

TRANSCRIPT OF PROCEEDINGS

PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND

PUBLIC HEARING

FRIDAY,  
JULY 20, 1979

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PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND

PUBLIC HEARING

FRIDAY,  
JULY 20, 1979

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

The hearing was convened pursuant to notice at 10:10 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

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PARTICIPANTS: (continued)

Lloyd McBride  
President  
United Steelworkers of America

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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I N D E X

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Witness - Donald H. Roy

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Witness - John H. MacMillan

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P R O C E E D I N G S

10:10 A. M.

1  
2 CHAIRMAN KEMENY: Will the meeting please come to  
3 order. Chief Counsel, please swear in the next witness.

4 Whereupon,

5 DONALD H. ROY

6 was called as a witness and, having first been duly sworn by  
7 Mr. Gorinson, was examined and testified as follows:

8 MR. KEMENY: Would you please state your full name  
9 and your current position within Babcock & Wilcox.

10 MR. ROY: My name is Donald Henry Roy. I am Manager  
11 of the Engineering Department, Babcock & Wilcox Nuclear Power  
12 Generation Division.

13 MR. KEMENY: Chief Counsel, who will lead off the  
14 questioning?

15 MR. GORINSON: Mr. Kane.

16 MR. KANE: Thank you, Mr. Gorinson.

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

18 MR. ROY: Since 1959, 20 years now.

19 MR. KANE: And would you briefly explain the duties  
20 of your current position as Manager of the Engineering Depart-  
21 ment.

22 MR. ROY: The Engineering Department is responsible  
23 for the design of systems, equipment, and components within  
24 the NSS and fuel scope of supply of the division.

25 MR. KANE: From April 1, 1974, to August 1, 1978,

1 you were Manager of the Plant Design Section of the Engineer-  
2 ing Department, were you not?

3 MR. ROY: Yes, sir.

4 MR. KANE: And in that position, you were the imme-  
5 diate supervisor of Mr. Bert Dunn, who has already testified  
6 before this Commission?

7 MR. ROY: Yes, I was.

8 MR. KANE: The Commission has already heard extensive  
9 testimony concerning a transient at Davis-Besse on September  
10 24, 1977. I don't want to have you repeat any portion of that  
11 testimony but I understand from the deposition that was taken  
12 from you in connection with this Commission's proceedings on  
13 July 7, 1979, that you stated that since March 28, 1979, you  
14 have had discussion with Dr. Womack of B&W concerning how to  
15 improve internal B&W procedures. Is that correct?

16 MR. ROY: Yes. This was in the context and also in  
17 discussions with Mr. Taylor in causing a review to be con-  
18 ducted, and I asked Mr. Taylor to conduct this review of the  
19 systems and procedures which exist at NPGD to assure that we  
20 adequately address all avenues by which safety concerns arise,  
21 that we have -- that our system is appropriate or : recommenda-  
22 tions for changes should be made to assure that these safety  
23 issues are made visible, that they are brought to closure.

24 I also asked Mr. Taylor to conduct a -- to consider  
25 the formation of a safety review group, standing safety review

1 group, to provide policy and guidance to him, and he design  
2 reviews as they relate to safety significance and systems and  
3 policies with respect to resolving safety issues.

4 MR. KANE: Have there been any changes in fact made  
5 at B&W, as opposed to simply considering them at this point?

6 MR. ROY: With respect to site problem reports, we  
7 are improving that procedure in terms of requiring engineering  
8 department unit manager review and sign-off on site problem  
9 reports, reports which arise from the site of equipment prob-  
10 lems or transients, and as it may be. So we have done work,  
11 are in the process now of releasing that revised procedure.

12 We have requested of the NRC to supply to us copies  
13 of all licensee event reports, and Mr. Taylor is now consider-  
14 ing a system for the processing of those licensee event  
15 reports, for the perusal of them for issues of safety signifi-  
16 cance and how we would handle those in the building.

17 He is in the process now -- we have determined that  
18 we do want to formulate the standing safety review group, and  
19 he is expected to have a draft charter for the group and recom-  
20 mendations on membership by the end of this month. They are  
21 some of the actions which have been taken to date.

22 MR. KANE: All right. Is B&W now developing instru-  
23 mentation to compute reactor core coolant conditions from  
24 primary system parameters?

25 MR. ROY: You probably are referring to what is

1 called the saturation meter. Yes, we have built a prototype  
2 for a saturation meter which accepts hot and cold leg tempera-  
3 tures and primary pressure and will compute the saturation  
4 margin and display it, and we are now in the final design  
5 process for that meter at this stage.

6 MR. KANE: Does the prototype of that particular  
7 device have a digital readout?

8 MR. ROY: Yes, it does.

9 MR. KANE: And has all the work or consideration on  
10 this device been commenced since March 28, 1979?

11 MR. ROY: Yes, it has.

12 MR. KANE: All right. Has B&W also made changes in  
13 the set points for a high pressure trip in connection with the  
14 pressurizer?

15 MR. ROY: Yes. The change in the high pressure trip  
16 set point was made in conjunction with a change in the set  
17 point for the pilot-operated relief valve.

18 MR. KANE: Why have those changes been made?

19 MR. ROY: Shortly after TMI II, the NRC and B&W had  
20 dialogue, and the NRC wanted to reduce the incidences in which  
21 -- which would lead to challenges to the pilot-operated relief  
22 valve and had B&W consider the alternatives for how that might  
23 be accomplished. We considered alternatives and selected and  
24 proposed to the staff, and they accepted, a recommendation  
25 which was subsequently issued as a bulletin to the operating



1 plants to raise the pilot-operated relief valve set point and  
2 to lower slightly the high pressure trip set point for the  
3 reactor, such that on events like turbine trip or loss of  
4 main feedwater, the pilot-operated relief valve would not be  
5 challenged.

6 MR. KANE: All right. Do you agree with the NRC  
7 position on this matter?

8 MR. ROY: This, I think, is appropriate response in  
9 the short term to the concerns raised by the Nuclear Regulatory  
10 Commission. We hope to look at the long term desirability of  
11 maintaining that relationship. It was in response, direct  
12 response, to their requirement to reduce that frequency, and  
13 I think that particular alternative at this time was an appro-  
14 priate response to their request.

15 MR. KANE: Is B&W also now considering changes in  
16 containment isolation; that is, containment isolation actua-  
17 tion?

18 MR. ROY: Yes. As part of the requirements of the  
19 NRC with respect to shutdown orders which were issued shortly  
20 after TMI II, the NRC requested that the provisions for con-  
21 tainment isolation be examined and that a diverse means be  
22 provided. We had recommended to our operating plants which do  
23 not already isolate containment on a diverse signal to include  
24 containment isolation on both high building pressure and  
25 initiation of ESFAS, tripping of the ESFAS at 1,600 psig,

1 ESFAS being the emergency safeguard feature system.

2 MR. KANE: And have these changes been considered  
3 only since March 28, 1979?

4 MR. ROY: That is true, yes.

5 MR. KANE: Mr. Roy, in your position as Manager of  
6 the Engineering Department or in your prior position as Mana-  
7 ger of the Plant Design Section, have you observed a B&W  
8 reactor operated at power from the control room?

9 MR. ROY: I have not been in an operating B&W plant  
10 control room in operation. Of course, I have been to them  
11 when we could get inside of the containment and look at the  
12 equipment, during outages and during construction.

13 MR. KANE: Mr. Roy, is it true that B&W engineers  
14 are not systematically trained on B&W's Lynchburg simulator  
15 and that perhaps as few as 20 percent of those engineers are  
16 in fact trained in that way?

17 MR. ROY: The 20 percent figure was my "guesstimate"  
18 of the number that -- very much a guesstimate -- of the number  
19 that have had introduction to the simulator training course,  
20 demonstration and some hands-on exercise with respect to the  
21 simulator.

22 Over a period of several years past, we have con-  
23 ducted, through the -- the training department, rather, has  
24 conducted sessions for engineers, and these are not systemati-  
25 cally done, but they have been done on several occasions,

1 whereby the engineers have an opportunity to be familiar with  
2 the simulator, to go through a start-up operation, and it is  
3 not a systematic program in that it is scheduled on a routine  
4 basis and specifications are developed for who will go and  
5 what the class size will be, and so forth.

6 MR. KANE: Mr. Roy, is it also true that no system  
7 has existed at B&W for the transmission of information from  
8 the Engineering Department to the Training Department?

9 MR. ROY: As I testified in the deposition, I don't  
10 know of a systematic or procedure which requires the trans-  
11 mission of certain documents from Engineering Department to  
12 the Nuclear Service Department. A great deal of material does  
13 flow in terms of limits and precautions documents. The  
14 safety analysis report material is providing by the Engineer-  
15 ing Department and made available to the Customer Service  
16 Department, which they have used in their training programs.  
17 There is not a procedurized, systematic flow defining specific  
18 documents which must flow, to my knowledge, at this time.

19 MR. KANE: All right. Mr. Roy, is it also true that  
20 not very many of B&W's engineers have ever sat in on any of  
21 the training courses offered to operators by B&W in Lynchburg?

22 MR. ROY: In terms of the classroom training ses-  
23 sions?

24 MR. KANE: Yes.

25 MR. ROY: I don't think that that has been a frequent

1 occurrence or a large number of the engineers have participated  
2 in that.

3 MR. KANE: All right. And lastly, Mr. Roy, has the  
4 B&W Engineering Department ever conducted any review of the  
5 substantive content of the B&W training program?

6 MR. ROY: Not to my knowledge.

7 MR. KANE: All right. That's all the questions I  
8 have, Mr. Chairman.

9 CHAIRMAN KEMENY: Thank you, counsel.

10 Professor Taylor?

11 COMMISSIONER TAYLOR: Mr. Roy, has there been some  
12 ongoing effort at B&W to try to estimate the causes of, the  
13 nature of, and the extent of core damage in the TMI core,  
14 TMI II core?

15 MR. ROY: Two avenues with respect to that, Commis-  
16 sioner. During the several weeks following TMI II, we had a  
17 task force appointed to coordinate, to centralize examinations  
18 and the tracking of core performance. A part of their assign-  
19 ment was to estimate and try to determine and diagnose the  
20 extent of core damage.

21 On at least one occasion I am aware of, we did pre-  
22 pare a report with estimates of the extent of that core damage.  
23 I don't think we have updated that, and I can't give you the  
24 exact time frame since TMI II.

25 A second avenue, we have worked and provided with

1 EPRI, provided engineers from our Fuel Engineering Section who  
2 had previously worked on the TMI II fuel engineering task  
3 force, core engineering task force, who have been to EPRI,  
4 worked with the engineers at the Nuclear Safety Analysis Center  
5 there, in assisting them in the preparation of their report on  
6 the extent of core damage.

