs that were seen as filling

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the utilities needs to train their people to operate their plant.

CHAIRMAN KEMENY: Did you also, as part of that process, use your own instructors more heavily and less heavily people from outside the training division than before?

MR. ELLIOTT: Yes, that is correct.

CHAIRMAN KEMENY: What were your reasons for that, Mr. Elliott?

MR. ELLIOTT: The primary reason for that was that we were using, or beginning to use operational personnel to communicate to other operational personnel. They communicated on a close or similar vocabulary. They had operating experience which allowed them to treat a broad range of subjects from the heat transfer to rod withdrawal limits, to heat transfer in the steam generators, to how the reactor coolant pump motors worked, or seals worked, the whole range. Any one instructor could then handle al ost any question that was raised by the students. The difficulty in dealing with engineering people is that their work involves a very narrow scope and they are unfamiliar with the performance and inter-relationships of some of the systems and components removed from their area of expertise.

CHAIRMAN KEMENY: Would it be fair, therefore, to describe it that you put more practical content into it and less theoretical content?

MR. ELLIOTT: Yes.

CHAIRMAN KEMENY: The reason I raise that issue is that we have heard testimony that one of the changes that would be desirable would be for operators to have a deeper understanding of the system, rather than just operating procedures. And I do wonder whether the removal of more theoretical content might not go in the opposite direction.

MR. ELLIOTT: I don't believe that is true, sir. The area, I believe, that is a difficulty in this is the total training program. My contribution to that training program is relatively small, and may be as little as two weeks out of a two year training program. The training program requires a basic training in the technology, the basic physics, thermo, heat, reactors, that is to occur very early in this training program. It is my personal experience that that course and performance in that area is somewhat lacking on these people. I believe it is a real problem. Many of our students have come from the Navy program and apparently even that basic training program may be insufficient to supply this level of student with the appropriate understanding of the basic physics in the engineering discipline.

CHAIRMAN KEMENY: Is it not correct that most of your instructors also come out of that training program?

MR. ELLIOTT: That is correct.

CHAIRMAN KEMENY: What additional theoretical training do your instructors receive besides that which is required for

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becoming licensed operators?

MR. ELLIOTT: Well, my instructors who conduct training in the very theoretical subjects and please let us not confuse things -- we present heat transfer on a quantitative fashion of sticking to the relatively simple equations of q equal u a delta t and q equal the flow rate times the c sub p delta t area but we can convey the ideas of the heat transfer and the distribution of temperatures through the fuel by drawing a picture and people can recognize they have seen that picture before. Then we try to explain it. It does not require the solution of the fusion like equations for the heat transfer out of the cylinder to understand the heat transferred across.

Now, the training of my instructors is, they will develop one of these lesson plans or theoretical area and it tends to be self-taught. They must go to the B&W engineers and drag out of them what they need to present that. And then those lessons are then observed by the other instructors there. And that is how we develop a very technical subject. But it must be communicatable to the level of student that we have got.

CHAIRMAN KEMENY: How often do members of the engineering division give instruction to your instructors?

MR. ELLIOTT: That is an ongoing project of developing new training subjects. Now it is a one to one teach in that if I were to come to you and I say I am trying to understand the blow down of the reactor in the time, and here is the B&W

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report, would you help me understand it? So it is an ongoing problem of developing new subjects.

CHAIRMAN KEMENY: You said that occurs when you develop new subjects. Let me take a random example, let us take for example, the high pressure injection system. What would be the last time that Mr. Dunn, or a member of his Section would have given instruction to your instructors on this subject? I mean, would that have happened when that course was --?

MR. ELLIOTT: Two weeks ago. We were developing an additional presentation on the small break analysis. We were conducting that instruction for Three Mile Island. We were developing a new course and the review of that was done by Mr. Dunn and Mr. Jones, who works for Mr. Dunn, helped with my instructor who was doing that lesson plan. The high pressure injection system as such, is a mechanical fluid system. It is the use of it and the behavior of that water in the reactor that Mr. Dunn is concerned with, that is the EECS analysis, rather than the system. Systems are primarily researched by my people. If they are understandable in the documents they can present the lectures. But the highly theoretical areas, such as EECS analysis we have to have help from outside.