7 COMMISSIONER TAYLOR: Are any of your people now  
8 involved in the EPRI analysis? I understand there is a very  
9 large effort going on there to model what happened, to do  
10 thermohydraulic calculations, make estimates of temperatures,  
11 and so on.

12 MR. ROY: I can't say specifically whether we have  
13 a group there right now. We have had in, say, the past 2  
14 weeks. We are also now in dialogue with EPRI for the assign-  
15 ment of a permanent -- for a 2-year assignment -- of one of  
16 our unit managers in the methods development area -- as a mat-  
17 ter of fact, he is manager of the Thermohydraulics Methods  
18 Development Unit -- for assignment at EPRI to assist them in  
19 the work that NSAC is doing with respect to TMI II follow-up.

20 COMMISSIONER TAYLOR: Have any estimates been made  
21 within B&W since the accident of the maximum temperature to  
22 which any part of the core fuel reached?

23 MR. ROY: Not with respect to a detailed analysis  
24 such as would be conducted for a loss of coolant accident  
25 analysis. We are in the process of benchmarking the ECCS

1 codes for the TMI II sequence. That is proceeding with the  
2 basic thermohydraulic response to the primary system. Once we  
3 know these flows versus time, we will then use that informa-  
4 tion as input to a detailed core thermohydraulics analysis  
5 to predict, using our basic ECCS methods, what the cladding  
6 temperatures were achieved and what the extent of core damage  
7 is.

8 I do believe that estimates of the extent of clad-  
9 ding temperatures were made based on results from sample  
10 analyses. I think also hand calculations to relate the amount  
11 of hydrogen that was generated versus the extent of metal-to-  
12 water reaction have been made, but I cannot --

13 COMMISSIONER TAYLOR: Were these estimates made by  
14 B&W people that you are referring to?

15 MR. ROY: Yes.

16 COMMISSIONER TAYLOR: Where did those estimates or  
17 where have those estimates come out in terms of the highest  
18 fuel cladding temperatures that were achieved in the accident?  
19 What number of degrees?

20 MR. ROY: I can't recall the specific numbers. I am  
21 going to give you a number that I do recall in the 2,300 to  
22 2,500 degree Fahrenheit range peak temperature. There is a  
23 number I recall, but I just don't recall the specifics.

24 COMMISSIONER TAYLOR: Are you, yourself, aware of  
25 any estimates that have been made by NRC of what those peak

1 temperatures were?

2 MR. ROY: No, I'm not.

3 COMMISSIONER TAYLOR: There is a memorandum prepared  
4 by Dr. Pickelsimmer in the Fuel Behavior Research Branch of  
5 NRC. It is dated July 3, 1979. Have you seen that report?

6 MR. ROY: Not that I recall.

7 COMMISSIONER TAYLOR: Okay.

8 MR. ROY: Perhaps if I could see it, I -- I don't  
9 recall the report.

10 COMMISSIONER TAYLOR: Let me give this to you.

11 (Whereupon, a document was handed  
12 to the witness.)

13 Now, I might point out that on the distribution  
14 list, which is at the end of the textual part of that memo-  
15 randum, there are two B&W people listed as having been on the  
16 distribution. One is Mr. Rowe and another is Mr. Montgomery.  
17 Are those people in your Engineering Department? I realize  
18 that it is a large department, and you won't necessary know  
19 the name of everyone in it.

20 MR. ROY: Yes, they are in the Engineering Depart-  
21 ment.

22 COMMISSIONER TAYLOR: Do you know whether they  
23 actually received that document and read it?

24 MR. ROY: No, I would not know.

25 COMMISSIONER TAYLOR: The reason I am asking this

1 is that there are so-called upper bound and lower bound esti-  
2 mates in that document, which are based on what NRC describes  
3 to be fairly approximate ways of estimating the highest tem-  
4 peratures in various parts of the core.

5 MR. ROY: Yes.

6 COMMISSIONER TAYLOR: And the range of temperatures  
7 bounded by what they call their worst case and their minimum  
8 case is in the range of 4,000 to 5,000 degrees Fahrenheit.  
9 Do you know the melting point offhand of the fuel, what the  
10 temperature is?

11 MR. ROY: Yes, roughly 5,080 degrees Fahrenheit,  
12 in the range --

13 COMMISSIONER TAYLOR: Yes, I understand there is a  
14 little -- there is some uncertainty in that. It depends on  
15 its composition. But based at least on that NRC admittedly  
16 preliminary set of estimates, they apparently are saying that  
17 significant fractions of the fuel -- that is, more than 5  
18 percent and possibly a fair bit more than that -- did reach  
19 temperatures above 4,000 degrees Fahrenheit, and --

20 MR. ROY: This is fuel temperatures?

21 COMMISSIONER TAYLOR: That is fuel temperatures.  
22 That is correct.

23 MR. ROY: Yes, I was speaking before of clad.

24 COMMISSIONER TAYLOR: I see. Well, then, let me  
25 ask you again, have there been estimates of the highest fuel



1 temperatures in the core by B&W?

2 MR. ROY: Not that have come to my attention, that  
3 I recall.

4 COMMISSIONER TAYLOR: In that document you have  
5 before you, there is also a discussion of a mixture of zir-  
6 conium oxide, which was formed by metal water reaction, and  
7 uranium oxide, called a eutectic, for which the formation tem-  
8 perature is 3,500 degrees Fahrenheit. Are you aware of that  
9 term, of that --

10 MR. ROY: Yes.

11 COMMISSIONER TAYLOR: Have there been, as far as  
12 you know, any estimates within B&W of the extent to which that  
13 material was formed in the core?

14 MR. ROY: Not to my knowledge. On the eutectic  
15 formations?

16 COMMISSIONER TAYLOR: That's right.

17 MR. ROY: Not to my knowledge.

18 COMMISSIONER TAYLOR: The reason I am focusing on  
19 that is because the formation temperature at which this melted  
20 material forms is about 3,500 degrees Fahrenheit, and on that  
21 basis this part of NRC is saying in a preliminary way, appar-  
22 ently, that significant fractions of the zirconium that was  
23 oxidized mixed with uranium and formed a melted material.

24 The reason I am bringing up this question is, it  
25 relates to the next question I would like to ask you, and that

1 is, from everything you know, on the basis of what has been  
2 done at B&W that you are aware of and outside B&W, how would  
3 you answer the question, did any significant amount of fuel  
4 in the core melt? How would you answer that question?

5 MR. ROY: I would answer no on the basis that in the  
6 analysis of RCS samples, we have asked the radiochemists to  
7 very carefully watch that data for any indication that there  
8 would -- may have been significant melting of the fuel. The  
9 information portrayed to me was that there was not a signifi-  
10 cant melting of fuel. I recall an early sample analysis by  
11 Bettis Atomic Power Laboratory that arrived at the same con-  
12 clusion. That is one specific analysis that I do recall.

13 So the information, at least the information as  
14 portrayed to me by the review of both those in the field  
15 engineering and the radiochemists was there was not, and that  
16 was my perception --

17 COMMISSIONER TAYLOR: I understand.

18 MR. ROY: -- that it was not significant.

1 COMMISSIONER TAYLOR: Did anyone explain to you  
2 why one would expect to see something, uranium or something  
3 else, in the primary cooling water samples that would indicate  
4 a core melting, or melting of some of the core? Was there any  
5 discussion of why you would expect to see something if the core  
6 had melted that you would not otherwise see?

7 MR. ROY: There was discussion of some isotopes that  
8 would be released by the higher temperatures that would accompany  
9 melting of the fuel. I don't recall those isotopes now. And,  
10 of course, the measurement of the concentration of uranium in  
11 the samples itself, which would be some just due to the breaking  
12 up and erosion of some of the pellets which may have been ex-  
13 posed to the fluid stream. But I don't recall those details,  
14 sir.

15 COMMISSIONER TAYLOR: But you still say that your  
16 answer to the question, "Did any of the core material melt?"  
17 from all the knowledge that you had presented to you, that the  
18 answer is no. Is that correct?

19 MR. ROY: That is true.

20 COMMISSIONER TAYLOR: I would like to go on, just for  
21 a moment, to the hydrogen situation. I want to distinguish  
22 between two situations; one is the hydrogen inside the pressure  
23 vessel, and the other is the hydrogen in containment.

24 Have there been estimates, calculations, since the  
25 accident started by B&W people of how much oxygen might have

1 appeared in the bubble inside the pressure vessel from any  
2 possible sources of oxygen?

3 MR. ROY: When the concern and recognition of the  
4 hydrogen bubble was made shortly after TMI-2, a few days follow-  
5 ing it, one or two days following it, three avenues of analysis  
6 associated with the bubble size, whether there would be signi-  
7 ficant oxygen present to support detonation, and what would the  
8 effects of detonation be if --

9 COMMISSIONER TAYLOR: Inside the pressure vessel?

10 MR. ROY: Yes. Inside the pressure vessel we are  
11 talking about now. With respect to the presence of oxygen, one  
12 of our radio-chemists who was tracking that element of it had  
13 accumulated information from -- I think one source was Oak  
14 Ridge National Laboratory, Westinghouse Research Laboratories  
15 may have been another -- but he recalled and was able to obtain  
16 information which he analyzed with respect to the probability  
17 that there would be significant oxygen contained when there  
18 was a rich hydrogen over-blanket in the presence of a gamma  
19 field where you do have radiolysis for the formation of the  
20 oxygen.

21 And his analysis persuaded him, as he presented it  
22 to me, that there would be insignificant or not sufficient  
23 oxygen present to support a detonation in the presence of a rich  
24 hydrogen over-blanket which, of course, was there due to the  
25 metal-water reaction itself.

1           That was the line of the analysis with respect to  
2 the oxygen content of the bubble.

3           COMMISSIONER TAYLOR: Now, when was it that he pre-  
4 sented you with that result?

5           MR. ROY: This was during the period of March 30,  
6 31, 1st, 2nd of April, early timeframe.

7           COMMISSIONER TAYLOR: So it is your recollection  
8 that it was some time within a day or two of the weekend follow-  
9 ing the accident, that is, Saturday or Sunday, or Monday possi-  
10 bly?

11           MR. ROY: Yes, in the week of the accident itself,  
12 and I am sure analyses probably were proceeding on into the  
13 next week, but I do recall that that work was going on fairly  
14 early.

15           COMMISSIONER TAYLOR: Now, have there been further  
16 attempts to try to identify any other possible sources of oxygen  
17 and what those concentrations might be, let's say, sort of  
18 realistically if possible?

19           MR. ROY: Yes. This gentleman did a detailed balance  
20 in trying to determine all the sources for non-condensables in  
21 oxygen which would be present, such as that transported from  
22 the borated storage tank in case that there was injection flow  
23 during that period. And other sources -- the answer, as I  
24 remember, he had a gas balance, if you want to call it, for  
25 the various sources which might give rise to the presence of

1 oxygen in the reactor coolant system.

2 COMMISSIONER TAYLOR: So I gather -- is it fair to  
3 say that the overall conclusion within the week after the  
4 accident started was that your people were unable to identify  
5 any source of oxygen such that it would create a situation in  
6 which hydrogen inside the pressure vessel could burn or detonate --  
7 is that correct?

8 MR. ROY: Yes, detonate. With respect to the presence  
9 of sufficient free oxygen to support detonation, we had reached  
10 a conclusion, on the basis of the analysis which we had done,  
11 that the oxygen content would be insufficient to support  
12 detonation in the vessel.

13 COMMISSIONER TAYLOR: Now, are you aware of the  
14 estimates that were being made at about the same time by people  
15 in NRC that were giving a different result, that at least there  
16 was a possibility that that might happen?

17 MR. ROY: No, I wasn't aware of their sources.

18 COMMISSIONER TAYLOR: Well, I am saying, are you now  
19 that --

20 MR. ROY: No, I am not now of the various other avenues  
21 by which they were receiving advice, perhaps in their own  
22 calculations, too, regarding oxygen content in the reactor  
23 coolant system. I am not aware of the information flow which  
24 they were receiving with respect to the same subject, and we  
25 haven't since then.

1           COMMISSIONER TAYLOR: Well, then turning more or less  
2 to the present or to the recent past, do you know whether people  
3 in B&W, in your department that are trying to understand this  
4 set of technical issues, are interacting with those people in  
5 NRC that were making estimates that I gather from the depositions  
6 B&W feels was erroneous at the time of the accident?

7           MR. ROY: That is certainly possible, but I am not  
8 aware that that interaction is occurring on it.

9           COMMISSIONER TAYLOR: Now, just very briefly, on the  
10 situation outside the pressure vessel, are there people or were  
11 there people at B&W at the time when the knowledge that there  
12 was some hydrogen in containment and that probably a significant  
13 amount of hydrogen had either burned or detonated, were there  
14 estimates being made of how much hydrogen might be involved in  
15 a burning or detonation and what the effects of that might  
16 be, in the context of possibly releasing a substantial amount  
17 of radioactive material?

18           MR. ROY: We were tracking hydrogen concentration  
19 in the building. I am not aware of any calculations on detona-  
20 tion potential and what its effects would be for the containment  
21 building. I might mention that shortly after, to give the  
22 context of how this work was going on, the day after the accident  
23 itself we established an ad hoc functional organization with  
24 various functional areas manned, including radiochemistry,  
25 event sequence, systems analysis, so forth, various functions

1 defined on an organizational chart as a task force, to assure  
2 that support for TMI-2, the reactor itself, and stabilization  
3 recovery efforts would be manned on a 24-hour basis. And so  
4 we had identified this field engineering task force I mentioned  
5 was part of that, concentrating specifically on TMI-2.

6 The analyses with respect to oxygen bubble and detona-  
7 tion of the building were under a radiochemistry organization.  
8 So we had this kind of organization which considered quite some  
9 time after the accident, tracking these kinds of parameters.  
10 But with respect to detonation in the containment building,  
11 no, we do not believe we have made any analyses of detonation  
12 potential. We were tracking the concentration, and I am sure  
13 the knowledge and discussions of the various burning versus  
14 detonation modes of hydrogen were discussed, but I don't recall  
15 any effects analysis of a detonation in the building.

16 COMMISSIONER TAYLOR: Do you recall roughly when B&W,  
17 yourself or people responsive to you, became aware of the famous  
18 28 p.s.i. spike, so called, and what their reaction to that  
19 was?

20 Let me ask the question more directly. Was there  
21 much doubt in anyone's mind by Sunday following the accident,  
22 that that had in fact been burning or possibly detonation of  
23 hydrogen in the containment structure? Was there any doubt  
24 about that?

25 MR. ROY: First of all, we became aware of that -- I



1 became aware of that spike on Friday after the accident.

2 COMMISSIONER TAYLOR: I see.

3 MR. ROY: And I can't say there wasn't some doubt  
4 as to what the cause of that spike was. It is difficult; there  
5 is very little to go on as to separating it from some sort of  
6 spurious performance of the instrument itself versus a burning.  
7 I would say the consensus of opinion is that it was a legitimate  
8 burning spike. I can't give you the basis, but I think that  
9 is the general consensus of opinion of B&W.

10 COMMISSIONER TAYLOR: Now, during that period, was  
11 there any concern about the possibility of some breach of  
12 containment by the burning, the rapid burning, or the, formally,  
13 detonation of hydrogen in containment? You say that you weren't  
14 analyzing this, but was there a concern that that might happen  
15 and might actually result in a release of a substantial amount  
16 of the radioactivity in containment?

17 MR. ROY: The spike itself, at least as recorded by  
18 the instrument, which very possibly -- I will say possibly  
19 this local burning which showed about a 28 p.s.i. spike would  
20 be well below the design pressure. But certainly in terms of  
21 the containment building as a whole and breaching of the contain-  
22 ment building, we were tracking the hydrogen concentration, and  
23 I don't detect serious concern. The containment building  
24 structural analysis we don't ourselves there at B&W, but certainly  
25 it was tracking and that possibility is recognized if the

1 concentration gets high enough. It did not --

2 COMMISSIONER TAYLOR: Well, given the fact that  
3 apparently, with some doubts but not, I gather, a great many,  
4 that there had been a detonation already -- I am sorry --  
5 a burning of hydrogen in containment, was there a concern that  
6 that might happen again and involve more hydrogen? For example,  
7 most of the hydrogen that, let's say, on Sunday was known to be  
8 in the -- or surmised to be in the pressure vessel, that is,  
9 the 1,000 cubic feet roughly, 1,000 p.s.i. hydrogen, was there  
10 any concern that that might get into containment and in a  
11 similar fashion to the hydrogen that had burned before, presumably,  
12 yield a higher pressure than 28 p.s.i.?

13 MR. ROY: As I said, we were tracking the hydrogen  
14 concentration in the building. Certainly the possibility of  
15 another local kind of burning occurring could not be ruled out.  
16 I am not aware -- we did not have to -- a team tracking this  
17 explosive potential in the containment building itself and  
18 analytically assessing the effects or continued possibility or  
19 continued possibility of a detonation in the building. We were  
20 not tracking that in detail in that time.

21 COMMISSIONER TAYLOR: Well, then let me ask, if that  
22 is the case, how could one say with assurance that the possibility  
23 of a rapid burn, not necessarily detonation, in the containment  
24 structure might not rupture some part of containment and release  
25 gaseous or possibly liquid radioactive materials to the outside?

1 I mean on what basis could one say that there was very little  
2 possibility of that?

3 MR. ROY: I don't think we made that determination  
4 one way or the other. We are not equipped to do the structural  
5 analyses associated with a containment building.

6 COMMISSIONER TAYLOR: Do you know if anyone was doing  
7 that at that time?

8 MR. ROY: And I am not aware that -- I can't say  
9 that there wasn't someone doing it. I am not aware that it  
10 was being done.

11 COMMISSIONER TAYLOR: Okay. Very briefly, I would  
12 like to move now to the present time and ask you a few questions  
13 about the situation so far as the core is concerned right now.

14 I gather that it is quite clear it is subcritical,  
15 and is there a group now at B&W that is trying to keep on top  
16 of what the situation with respect to the core, to any possi-  
17 bility of the core changing its capacity to sustain a chain  
18 reaction, change its degree of subcriticality? Is that now  
19 being monitored by some people in your department to try to  
20 keep track of that?

21 MR. ROY: First of all, there is an organization, a  
22 task force comprised of both service and engineering personnel  
23 who are charged with the responsibility of the day-to-day  
24 monitoring of the situation at TMI-2 and providing support as  
25 necessary to GPU and to Met Ed associated with the recovery

1 efforts at the plant.

2 Now, we did do, early on, after TMI-2 various --  
3 considered various representations of the core; for example,  
4 slab formations, what we thought would be very conservative  
5 representations of the configuration to which the core might  
6 evolve to and to determine the acceptability of boron concentra-  
7 tion for hold-down, assuming the rods were present, as a matter  
8 of fact, conservative assumptions with respect to that rod  
9 worth.

10 That was done early on. I don't know that we are  
11 tracking that specific aspect now, but we do have a group that,  
12 should there be some change in configuration, would be aware of  
13 that very quickly and could obtain the assistance to examine  
14 the effects of such configuration, where it might go.

15 But we have done calculations, as I mentioned early  
16 on, with representations of the core, which I think would be  
17 conservative representations as to what it could evolve to if  
18 there were some further lack of structural integrity and cause  
19 some slumping, say, in the core itself, and provided minimum  
20 boron concentrations to assure that the system would still  
21 remain subcritical.

22 So I don't know that we are tracking that specific  
23 effect now, but were it to change we would be very quickly  
24 notified of that, having an organization that is very closely  
25 tracking the condition of the plant as a whole, and could take

1 some action.

2 COMMISSIONER TAYLOR: Have there been any estimates  
3 by B&W personnel that suggest that some significant fraction  
4 of the control rods that were inserted in the reactor after  
5 SCRAM were melted?

6 MR. ROY: Early on, we were looking for the presence  
7 of silver cadmium and indium in the samples of the reactor  
8 coolant system, and there were none. It was not detected.  
9 And on that basis and the calculations which would indicate  
10 with this particular boron concentration and with rods inserted --  
11 you know, we have a subcritical system -- that the rods are  
12 present in the core and substantially in the configuration which  
13 would show relatively good integrity.