CHAIRMAN KEMENY: Yes. You did that you said two weeks ago. When would the last time have been prior to March 28th of this year that such an exchange took place?

MR. ELLIOTT: With Mr. Dunn I would say it was six months ago. We were presenting lectures on the EECS analysis and performance for the large break, not small break.

CHAIRMAN KEMENY: For the large break. What would the last time have been for a small break?

MR. ELLIOTT: The small break work with Mr. Dunn has been done since the Three Mile Island accident.

CHAIRMAN KEMENY: No. I meant prior to Three Mile Island. What would the last time have been -- discussion on small breaks?

MR. ELLIOTT: I believe it was in the fall of '78.

CHAIRMAN KEMENY: The fall of '78.

MR. ELLIOTT: That we were working with Mr. Dunn on EECS.

CHAIRMAN KEMENY: I see. Did he at that time, to your knowledge, express to members of your department his concerns that grew out of Davis Besse-1?

MR. ELLIOTT: Not to my knowledge.

CHAIRMAN KEMENY: Commissioner Trunk, I believe you had some questions you wished to ask?

COMMISSIONER TRUNK: He has answered a lot of them.

CHAIRMAN KEMENY: Oh, he has answered a lot of them.

COMMISSIONER TRUNK: I would like to know one thing. How often does the NRC sit in on these courses?

MR. ELLIOTT: We get a visit from the NRC normally about every six months.

COMMISSIONER TRUNK: And do they evaluate it? And tell you? Or update it?

MR. ELLIOTT: We get a rather informal evaluation from the Operator Licensing Branch, which is a very small group that handles operator licenses. They come and observe how we conduct examinations, primarily.

COMMISSIONER TRUNK: Have any students failed your course?

MR. ELLIOTT: Yes.

COMMISSIONER ELLIOTT: What do you do with them?

MR. ELLIOTT: Send them back to the utility.

COMMISSIONER TRUNK: To run the plant? Thanks.

MR. ELLIOTT: Students come to us from one job. They may be doing a job as the auxilliary operator. These are the people who are out in the turbine building and handling various valves and controls out there on direction from the control room operators. When the utility wishes to advance one of those individuals from that auxilliary operator to a control operator, somebody who works in the control room, they normally have a six months to a year training program for that individual. As a part of that training program, normally about two weeks, they are sent to Lynchburg to my training group, in a group of three to six students and we conduct a specific training course for them. At the end of the first week they have an examination on starting up the reactor. They must do that under the scrutiny of one of my instructors who is an examiner, plus an observer which is usually myself, or in the case we have

mentioned, a Mr. Lind who is the supervisor instructor, and usually a representative from the company as a management. So we are observing to be sure that the man is treated fairly and that the exam was done correctly, as defined for us by the NRC. Sometimes the NRC comes. We inform them periodically of what the schedule of when we are going to do these examinations are and they are invited to come. If the student fails that examination he may be given a second chance after some additional training to take the exam again. But he might fail again. We just return him to the plant. But we don't provide the certification letter. The certification letter is that piece of paper that he must have to take the license examination. But he goes back to his old job.

CHAIRMAN KEMENY: Professor Pigford?

COMMISSIONER PIGFORD: I have a few brief questions.

MR. ELLIOTT: Yes, sir.

COMMISSIONER PIGFORD: In the training, do you have the students operate the simulator on the whole range of accidents that were considered in the safety analysis report?

MR. ELLIOTT: We cover many of those accidents that are in the safety analysis. Of course, there are some of them that aren't really accidents. But in the long course, cold license course, which is eight weeks long, we will do most of those accidents. Drop rod, rejected rod, we do all of the leaks -- small leaks, large leaks, steam line breaks, inner

reactor building, outer reactor building. For the most part we do cover those in the long course. The short courses, two week ones, which I just described, we will do some of those. Primarily the leaks and the primary coolant and the steam line breaks and loss of feed accidents.

COMMISSIONER PIGFORD: You do all the small break loss of coolant accidents? Is that correct?

MR. ELLIOTT: We do many.

COMMISSIONER PIGFORD: Which ones do you leave out?