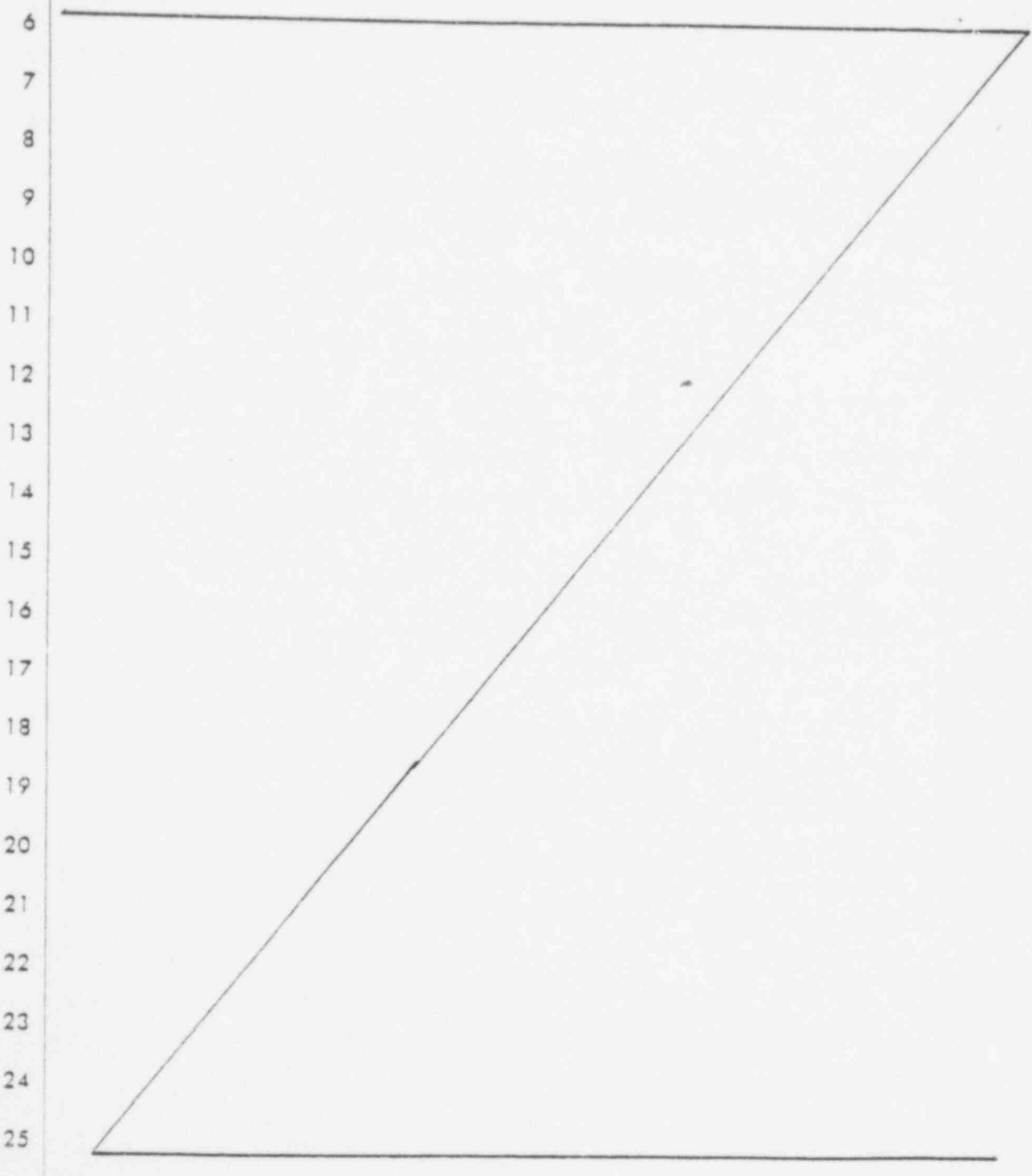
14 COMMISSIONER TAYLOR: Have there been any B&W calcula-  
15 tions of heat transfer from the hot part of the fuel during the  
16 time of core uncovering to the rods that might reach melting  
17 temperatures?

18 MR. ROY: I have a recollection that we did do estimates  
19 of that as a further backup, that the temperatures perhaps would  
20 not be reached, again as maybe these hand calculations that we  
21 had done, trying to estimate what the peak cladding temperature  
22 was, but I can't swear to that.

23 COMMISSIONER TAYLOR: Do you remember the results of  
24 those? That is, whether they said that no -- at least those  
25 calculations results are that the melting temperature of the

1 poison-bearing part of the rods was reached?

2 MR. ROY: No, I don't. If they were performed, as  
3 I seem to have a recollection that they were, they would have  
4 been supportive of the conclusion that the rods had not melted  
5 on it.



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1 COMMISSIONER TAYLOR: Are you aware of any NRC  
2 calculations aimed at answering the question whether or not  
3 any of the control rods melted?

4 MR. ROY: No.

5 COMMISSIONER TAYLOR: Has B&W or as far as you know  
6 has anyone inquired formally or informally of NRC people or  
7 EPRI about whether or not their estimates have suggested whe-  
8 ther or not there was melting of the control rods -- signifi-  
9 cant knowledge?

10 MR. ROY: I can't say the dialogue hasn't gone on,  
11 but I am not aware of it, that it has.

12 COMMISSIONER TAYLOR: Now, so far as the situation  
13 there right now is concerned, do you happen to know what either  
14 measurements or calculations are saying is the overall nullifi-  
15 cation factor of the reactor as it is there now; that is, the  
16 so-called K effective?

17 MR. ROY: We have --

18 COMMISSIONER TAYLOR: Let me ask it in two parts.  
19 Has there been any effort to try to measure that directly that  
20 you are aware of?

21 MR. ROY: None that I know of to measure directly  
22 the sub-critical multiplication factor.

23 COMMISSIONER TAYLOR: I realize it is not necessarily  
24 an easy thing to do in the situation there.

25 MR. ROY: And, of course, we have done calculations

02 1 of what we think that is. Now, they are probably conservative.  
2 We are probably underestimating the K effective.

3 COMMISSIONER TAYLOR: Do you have a number of roughly  
4 where does it come out?

5 MR. ROY: No, I don't. Not a specific number.

6 COMMISSIONER TAYLOR: Could we try to get that from  
7 you?

8 MR. ROY: All right.

9 COMMISSIONER TAYLOR: Thank you.

10 One final question or two questions on the situation  
11 there now, one of them is is the boron in solution in the water  
12 in the core -- the boron in the water in the core -- let me  
13 put it that way -- as far as you know, the primary poison now  
14 in the core with respect to anything that can be adjusted to  
15 change the state of criticality of the core? Is it greater  
16 than the control rod worth, assuming that the control rods are  
17 intact and so on?

18 MR. ROY: As far as ability to change the reactivity  
19 of the core itself without some change in configuration of the  
20 core, the boron would be the only factor right now that could  
21 change. In other words, if you change -- that is a variable  
22 that could be changed that would cause a change in the reactivi-  
23 ty of the core. The relative worth of the rods versus the  
24 boron, I don't know specifically, but I would assume the rods  
25 are a major contributor to --



1 COMMISSIONER TAYLOR: Are there any withdrawn rods  
2 that could at least in principle be inserted in the core to  
3 decrease the reactivity further?

4 MR. ROY: I would believe all of the rods --

5 COMMISSIONER TAYLOR: All in.

6 MR. ROY: Yes. All in.

7 COMMISSIONER TAYLOR: Has there been any possibility  
8 discussed of withdrawing for any reason any of those rods?

9 MR. ROY: I was just trying to think of that. I  
10 recall a discussion in which we were at least discussing the  
11 possibility of trying to attain some understanding of K effect-  
12 ive -- not K effective, but of the configuration of the core,  
13 where the rods locked in -- of attempting to withdraw it, but  
14 to my knowledge, we did not make that attempt.

15 COMMISSIONER TAYLOR: Are you worried at all or  
16 are people that are talking to your directly worried at all  
17 about the possible consequences of motion -- of mechanical  
18 motion -- of the rods with the core introducing some motion  
19 of the core itself, of the fuel material, which I gather every-  
20 body agrees -- at least near the top -- has been severely  
21 damaged.

22 MR. ROY: That would be a concern certainly in trying  
23 to move the rod. It is the same sort of a concern expressed  
24 with respect to starting pumps. You know, would there be some  
25 configuration change in the core. Yes, that is a concern.

004 1 COMMISSIONER TAYLOR: My final question is this.  
2 Are there calculations, estimates, attempts of any sort to try  
3 to determine whether a change in the configuration, particular-  
4 ly at the upper part of the core, where the damage has been  
5 relatively severe, would increase or decrease the effective  
6 multiplication in the core? Are there some calculations going  
7 on to try to understand what effective readjustment might be?  
8 The direction of it primarily -- would it go up or down?

9 MR. ROY: Calculations of that detail, we have not  
10 done. As I mentioned, we have postulated what we think are  
11 the conservative representation as to the compaction of fuel  
12 which might occur; the metal to water ratio that might be  
13 generated in certain configurations in establishing what are  
14 the conservative specification for boron concentration to main-  
15 tain criticality and we haven't fine tuned that with respect  
16 to, say, just changes in one portion of the core. We have not  
17 done that.

18 COMMISSIONER TAYLOR: Well, then finally, to sort  
19 of wrap up that question, do you have any significant concerns  
20 or have you heard concerns expressed to you by anyone else of  
21 the possibility of the core going critical again?

22 MR. ROY: No, I have not. The provisions for bora-  
23 tion are available and I have not had a concern expressed to  
24 me regarding that nor have I generated one of my own.

25 COMMISSIONER TAYLOR: Thank you very much.

1 CHAIRMAN KEMENY: Can I just bring up one point of  
2 clarification for our audience?

3 In your exchange there was several mentions of uses  
4 of the word "poison". Am I correct that this is not in the  
5 ordinary sense of the word, but it means an agent that stops  
6 radioactive free action from going on.

7 MR. ROY: Yes, sir. It is a neutron absorber for  
8 which we often use the name "poison".

9 CHAIRMAN KEMENY: Therefore, under the present cir-  
10 cumstances it is desirable to have those agents present.

11 MR. ROY: Yes. It is desirable to have this neutron  
12 absorber present.

13 CHAIRMAN KEMENY: Thank you.

14 Professor Pigford.

15 COMMISSIONER PIGFORD: Mr. Roy, is Mr. Nitti in your  
16 organization?

17 MR. ROY: Yes, sir.

18 COMMISSIONER PIGFORD: In your department?

19 MR. ROY: Yes, sir.

20 COMMISSIONER PIGFORD: I gather that he is the one  
21 who made the estimates on the amount of oxygen that could be  
22 present in the reactor coolant system on March 29. Is that  
23 correct?

24 MR. ROY: Okay. I am not sure of the date myself,  
25 when that was done, but Don Nitti was the radio chemist

1 responsible for that analysis.

2 COMMISSIONER PIGFORD: And he is the one who concluded,  
3 as you have stated, that because of the presence of hydro-  
4 gen, the net amount of oxygen is so small that it is not possi-  
5 ble for it to undergo an explosion. Is that correct?

6 MR. ROY: That was his conclusion. Yes, sir.

7 COMMISSIONER PIGFORD: Now, earlier, in answer to  
8 Dr. Taylor, you mentioned that this was carried out in -- by  
9 an answer to a question posed by Metropolitan Edison. Is that  
10 correct?

11 MR. ROY: I don't recall saying that to Mr. Taylor.  
12 We had a lot of discussion then. It may have been a question  
13 posed to us by GPU. I don't recall the avenue by which we  
14 got into that.

15 COMMISSIONER PIGFORD: Fine. What I am getting at  
16 is I find from the answer given to the Udall subcommittee by  
17 Mr. MacMillan on June 11, that this was also supplied to NRC,  
18 to a Mr. -- is there a Mr. Novak in NRC that you know of?

19 MR. ROY: Yes. We had transmitted that both to GPU  
20 and to the NRC and I don't recall right now the recipient. It  
21 could have been Mr. Novak.

22 COMMISSIONER PIGFORD: It was supplied then to NRC  
23 evidently, either on March 29 or March 30; namely, your con-  
24 clusion that the oxygen would not formed to sufficient extent  
25 to form an explosion. Is that correct?

1 MR. ROY: Yes, sir.

2 COMMISSIONER PIGFORD: Thank you.

3 Is Mr. Tulenko in your organization?

4 MR. ROY: Yes, sir.

5 COMMISSIONER PIGFORD: In your department?

6 MR. ROY: Yes, sir. He is manager of fuel engineer-  
7 ing section.

8 COMMISSIONER PIGFORD: Yes. Now, just to see if  
9 we are going in the right direction. We are very much inter-  
10 ested in getting these issues of core damage cleared up. He  
11 is still working on that, I gather, is he?

12 MR. ROY: As I said, we have had personnel working  
13 closely with EPRI. I am not aware of ongoing assessments for  
14 the fuel damage in fuel engineering, myself, right now, but  
15 there may be.

16 COMMISSIONER PIGFORD: Yes. But he might be cooper-  
17 ating with the EPRI analysis then?

18 MR. ROY: Yes, sir.

19 COMMISSIONER PIGFORD: Now, when we reached this part  
20 in questioning the NRC people, back in some previous months --  
21 I have forgotten which months -- we were left in a kind of  
22 confused state and it was suggested that that organization  
23 might be able to give us a little more definitive answer to  
24 the question such as what is the eutectic temperature? To what  
25 extent has that eutectic been formed and what is the extent of

1 core damage? Is that a question that B&W -- your division --  
2 could provide an answer on?

3 MR. ROY: We have the capability of making those  
4 estimates. We have not done so. I don't think EPRI has got  
5 in that yet, either; but we have the capability of doing that.

6 COMMISSIONER PLISFORD: All right. Well, I am not  
7 going to say that we are going to pose the question. I just  
8 wanted to see if it was possible. Thank you.

9 CHAIRMAN KEMENY: Governor Peterson.

10 COMMISSIONER PETERSON: I have several questions.  
11 I would like to follow up first on Professor Taylor's questions  
12 in connection with the hydrogen explosion in the containment  
13 building. First, why do you call that "burning", instead of  
14 calling it an explosion? Wouldn't 28 pounds per square inch  
15 pressure spike in this building devastate it?

16 MR. ROY: No, sir. That is believed to have been a  
17 local response of the instrumentation at the time. But the  
18 building is capable of withstanding --

19 COMMISSIONER PETERSON: No, I said "this building".  
20 A 28 pounds per square inch spike here would devastate this  
21 building.

22 MR. ROY: Well, it depends if it is was a burning  
23 phenomena, rather than the generation of a shock wave which  
24 would differentiate it from detonation. All right. You could  
25 produce the pressure spike which could be local without a large

1 shock wave and not detonate the building. It would depend on  
2 how this generated over what time interval and whether it is  
3 a detonation versus a burning.

4 COMMISSIONER PETERSON: In other words, the instru-  
5 ment was not measuring the pressure in the vessel?

6 MR. ROY: Well, it is not exactly sure what it was  
7 measuring, but it had a 28 PSI burning pressure response. If  
8 it created a shock wave it could destroy the building.

9 COMMISSIONER PETERSON: Now, the instrument showed  
10 this rapid increase in pressure after 28 pounds per square  
11 inch and it came back down rapidly which could have been an  
12 explosion, right?

13 MR. ROY: My --

14 COMMISSIONER PETERSON: It could have been a rapid  
15 detonation.

16 MR. ROY: A little out of field here, but my percep-  
17 tion at that time is that the hydrogen concentration in the  
18 building overall was not high enough to support detonation on  
19 it and believed to be a local concentration with a burning  
20 which would produce this pressure spike on it. That is the  
21 perception I have of the event.

22 COMMISSIONER PETERSON: Have you calculated what  
23 would have happened if all of the zirconium cladding had  
24 reacted with water to produce hydrogen and if all of that hy-  
25 drogen had moved into the containment building before it was

1 detonated? What kind of pressure might have built up in the  
2 containment building?

3 MR. ROY: No, sir. We have not done that calculation,  
4 including the response of the building to such a detonation on  
5 it.

6 COMMISSIONER PETERSON: What kind of pressure will  
7 it withstand?

8 MR. ROY: Design pressure is approximately between  
9 50 and 60 PSI.

10 COMMISSIONER PETERSON: So, you don't know whether  
11 the pressure which might have been released by detonation of  
12 this larger quantity of hydrogen would have exceeded that cap-  
13 acity or not?

14 MR. ROY: Built up into a large scale -- that is  
15 approximately a three million cubic foot building. Just have  
16 not done that calculation and look at what the assessment of  
17 the structural integrity of the building would be and what  
18 kind of shock force would be generated.

19 COMMISSIONER PETERSON: In regard to the core, when  
20 you take out used fuel, withdraw a fuel assembly, which norm-  
21 ally, of course, has its integrity -- so everything comes with  
22 it when you lift it -- Professor Taylor talked about the possi-  
23 bility of dislodging the debris in there as you removed the  
24 control rod. What might happen if you started to remove the  
25 fuel assembly with the control rods in place? Is it possible



1 that the fuel as a powder could fall to the bottom and, thereby,  
2 create a critical mass?

3 MR. ROY: I don't believe that with the boration that  
4 is present and the rough estimates of the amount of free uran-  
5 ium which may be available that we achieve a critical situation.  
6 As a matter of fact, I think we have looked at large scale  
7 slumping or dropping pellets into the bottom of the vessel as  
8 one of the conservative calculations I mentioned to Commissioner  
9 Taylor.

10 Of course, the job of removing the fuel assembly is  
11 going to require very careful planning. This TMI-2 recovery  
12 team, I mentioned earlier, is considering what would have to  
13 be done and the approach to take for safe removal of fuel.  
14 And, of course, one of the key elements of that is going to be  
15 the inspection of the fuel condition itself, which would govern  
16 the kind of tooling and approach which would have to be used  
17 to remove fuel safely.

18 Part of the process of considering removal of the  
19 core is going to be a very careful means for examining the  
20 condition of that fuel which will then dictate how it is to be  
21 done safely.

22 COMMISSIONER PETERSON: Another question: When we  
23 visited the Three Mile Island installation, I was told by one  
24 of the key people of Metropolitan Edison that when they started  
25 up Plant 2 they were plagued by a number of problems which

0012 1 stemmed from the fact that they were required to procure  
2 equipment from low bidders; equipment which was different from  
3 the design they had used in Plant 1. And in some cases they  
4 had many headaches with that and they had eventually replaced  
5 the equipment in Plant 2 with design similar to what they had  
6 in Plant 1. Does that happen quite often around the plants  
7 where you are involved?

8 MR. ROY: No. The scope of supplies that we would  
9 provide with respect to the NSS in fuel and in related auxil-  
10 iary systems, they do vary some in equipment, one pump versus  
11 another pump. That has not been a big problem, this differen-  
12 tiation. I think in looking at that statement, you would have  
13 to consider the context of the total plant itself, the steam  
14 plant plus the NSS itself. I am sure that the context of their  
15 remarks were with respect to the total plant, much, much more  
16 equipment in terms of magnitude number associated with the  
17 steam plant than with the NSS itself.

18 I just can't speak to the purchasing of the low  
19 bidder and having to go back and get equipment similar to that  
20 in TMI-1 in order to achieve the desired performance. I am  
21 just not familiar with that experience record on the startup  
22 of TMI-2. But I think it would have to be looked at in the  
23 context of the total plant.  
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COMMISSIONER PETERSON: When we talk about training programs and about a shift supervisor from one plant can walk into another plant or about NRC sending people to plants when they're in trouble, obviously one variability from plant to plant complicates the problems of people knowing what they're doing. And I thought this was just another place where you can introduce variability, which might not be necessary if, in view of the great safety problems in this kind of plant, maybe you ought to loosen up on this getting equipment from the low bidder.

MR. ROY: I can understand the source of the statement. Engineers are often confronted with the balancing of a standardization and the advantages of standardization, which are quite real, versus the ability to advance a piece of equipment, improve its design, and to be able to use that as our technology advances. So there's always a trade-off, I think, with respect to that.

COMMISSIONER PETERSON: But you don't know whether this is any serious problem among the plants you're dealing with.

MR. ROY: Not to my knowledge, no, sir.

CHAIRMAN KEMENY: May I suggest to the Commission that we might permit questioning of this witness to one more commissioner, and I believe Dr. Marks asked before.

COMMISSIONER MARKS: In the June 5th, 1979, press

A 2 1 conference that Babcock and Wilcox had, Mr. MacMillan said --  
2 and I quote -- "There will be extensive investigations to  
3 improve the man-machine interface," and then went on to say,  
4 "Operators will be better trained."

5           Could you specifically tell us what your role as  
6 manager of engineering is in this effort?

7           MR. ROY: Yes. That covers a broad spectrum of  
8 items which we're looking at. I would say that that as a  
9 lessons learned in an area in which we should focus atten-  
10 tion -- and I'm talking B&W and generically for our industry --  
11 would probably be second only to the operator qualification  
12 and training programs, of which you've really put them  
13 together, along with the man-machine interface, which we  
14 viewed in terms of instrumentation and control, hyphen,  
15 human engineering. And it has to be attacked, I think, on  
16 a fairly broad front, and we have done a number of things.

17           One in the deposition talked about the analyses of  
18 off-normal transients and accidents of the small break  
19 character, accompanied by other actions, equipment malfunctions,  
20 such as no auxiliary feedwater flow, with and without reactor  
21 coolant pumps, with the intent of providing guidelines to the  
22 operator for the management of small breaks in combination  
23 with complicating factors, such as no auxiliary feedwater  
24 flow, no pumps.