MR. ELLIOTT: Well, you see small break analysis goes from a very, very tiny one and the simulator at the moment is set up in gallons per minute rather than an orifice size, which is being changed next week.

COMMISSIONER PIGFORD: Rather than what?

MR. ELLIOTT: Orifice. We have a leak rate which then is computed on differential pressure, but that is how we handle the leak at the moment.

COMMISSIONER PIGFORD: And you say you do not include an accident that involves loss of auzilliary feedwater?

MR. ELLIOTT: We had not prior to the TMI incident done one with feedwater -- loss of all feedwater. We just didn't believe that was what was going to happen.

COMMISSIONER PIGFORD: Was it analyzed in the safety analysis report?

MR. ELLIOTT: At the moment I can't tell you, sir.

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COMMISSIONER PIGFORD: Did you consider it less likely than the large break accident?

MR. ELLIOTT: my intuitive thing says yes. We are speaking in the past and the experience has gotten to us now. We have found out that --

COMMISSIONER PIGFORD: Do you consider the small break accidents less likely than the large break accident?

MR. ELLIOTT: No, sir. We did a number of small break accidents starting at 30 gallons a minute and went up to five, six hundred to a thousand gallons per minute.

COMMISSIONER PIGFORD: Do you have some special training program for some operators to make them specialists on small break loss of coolant accidents?

MR. ELLIOTT: We have since TMI, yes, sir.

COMMISSIONER PIGFORD: You have what?

MR. ELLIOTT: We have set up a program since --

COMMISSIONER PIGFORD: Since TMI?

MR. ELLIOTT: Yes, sir.

COMMISSIONER PIGFORD: Was that not in existence prior to TMI?

MR. ELLIOTT: That is correct, sir.

COMMISSIONER PIGFORD: Now, at Metropolitan Edison they do designate some operators as control room loss of coolant operators, who are stationed in the control room and trained to recognize the symptoms and respond to a small break loss of

coolant accident. Where did they get that special training?

MR. ELLIOTT: If we look at the procedure for loss of coolant accident, they're generally broken into two parts and maybe three parts. But there are a series of accidents, the leak rate is sufficiently small that the high pressure injection will make up the inventory in the primary system.

COMMISSIONER PIGFORD: How does a man get qualified to become a control room LOCA operator, especially trained to respond to the small break LOCA?

MR. ELLIOTT: I'm not sure, sir.

COMMISSIONER PIGFORD: That's not something that B&W implements?

MR. ELLIOTT: We have never been associated with that, no, sir.

COMMISSIONER PIGFORD: And there's an auxiliary building LOCA operator. Do you train that?

MR. ELLIOTT: No, sir.

COMMISSIONER PIGFORD: In your simulations, do you have some simulations where the operator must manually operate the high pressure injection system?

MR. ELLIOTT: Yes.

COMMISSIONER PIGFORD: Thank you.

CHAIRMAN KEMENY: There are two other commissioners. I just have one quick question, since we're on simulators. Two questions. One, I assume, since you devote significant amount of parts of your training program to simulators, that

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you consider this an important tool in training.

MR. ELLIOTT: Yes.

CHAIRMAN KEMENY: Since you have testified that the largest part of the training operators receive is not at B&W but at the utility, would you consider it important for utilities to have their own simulators for their part of the training?

MR. ELLIOTT: Having simulators that are identical to the control room and very faithful is helpful, would be helpful.

CHAIRMAN KEMENY: Thank you. Professor Marrett.

COMMISSIONER MARRETT: I'm interested in how broad an assessment, you, as director of the training program, how do you assess the effectiveness of the training program? What makes you know whether your training is effective or not?

MR. ELLIOTT: Our prime measure of understanding of effectiveness is observe student response in the simulator.

COMMISSIONER MARRETT: How they respond on the simulator.

MR. ELLIOTT: Yes.

COMMISSIONER MARRETT: So it's only in terms of -- And what do you mean by response? Is that whether or not they're able to work out an accident? Does it also include psychological response to what they're doing?

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MR. ELLIOTT: No, we are not staffed or believed to be qualified in psychological examination. We observe individuals under stress of an accident situation in a simulator.