25           And one approach that we took to that, which I think

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1 has a message -- and we are expanding the program -- is to do  
2 that with realistic analyses or realistic, as we can make  
3 them, assumptions, using codes that we had benchmarked to the  
4 TMI-2 sequence, which was a complex sequence itself, so that  
5 we can confront the operator and develop our own understanding  
6 of what will confront the operator in realistic terms, what  
7 he actually might face, versus using the conservative and  
8 bounding analyses, which we do in terms of designing safety  
9 systems, conservative accumulation of conservatisms to give  
10 bounding type of analyses, recognize that in order to factor  
11 in more complex sequences than previously analyzed, and in  
12 order to develop an understanding of that transient as it  
13 will confront the operator, translate that analysis then  
14 into guidelines to help him manage that, I say is one item  
15 with respect to the man-machine interface.

16 Another is with respect to the instrumentation and  
17 controls area. We have developed a task description, which  
18 we've entitled Control Room Upgrade, to begin to look at  
19 what might be desirable improvements in what instrumentation  
20 is displayed to the operator, how it's displayed, where it's  
21 located, what additional instrumentation might be necessary,  
22 as an outgrowth of this abnormal transient guideline program  
23 which we have underway

24 Some immediate forms associated with the instrumen-  
25 tation and controls is we have provided expanded range for the

LA 4 1 temperature indicators on the primary loop, expand them beyond  
2 the 620 degrees Fahrenheit peg point, which existed at TMI-2.  
3 We have provided fuel change package for the computer so that  
4 he can call out a margin to saturation from his computer now.  
5 And I would include the saturation meter as an attempt now  
6 to assist the operator and hopefully provide him with  
7 additional information to help him diagnose and follow the  
8 course of an accident.

9 They would be elements of a broad category which we  
10 called instrumentation and control, hyphen, human engineering.  
11 The control room upgrade is part of that.

12 We also are looking at ways to assist in the  
13 simulation of the information. For example, alarm differen-  
14 tiation, large number of alarms in the control room confronting  
15 the operator now, we're looking at systems to differentiate,  
16 to remove the -- his direct attention as may be called to  
17 nuisance alarms and try to identify the critical alarms.  
18 And we hope to make some progress in that area. It's going  
19 to take some time.

20 Also with respect to systems status monitoring,  
21 we have a task description underway that we hope will be  
22 the formation -- form the basis for a program to provide  
23 information on the status of systems, such as the auxiliary  
24 feedwater supply and what position the block valves were in.

25 Also important with respect to that is the monitoring

LA 5

1 of systems which, if they are degraded or misaligned, even  
2 though they may not be safety systems, they are systems  
3 essential to safety, or means of helping the operator to  
4 better manage an abnormal transient, such as component cooling  
5 water supply, other systems which would assist him and whose  
6 status should be displayed to him, such that if that system  
7 is down, this one doesn't work, to get the interrelationship  
8 and interconnecting relationship of systems, through this  
9 status monitoring.

10 We have some work in that area under this broad  
11 category of I and C-human engineering. They're some of the  
12 elements that are underway now.

13 COMMISSIONER MARKS: How much of this has actually  
14 been transmitted to the training department already?

15 MR. ROY: Most of these items don't necessarily  
16 involve the training department with respect to, say, some  
17 of the instrumentation itself. It will ultimately, of course,  
18 as it made available to the operators. For example, our  
19 saturation meter prototype is now mounted on the simulator  
20 at Lynchburg, in Lynchburg. The abnormal guideline program  
21 is where we're probably going to pull together our closest  
22 connection with the training department. We've laid out a  
23 logic flow diagram for the approach to this development of  
24 guidelines: first, the identification of the sequences we  
25 want to analyze, event sequence trees; the identification then

LA 6 1 of the sequences that we believe are -- should be analyzed;  
2 the development of guidelines for the management of those.  
3 And at that point, the training department will be an integral  
4 part of the development of the operating guidelines for the  
5 management of it, from two standpoints: one, to assure that  
6 these guidelines can be properly transformed into operating  
7 procedures in the plant, and they bring that expertise, that  
8 knowledge; two, the identification of perhaps additional  
9 indicators that might need to be made available to the  
10 operator to help manage it. That would grow out of the  
11 considerations of these operating guidelines.

12 So in the logic flow for this guideline program,  
13 we have a very distinct block for a connection with the  
14 training department. And I think it's going to be very  
15 useful.

16 By the way, that was -- the model for this program  
17 will be the exercise we went through in the provision of  
18 guidelines for management of small breaks, which we did in  
19 response to the NRC requirements for additional analyses.  
20 We had, in one room as we were developing these, our analysts,  
21 such as the ECCS Analysis -- members of the ECCS Analysis  
22 Unit, we had operators from the various plants and super-  
23 visory personnel from the operating staff, we had a member of  
24 the NRC, we had our training department members, collectively  
25 working together to develop these guidelines, and a very



LA 7 1 useful exercise and will form the model for the continuation  
2 of that program.

3 COMMISSIONER MARKS: When did that occur?

4 MR. ROY: Mid-April, my guess right now.

5 COMMISSIONER MARKS: Thank you.

6 MR. ROY: Thank you, sir.

7 CHAIRMAN KEMENY: Thank you. The witness is  
8 excused.

9 Would chief counsel please call the next witness?

10 MR. GORINSON: Mr. MacMillan.

11 Whereupon,

12 JOHN H. MAC MILLAN

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

15 CHAIRMAN KEMENY: Could you please state your full  
16 name and your current position within B&W?

17 MR. MAC MILLAN: My name is John H. MacMillan. I'm  
18 the vice president of the Nuclear Power Generation Division  
19 of the Babcock and Wilcox Company.

20 CHAIRMAN KEMENY: Chief Counsel.

21 MR. GORINSON: Thank you, Mr. Chairman. Mr.  
22 MacMillan, would you briefly describe for us your duties as  
23 vice president of the Nuclear Power Generation Division at  
24 Babcock and Wilcox?

25 MR. MAC MILLAN: As vice president of the Nuclear

LA 8 1 Power Generation Division, I have the responsibility for the  
2 commercial nuclear business for the Babcock and Wilcox  
3 Company, including the design and development of nuclear  
4 steam systems and nuclear fuel to supply those systems, the  
5 engineering and contract management of those units, the  
6 manufacturing of that equipment or the procurement of the  
7 equipment that constitutes that scope of supply, the support  
8 of the utility in its start-up of the units and the continuing  
9 operation of those units after they go into service. And  
10 in that category, I would include the training -- that por-  
11 tion of the training program which B&W would provide for the  
12 licensed operators of the utility units.

13 MR. GORINSON: You are the chief policy making  
14 official of that division. Is that correct, sir?

15 MR. MAC MILLAN: Yes, sir.

16 MR. GORINSON: Do the various department heads in  
17 that division report to you?

18 MR. MAC MILLAN: Yes, sir.

19 MR. GORINSON: Does that include the Nuclear Service  
20 Department?

21 MR. MAC MILLAN: There is what we now call a  
22 Customer Service Department. Mr. Kosiba is manager of that  
23 department and he reports directly to me.

24 MR. GORINSON: That department was formerly called,  
25 through, Nuclear Services, was it not?

LA 9

1 MR. MAC MILLAN: Prior to the early part of 1979,  
2 there was a Nuclear Service Department, and that was combined  
3 with a Nuclear Parts Center, some in-service inspection  
4 functions, and made into a larger department, which is now  
5 called the Customer Service Department.

6 MR. GORINSON: And the Nuclear Service Department  
7 contained within it the training unit.

8 MR. MAC MILLAN: Yes, sir.

9 MR. GORINSON: Prior to March 28, 1979, about what  
10 percentage of your time, on a monthly basis, was devoted to  
11 issues related to the Nuclear Service Department?

12 MR. MAC MILLAN: I can't say that I've ever made  
13 an analysis of that. I'd have to give you a feeling. I  
14 would guess something in the range of 20, maybe as much as  
15 25 percent.

16 MR. GORINSON: Okay. Realizing that it's really a  
17 guesstimate, of that 20 or 25 percent, about how much of that  
18 time was devoted to training issues?

19 MR. MAC MILLAN: I'd say a rather limited portion of  
20 that time, a very few percentage points of my time were  
21 involved with concern over training issues.

22 MR. GORINSON: Did any issues concerning training  
23 come to your attention?

24 MR. MAC MILLAN: From time to time, there were  
25 issues of priority on training, business discussions related

1 to the training contracts that would be brought to my  
2 attention.

3 MR. GORINSON: When you say priorities on training,  
4 sir, what do you mean?

5 MR. MAC MILLAN: We have a simulator facility in  
6 Lynchburg and we have to schedule that facility to meet the  
7 requirements of our customers. And occasionally we get into  
8 a conflict between various customers as to who ought to have  
9 access to the computer -- or to the simulator. So there'd  
10 be some resolution of priority in that situation.

11 MR. GORINSON: Prior to March 28, 1979, had you  
12 ever had discussions about operator training with the  
13 utilities?

14 MR. MAC MILLAN: I have had, from time to time,  
15 discussions of operator training with some of our utility  
16 customers, yes.

17 MR. GORINSON: And what types of discussions would  
18 those be? What kind of issues would come up?

19 MR. MAC MILLAN: Generally, the discussions that I  
20 would be involved in would be related to the content of the  
21 program and our participation, what segment of that total  
22 training for operator would be provided by Babcock and Wilcox,  
23 and in some cases, the commercial conditions under which that  
24 training would be performed.

25 MR. GORINSON: Had you ever had similar discussions

LA 11

1 with the NRC prior to March 28, 1979?

2 MR. MAC MILLAN: No.

3 MR. GORINSON: Could you briefly state for us, as  
4 the chief policy making official for the Nuclear Power  
5 Generation Division, what were your goals for the training  
6 program?

7 MR. MAC MILLAN: Well, the training program, as is,  
8 I think, representative also of our total Customer Service  
9 Department function, is to serve our utility customers and  
10 provide for them the expertise which we have in our organi-  
11 zation in the support of, in the case of training, the train-  
12 ing of their operators who are candidates for operating  
13 licenses by the NRC, and, even in a broader way, the training  
14 of other personnel that will be associated with the management  
15 of and the maintenance of a nuclear plant. We have a broad  
16 spectrum of training programs available to the utilities.  
17 And we try to be responsive to their individual requirements  
18 in making these programs available to them.

19 MR. GORINSON: Had you articulated to the training  
20 department any sort of training philosophy that you wanted to  
21 see met?

22 MR. MAC MILLAN: I don't believe I've articulated  
23 any training policy or philosophy.

24 MR. GORINSON: Have there been any changes in your  
25 approach to the training department since March 28, 1979?

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LA 12 1 MR. MAC MILLAN: In the weeks following the March 28  
2 accident at Three Mile Island, we, within the first week,  
3 got together with the utilities that had units in service,  
4 also incorporating the Babcock and Wilcox nuclear steam  
5 supply system. And one of the things that we discussed with  
6 them in those discussions, one of the things that we offered  
7 to do for them, was supplementary training on our simulator,  
8 which we immediately modified to be able to fully simulate  
9 the conditions that took place at Three Mile Island. We  
10 offered to provide supplementary training. They could send  
11 their operators to Lynchburg, we would go through the  
12 sequence of events that occurred at Three Mile Island, we  
13 would look at some supplemental training related to loss of  
14 feedwater flow, related to stuck open pilot operated relief  
15 valves, and probably most important, in my opinion, the  
16 recognition of saturated conditions in the reactor coolant  
17 system, how do you recognize those, what are the symptoms,  
18 and what do you do to get recovery from those conditions,  
19 without consideration for how you might have gotten there in  
20 the first place.

21 So in the weeks immediately following March 28,  
22 there was an active program involved in the training organiza-  
23 tion to modify the simulator and offer this supplementary  
24 training to the operators of our other operating units.

25 In addition to that, I have had some discussions

LA 13

1 with Mr. Kosiba, who is the manager of the Customer Service  
2 Department, and have recommended to him that he conduct an  
3 assessment of our training programs, in light of the experience  
4 that we had at Three Mile Island, and reflecting the work that  
5 has been done since March 28, 1979, on more extended analyses  
6 of small breaks in the reactor coolant system, the estab-  
7 lishment of guidelines for our operating utilities to use  
8 as a basis for developing detailed operating procedures, to  
9 indicate to the operator the symptoms that he ought to be  
10 looking for in this type of situation and the corrective  
11 measures that he should take to recover from these situations  
12 if they develop.

13 I think what we're driving at here basically is  
14 a closer coupling between -- in the string of participants,  
15 between the designer, the training organization, and the  
16 operating organization.

17 MR. GORINSON: Okay. Let's turn to a different  
18 subject, Mr. MacMillan. Is it fair to say that relief valves  
19 have a history of failing to close securely?

20 MR. MAC MILLAN: Yes.

21 MR. GORINSON: And pilot operated relief valves have  
22 failed to open in Babcock and Wilcox plants prior to the  
23 TMI-2 incident. Is that correct?

24 MR. MAC MILLAN: I'm not sure I -- did you say,  
25 have failed to open?

LA 14 1 MR. GORINSON: Excuse me, have failed to close.

2 MR. MAC MILLAN: We have had other situations where  
3 pilot operated relief valves have stuck open, yes.

4 MR. GORINSON: Arkansas-1 is a Babcock and Wilcox  
5 plant, isn't it?

6 MR. MAC MILLAN: Arkansas Nuclear-1 is a B&W unit,  
7 yes.

8 MR. GORINSON: And a pilot operated relief valve  
9 failed to close at that plant in 1974. Is that correct?

10 MR. MAC MILLAN: I'm not aware of that incident.

11 MR. GORINSON: Okay, let's go on. How about  
12 Okony-3, is that a Babcock and Wilcox plant?

13 MR. MAC MILLAN: Yes. I'd like to, if I might,  
14 just say here in response, the word "Babcock and Wilcox  
15 plant" is pretty broadly used. I think we ought to put in  
16 the context that, in the total nuclear plant, such as Okony-3,  
17 the one you're mentioning, the Babcock and Wilcox scope of  
18 supply, which we call the nuclear steam system, represents  
19 approximately ten percent of the cost of the total plant,  
20 so that when you talk about a Babcock and Wilcox plant,  
21 that's a pretty broad title. That is a plant which  
22 incorporates the Babcock and Wilcox nuclear steam system.

23 MR. GORINSON: Is the pilot operated relief valve  
24 within your ten percent of the plant?

25 MR. MAC MILLAN: Yes, sir.



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MR. GORINSON: A pilot operated relief valve at Okony-3 failed to close in June 1975. Is that correct?

MR. MAC MILLAN: I know that we had an incident at Okony-3 where it failed to close. I don't know the date.

MR. GORINSON: When Babcock and Wilcox learned that it failed to close, what steps did it take?

MR. MAC MILLAN: In that situation, we dispatched engineers to the customer's site. We investigated the cause of the valve sticking open. We worked with the supplier of that valve, in that particular case, Dresser Industries. We, in conjunction with that supplier, recommended some modifications to the valve and recommended modifications of the maintenance procedures for maintaining that valve. Similar instructions were then transmitted to other units having the same Dresser pilot operated relief valve.

MR. GORINSON: Okay. Davis-Besse-1 has a Babcock and Wilcox nuclear steam supply system in it, does it not?

MR. MAC MILLAN: Yes, sir.

MR. GORINSON: And on September 24, 1977, a pilot operated relife valve failed to close there.

MR. MAC MILLAN: That's correct.

MR. GORINSON: What steps did Babcock and Wilcox take after learning about that incident?

MR. MAC MILLAN: In that situation, again we dispatched a team of engineers to the field to investigate the

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LA 16 1 cause of the stuck open relief valve. It was determined in  
2 that case that a relay had been left out of the electrical  
3 circuitry which controls that valve. The absence of that  
4 relay resulted in a rapid cycling of that relief valve when  
5 it reached a pressure at which it was designed to open.  
6 It cycled a number of times and then jammed in the open  
7 position. The electrical circuitry was modified to install  
8 the relay which should have been there in the first place.  
9 The valve was tested. We made some modifications in the  
10 valve to improve its reliability, tested the valve. We  
11 evaluated the effect of that transient that occurred, that  
12 stuck open valve, to determine whether or not there had  
13 been any damage to other components of the nuclear steam  
14 system which would preclude them from going back into  
15 operation. We determined that there had not been. We also  
16 had an assessment of the incident conducted by Mr. Kelly,  
17 who testified before this committee earlier in the week.

18 MR. GORINSON: Sir, a pilot operated relief valve  
19 stuck open at TMI-2 a year before this accident. Is that  
20 correct?

21 MR. MAC MILLAN: There was an incident at TMI-2  
22 about a year ahead, during the start-up testing program before  
23 the unit went into service, in which the valve stuck open,  
24 yes.

25 MR. GORINSON: What steps did Babcock and Wilcox

LA 17 1 take when it learned about that stuck open pilot operated  
2 relief valve?

3 MR. MAC MILLAN: I'm not sure that I can give you  
4 a detailed assessment of the steps that were taken in that  
5 particular case by Babcock and Wilcox.

6 MR. GORINSON: Did --

7 MR. MAC MILLAN: I was just asking for clarifica-  
8 tion here. I believe, as my memory serves me, that the  
9 modifications -- or investigation of that and the subsequent  
10 corrective measures were taken by Metropolitan Edison. And  
11 I simply don't know what our detailed involvement is. We  
12 can get that information for you, if it's important.

13 MR. GORINSON: Did anyone in your organization  
14 consider or make any recommendations, once there had been  
15 several failures of PORVs within a four- or five-year period?

16 MR. MAC MILLAN: I'm not aware of a broad recommen-  
17 dation of that sort. I have mentioned to you the corrective  
18 measures we took at Okony-3 and the steps that we took to  
19 notify other utilities incorporating that pilot operated  
20 valve in their units. I've indicated to you the steps that  
21 we took at Davis-Besse. In that particular case, that was  
22 a Crosby valve. It's the only unit in operation which  
23 incorporates the Crosby valve. And so the determination was  
24 made in that circumstance that it was not necessary to bring  
25 that to the attention of the other operating utilities.

LA 18 1 I'm not aware of anybody having, over a five-year  
2 period, looked at the total history of pilot operated relief  
3 valve performance and having made recommendations. I believe  
4 you asked earlier in the line of questioning whether this is --  
5 whether relief valves in general, of which pilot operated  
6 relief valves are a subset, whether relief valves in general  
7 are subject to a failure to completely reclose, having once  
8 lifted. And that is characteristic of relief valves. And  
9 it is, in fact, the reason why we incorporated in our design  
10 a block valve between the pilot operated relief valve and  
11 the pressurizer, so that in that event, where it failed to  
12 reseal, either sticking open or just simmering, that valve  
13 could be isolated.

14 MR. GORINSON: Since March 28, 1979, has there been  
15 anybody at Babcock and Wilcox looking at the question of  
16 pilot operated relief valves failures?

17 MR. MAC MILLAN: I don't think, again in the broad  
18 sense that you questioned, that we have had people looking  
19 at that aspect of it. In the earlier testimony this morning,  
20 the question was asked of Dr. Roy about the resetting of the  
21 pressure set points for the reactor scram and for the pilot  
22 operated relief valve, the objective of which was to reduce  
23 the frequency with which the relief valve would be challenged.  
24 And to that extent, there has been work done and incorporated  
25 in all the operating units to reduce that frequency.

LA 19

1 MR. GORINSON: Let's go back to that Davis-Besse  
2 transient for a moment. You attended a briefing about that  
3 transient a few days after the transient occurred. Is that  
4 correct?

5 MR. MAC MILLAN: I'm told that I was there. When  
6 reminded of that, I drew a blank. I don't specifically  
7 remember being in attendance at that briefing. I do  
8 remember, in the weeks following the Davis-Besse situation,  
9 being involved in discussions of the incident and particularly  
10 asking and being informed of the steps that had been taken  
11 on determination of the cause of the stuck open valve and  
12 the evaluation of the equipment in the nuclear steam system to  
13 see if it had been possibly damaged in that incident.

14 MR. GORINSON: In your discussions of the Davis-  
15 Besse transient at that time, were you told about the  
16 significant factors in that transient?

17 MR. MAC MILLAN: I would ask what you might -- what  
18 are you speaking of specifically, with respect to significant  
19 factors?

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1 MR. GORINSON: -- that there was a stuck open pilot  
2 operated relief valve. Did you talk about that?

3 MR. MAC MILLAN: That I knew, yes.

4 MR. GORINSON: Were you told that there was a loss  
5 of feedwater?

6 MR. MAC MILLAN: I believe that I was told that the  
7 initiating of that was either loss or partial loss of feed-  
8 water.