COMMISSIONER MARRETT: And how do you take that into account with reference to the training? To what extent does the information you obtain in the ways in which people respond under stress, does that make any difference with the way that you're training them is done?

MR. ELLIOTT: Well, we believe their performance under stress is associated with their understanding of the basic phenomenon and interrelations of all the systems and the basic physics of the power plant. And the better their understanding of that, the better they're able to respond under crisis.

COMMISSIONER MARRETT: I'm talking about their better understanding, how do you assess what gives that better understanding? To be precise, there are possibilities, for example, for comparing different methods of presenting material in the lectures, for example. Do you ever undertake that kind of systematic evaluation of the way in which material is presented?

MR. ELLIOTT: Not directly, no.

COMMISSIONER MARRETT: What about with reference to the kind of information that's contained, if there's a

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certain content that has to be provided, the way the materials, the wording of materials can make a difference? Do you ever systemically look at the level of presentation in any written materials in the training program?

MR. ELLIOTT: We have relatively little written material that we have prepared. This was one of the changes which I made when I came to Babcock and Wilcox. I guess it was a long-term beef of my own in being a student in various educational organizations. I changed the format in which technical manuals -- not technical, they were training system manuals were, that the page on which written material was presented, the figures. And we're really attempting to explain figures. The figures had to either fold out or be on the opposite page from the words, so that we didn't end up with three fingers in the book trying to read the figure at the back, because with students who may or may not be completely dedicated to this problem, it's hard to figure out where the figure is, he may just read the material and go on and never understand. So that was trying to make things less difficult for the student and therefore, hopefully, improving his retention and understanding.

COMMISSIONER MARRETT: Well, I understand that you made a number of changes that seem intuitively and perhaps in experience actually to be highly justified. I'm wondering, however, if there is an effort, as well, to ask, are there

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certain things that we should be examining. For example, if there is a question of the usefulness of homework, one response might be, based on what we know, the addition of homework might not make a difference. But the question becomes is there any effort made to compare different ways, to compare several kinds of systems, so that there becomes some indication that one system or one way for going about things may be preferable to another. It comes down finally to is there any research component to the training that you do?

MR. ELLIOTT: There is no research done in the training that I do. I agree with you. There are areas that should be researched. We need better methods of transmitting and communicating the understanding of engineering that we are presenting and the interrelations of systems. And it's very evident in this accident is the understanding of highly heated water and pressurized water, and when its pressure is removed, how it behaves, pressure and temperature, this saturation, which I'm sure you've heard many people speak of. But the plant went into saturation. And as an outsider, the individuals never recognized that. They somehow believed that system was just, once you sprung a leak, it ought to go to no pressure and not recognizing that the energy supplied by the core and the energy in the system would continue to boil and hold the pressure up.

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COMMISSIONER MARRETT: Well, in terms of any plan for the training department, what do you anticipate in terms of issues such as assessing more completely the effectiveness, because what I mean by effectiveness is not simply what the operator can do in the simulator, but how effective is the kind of training that's given that may enhance that performance in the simulator? Are there any specific plans you have now within the training department?

MR. ELLIOTT: My plan is to, at the moment -- we're attempting to hire some individuals with backgrounds similar to mine and use them, when they first come to B&W, to evaluate what's going on, so they're not contaminated by the way things really are and they can be objective for a short while. And shortly they become a part of everything else and they lose their objectivity.

COMMISSIONER MARRETT: One final question. We've made a number of comments with reference to the question of person-machine interface. And since it's your unit that has the human beings in it, in some respects, I guess the question becomes how is your training department going to fit into that, because the kinds of questions I was asking earlier about understanding response under stress might not have some direct impact right then on the training, but it will have impact on the questions about design and use of equipment? How, then, will your part of the organization fit

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into this attempt to bring into closer alignment the person and machine?

MR. ELLIOTT: We have, over a period of about -- at least four years, utilized our instructors as consultants or aids to the brief periods of attempts to design a better control room. The control rooms in these power plants were designed primarily by the architect-engineer, at least the architect. Sometimes the construction of a plant's done by a separate construction company. They're designed by the architect, working with the owner. Sometimes they utilize some suggestions from B&W. But they do it their way. And we were attempting to devise some better control rooms that we could provide as a part of our supply of standard control rooms.

Now, the design of the control room, because it's done by these people, is done to allow the control room to figure out and find all of the smallest malfunctions or non-proper operation at the plant, assuming that everything else is all right. And that leads to the tremendous number of alarm panels that are around the control room, many cases, highly redundant indication of instrumentation, maybe even excessively large switches on the panel. And probably out of this event, we should go to control rooms that are designed primarily to handle the plant in response to a casualty and then be operable for steady state.

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In the past and our existing control rooms were all designed for steady state. And through operator adaptation, they can live through the crisis.

CHAIRMAN KEMENY: Professor Taylor?

COMMISSIONER TAYLOR: You stressed in your testimony, Mr. Elliott, that you are trying to get across in your training program to the students some of the special characteristics of water and steam at these very high, relatively high, pressures. How high a temperature is the simulator capable of handling in terms of the liquid water temperature which it continues to act as a simulator? Do you recall that, offhand?

MR. ELLIOTT: The highest indication of water temperature we have in the simulator is 620 degrees TH, but I'm not sure where the compressor water tables that are in the simulator actually stop.

COMMISSIONER TAYLOR: So I gather from that, then, that the simulator will not handle situations when the water temperature gets above the critical point, which I understand is around 700 degrees.

MR. ELLIOTT: Yes, I think it is 703, 704 degrees.

COMMISSIONER TAYLOR: Now, is that because it is considered incredible that the temperature would ever get that high?

MR. ELLIOTT: Yes. In the design of this simulator, and I believe now that, having talked to you for a moment, I believe our tables stop at 2,500 psig, and I am not sure what the saturation --

COMMISSIONER TAYLOR: So there is a limit of 2,500

on the pressure and 630 degrees on the temperature. Is it correct, then, that both those limits were set by a conviction or a belief that there are not [illegible] to be situations facing the operators where either the pressure is above that value or the temperature in the water is above that value?

MR. ELLIOTT: Right. We were assuming, when the design of that simulator -- that was done before my time -- but that both B&W plants have two code relief valves, and that those code relief valves would limit the plant from achieving 2,500 psi. And so we just stopped the table. It is a lock-up table on the compressed water tables.

COMMISSIONER TAYLOR: Do you happen to know what the highest temperature that was recorded in the water in the TMI II accident was, or whether it -- let me ask it this way. Was it above 630 degrees?

MR. ELLIOTT: I suspect the water temperature --

COMMISSIONER TAYLOR: Water temperature, not --

MR. ELLIOTT: Water temperature -- well, we know that the temperature went off scale high, and so we are in the super heat region of the core. We were operating at a temperature pressure of about 1,000, 1,200 psi, and we were highly superheated, steam. The computation of steam temperature in the simulator is capable of going above that.

COMMISSIONER TAYLOR: Just one final question: Do you make sure that the students are able to relate pressures

and temperatures to saturation conditions? Did they know how to use steam tables and know what they mean? I mean, do you put special emphasis on that so that the meaning of saturation temperatures is quite clear to them?

MR. ELLIOTT: We do now. I was on reserve duty at the time of the accident. When I got back, we started the special training program that we discussed previously the day after I arrived, the day I arrived back at B&W. But we are forcing the students the steam tables and we have graphs around the simulator of the saturation curve, plus a margin curve on it, so they are forced to, and our drills on them force them to use that table.

Now, whether or not they really understand boiling, saturation, and that you can have a large variety of quality, going from zero to 100 percent, I am not sure. This relates to your questions about methods. Most of us learn the hard way, and we kind of believe, from working enough thermal problems and ranking cycle problems, that all of that is kind of true.

COMMISSIONER TAYLOR: Well, in the course of operating the simulator, before TMI II, would situations arise where in fact the water was above saturation temperature, the water temperature was above saturation temperature, without the students knowing that they were in a very special regime; in other words, would the meaning of that transition have been clear to them?

Let me put it another way. Were there steam tables in the control, in the simulator control area that they would then refer to, before the accident?

MR. ELLIOTT: There were steam tables there. They have been in the control room ever since I worked there. Students were forced to use them. We have the ASME tables and, for some oldtimers, Keenan and Keys.

COMMISSIONER TAYLOR: Fine. Thank you.

CHAIRMAN KEMENY: Just to follow that up with one question several TMI II operators testified before this Commission that during the accident, they were presented with situations that they had never experienced in the simulator. Would you feel that that statement is correct, in view of what you said on the limitation on temperature indication on your simulator?

MR. ELLIOTT: Yes.

CHAIRMAN KEMENY: Thank you. Professor Pigford had a follow-up.

COMMISSIONER PIGFORD: Mr. Elliott, are you saying that prior to TMI II, all students were taught to calculate saturation temperature from the observed pressure during the simulation runs?

MR. ELLIOTT: I could not say that all students had.

COMMISSIONER PIGFORD: It is possible for a student to go through without being taught how to calculate satu tion

temperature from the pressure?

MR. ELLIOTT: Before TMI, I believe that was possible.

COMMISSIONER PIGFORD: And were any students taught to compare saturation temperature with the hot leg and cold leg temperatures?

MR. ELLIOTT: I do not remember any specific work on that area.

COMMISSIONER PIGFORD: You do not know if any student was taught to make that comparison?

MR. ELLIOTT: Not by us. No, sir.

COMMISSIONER PIGFORD: Thank you.

CHAIRMAN KEMENY: Dr. Marks?

COMMISSIONER MARKS: I don't want to belabor this point, but in the hearings that Babcock & Wilcox had on June 5, Mr. McMillan made the statement that it is clear that of the six significant factors identified by the NRC and which we have discussed here today, five involve the operator. One of the implications, I think, one could draw from that is that operator training has been very inadequate.

He goes on to say that there will be extensive investigations to improve the man-machine interface. You just told us that you are not involved in any research related to training. Do you have any idea what Mr. McMillan had in mind when he said that there will be extensive investigations into improving the man-machine interface?

MR. ELLIOTT: Well, I believe Mr. McMillan is talking about the Procedures Task Force Mr. Taylor talked about earlier today, where we are trying to present to the students a better understanding of why things are the way they are and why they should respond in the way in which they --

COMMISSIONER MARKS: Well, Mr. Taylor said there was only one meeting of that group, and that was with the utilities.

MR. ELLIOTT: Yes.

COMMISSIONER MARKS: So you are not doing much yet.

MR. ELLIOTT: No, sir, I am not doing a whole lot.

COMMISSIONER MARKS: Are you doing anything?

MR. ELLIOTT: We are trying to communicate to the student that piece of technology that we are involved with and changing our ways of doing things every day that we can find out something different to do better.

COMMISSIONER MARKS: Well, there is a sense that your approach is very narrow, considering the magnitude of your responsibilities in this.

MR. ELLIOTT: I believe you are implying responsibilities that are --

COMMISSIONER MARKS: All I am saying is --

MR. ELLIOTT: B&W's responsibilities over and above what they might be.

COMMISSIONER MARKS: Well, maybe I don't have a clear understanding of what you consider your responsibility in

operator training. I mean, can you give us in lay terms what you think B&W's responsibilities are with respect to operator training.

MR. ELLIOTT: Yes, sir.

COMMISSIONER MARKS: What are your goals, in other words?

MR. ELLIOTT: Well, I have primarily two goals in operator training. One is to provide the customer, the utility, with that training which he feels he needs, and the second is to conduct that training such that the students are prepared, as best we can within the time constraints that the customer allows us, to safely operate his power plant.

COMMISSIONER MARKS: So you don't feel any sense of responsibility to say to a customer, we can't adequately train your student in the time that you are suggesting we give to the training of that student? Have you ever turned down a customer's request for training because they weren't providing enough money to cover the cost of your course?

MR. ELLIOTT: No.

CHAIRMAN KEMENY: Thank you. The witness is excused, and these hearings will recess until 10:00 a. m. tomorrow morning.

(Witness excused.)

(Whereupon, at 3:12 p. m., a recess was taken until the following day, Friday, July 20, 1979, at 10:00 a. m.)