9 MR. GORINSON: Were you told that there had been a  
10 rising pressurizer level while the pressure was decreasing?

11 MR. MAC MILLAN: That I don't recall being -- my  
12 memory doesn't recall that.

13 MR. GORINSON: Were you told that the operator having  
14 -- relying on that rising pressure level had prematurely term-  
15 inated the high pressure injection?

16 MR. MAC MILLAN: I don't recall being told that  
17 either.

18 MR. GORINSON: Do you have up there in front of you,  
19 Mr. MacMillan, what have previously been marked as Hearing  
20 Exhibits 1 through 5?

21 MR. MAC MILLAN: Yes, sir. I do

22 MR. GORINSON: Taking them one at a time, Hearing  
23 Exhibit 1 is a November 1, 1977 memo from J. J. Kelly to  
24 Distribution. Had you seen that memo before March 28, 1979?

25 MR. MAC MILLAN: No.

1 MR. GORINSON: Hearing Exhibit 2 is a memo of  
2 November 10, 1977 from J. F. Waiters to J. J. Kelly. Had you  
3 seen that before March 28, 1979?

4 MR. MAC MILLAN: No.

5 MR. GORINSON: Exhibit 3 is a February 9, 1978  
6 memorandum from Bert M. Dunn to Jim Taylor. Had you seen that  
7 before March 28, 1979?

8 MR. MAC MILLAN: No.

9 MR. GORINSON: Exhibit 4 is a February 16th memoran-  
10 dum from Bert Dunn to Jim Taylor. Had you seen that before  
11 March 28, 1979?

12 MR. MAC MILLAN: No.

13 MR. GORINSON: And finally, Exhibit 5 is an August  
14 3rd, 1978 memorandum from D. F. Hallman to B. A. Karrasch.  
15 Had you seen that before March 28, 1979?

16 MR. MAC MILLAN: No.

17 MR. GORINSON: Had you discussed the subject of  
18 operator interference with the HPI prior to March 28, 1979?

19 MR. MAC MILLAN: I don't remember discussing that.  
20 Now, I have been told that I was a participant in some -- at  
21 least parttime in some meetings when that issue was discussed.  
22 But I don't recall that.

23 MR. GORINSON: And who were you told that by?

24 MR. MAC MILLAN: I was told that by our legal counsel,  
25 Byron Nelson.

1 MR. GORINSON: When did you first see these memoranda?

2 MR. MAC MILLAN: I believe two of these memoranda  
3 I saw about April, 1979, at the time when I was getting pre-  
4 pared to make testimony before the Advisory Committee on  
5 Reactor Safeguards.

6 MR. GORINSON: Which two memoranda were those, sir?

7 MR. MAC MILLAN: The memorandum identified as  
8 Hearing Exhibit No. 3 from Bert Dunn to Jim Taylor, dated  
9 February 9, 1979 and the memorandum identified as Hearing  
10 Exhibit No. 5 from Mr. Hallman to Mr. Karrasch dated August  
11 3rd, 1978.

12 The other three memoranda, Exhibits 1, 2 -- at least,  
13 Exhibits 1 and 2 were brought to my attention at the time I  
14 made depositions to the staff of the President's Commission  
15 and Exhibit No. 4, I am not sure that I have seen that specific  
16 memo previously. That may have been shown to me at the same  
17 time, but, if so, it would have been in the last month.

18 MR. GORINSON: So, the Dunn memorandum of February  
19 9, 1978 and the Hallman memorandum of August 3rd, 1978, Exhi-  
20 bits 3 and 5 were brought to your attention in April?

21 MR. MAC MILLAN: Yes, that is correct.

22 MR. GORINSON: And the circumstances that they were  
23 brought to your attention under was that you were preparing  
24 for testimony before the Advisory Committee on Reactor Safe-  
25 guards?



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1 MR. MAC MILLAN: That was the specific activity that  
2 was going on at the time, yes.

3 MR. GORINSON: And it was brought to your attention  
4 in connection with your preparation for that testimony?

5 MR. MAC MILLAN: Yes. I would say in connection  
6 with the total available body of information that we had to  
7 support that testimony, yes.

8 MR. GORINSON: Who brought those memoranda to your  
9 attention?

10 MR. MAC MILLAN: I believe they were brought to my  
11 attention by Mr. Allan Womack, who is Manager of our Plant  
12 Design Section in the engineering department.

13 MR. GORINSON: And did he give you any reason as to  
14 why these memoranda were important for your preparation for  
15 that testimony?

16 MR. MAC MILLAN: Well, he brought them to my atten-  
17 tion so that I would be aware that we had recommendations in  
18 -- within the Nuclear Power Generation Division concerning  
19 the potential for high pressure injection interruption prema-  
20 turely and that I would understand that the issue had developed  
21 into a technical difference of opinion or dispute between the  
22 engineering personnel and our service people relative to  
23 whether or not supplementary instruction and what the charac-  
24 ter of those should be, whether they should be sent to the  
25 customer. And that this had remained unresolved and that no

1 supplementary instructions had been issued to our customers  
2 prior to the March 28, 1979.

3 MR. GORINSON: And when they were brought to your  
4 attention, you read the memoranda. Is that correct?

5 MR. MAC MILLAN: Yes.

6 MR. GORINSON: And after you read the memoranda,  
7 did you feel you needed to talk to anyone further to understand  
8 more fully what the issues were that were being addressed in  
9 those documents?

10 MR. MAC MILLAN: There were some further discussions.  
11 My interest, I would have to say, was more that of trying to  
12 understand what disposition or resolution had occurred, rather  
13 than understanding the technical content of the document.

14 MR. GORINSON: And with whom did you have the further  
15 discussions?

16 MR. MAC MILLAN: I believe I discussed these with  
17 Dr. Roy. I believe I discussed these with Mr. Kosiba of the  
18 service organization.

19 MR. GORINSON: And was the substance of the discus-  
20 sion what actions had been taken with respect to those memor-  
21 anda?

22 MR. MAC MILLAN: Yes. I was interested to know  
23 what action had been taken or had not been taken.

24 MR. GORINSON: And what were you told?

25 MR. MAC MILLAN: I was told that the letter from

1 Mr. Dunn to Mr. Taylor had initiated some discussions; that  
2 culminated in the recommendation to issue supplementary in-  
3 structions; that the service people, when they reviewed those  
4 recommendations for supplementary instructions had some sub-  
5 stantial concern about whether those were, in fact, the in-  
6 structions that should be issued and that those concerns were  
7 raised by Mr. Hallman in his letter to Mr. Karrasch in August  
8 of 1978 and that those concerns remain unresolved and that  
9 supplementary instructions had not been issued prior to March  
10 28, 1979.

11 MR. GORINSON: Supplementary instructions to the  
12 Babcock & Wilcox customers?

13 MR. MAC MILLAN: Yes, sir.

14 MR. GORINSON: Now, sir, you held a press conference  
15 on June 5, 1979. Is that correct?

16 MR. MAC MILLAN: Yes, sir.

17 MR. GORINSON: What reasons did B&W have for arran-  
18 ging that press conference?

19 MR. MAC MILLAN: Well, I think that I ought to go  
20 back to the early days following the accident at Three Mile  
21 Island. At that time there was a great deal of press interest  
22 in the incident and in the actions that were being taken. We  
23 assessed what our position ought to be in that circumstance  
24 and concluded that our job was to support the utility in bring-  
25 ing the unit under control and in the recovery of that unit in

DO7 1 the longer term and that if there was to be a public release  
2 or a public statement that that ought to come from the opera-  
3 ting utility and not from Babcock & Wilcox.

4 Subsequent to that, the Nuclear Regulatory Commission  
5 requested that they be the spokesman with the press and the  
6 media relative to the actions and activities that were taking  
7 place at Three Mile Island and we honored that request.

8 We were under substantial pressure from the media  
9 to indicate to them our assessment of the situation and what  
10 we were doing at Three Mile Island. We thought that inappro-  
11 priate in the early weeks after the incident. However, we  
12 felt that there would come a time when it was appropriate for  
13 us, having had a chance to assess the events that had taken  
14 place at Three Mile Island, to come forward with a statement  
15 of the situation as we understood it and our evaluation of that  
16 accident and to give the media the opportunity to ask whatever  
17 questions they might have of B&W. So, it was in response to  
18 that continuing interest on the part of the media that we felt  
19 it was appropriate to hold the press conference.

20 MR. GORINSON: And was there a meeting amongst B&W  
21 personnel to reach a decision as to whether to hold a press  
22 conference or not?

23 MR. MAC MILLAN: Yes, sir.

24 MR. GORINSON: And where was that meeting held?

25 MR. MAC MILLAN: The meeting was held in the New

1 Orleans office of J. Ray McDermott.

2 MR. GORINSON: And who attended that meeting, if you  
3 recall?

4 MR. MAC MILLAN: To the best of my memory, the  
5 principal participants in that meeting were Mr. George Zipf,  
6 who is vice chairman of J. Ray McDermott and president and  
7 chief operating officer for Babcock & Wilcox; Mr. Walter  
8 Vannoy, who is the chief administrative office for the J. Ray  
9 McDermott Company, myself, Mr. Lewis N. Favret, who is the  
10 executive vice president of the Power Generation group of  
11 Babcock & Wilcox and my immediate boss. I believe Mr. Dupy  
12 was there, who was in charge of public relations for McDermott  
13 Corporation and I believe that Mr. Miracle, who works with  
14 Mr. Dupy, also attended.

15 MR. GORINSON: During that meeting was the issue of  
16 the Dunn memorandum of February 9, 1978, discussed?

17 MR. MAC MILLAN: It was not.

18 MR. GORINSON: The press conference was held at  
19 Lynchburg. Is that correct?

20 MR. MAC MILLAN: Yes, sir.

21 MR. GORINSON: And the press was given a press kit,  
22 during that briefing. Is that correct?

23 MR. MAC MILLAN: Yes.

24 MR. GORINSON: Was the Dunn memorandum of February 9,  
25 1978 a part of the press kit?

1 MR. MAC MILLAN: No.

2 MR. GORINSON: Was the Dunn memorandum discussed  
3 during the press conference?

4 MR. MAC MILLAN: No.

5 MR. GORINSON: Why not, sir?

6 MR. MAC MILLAN: We were -- in the press conference  
7 we were presenting to the media our assessment of the events  
8 that took place at Three Mile Island and identifying in that  
9 sequence of events what we felt were the significant factors  
10 in the Three Mile Island incident and our assessment of those  
11 factors and as it applied specifically to what happened at  
12 Three Mile Island on March 28 and in the weeks thereafter, the  
13 Dunn memorandum was not germane.

14 MR. GORINSON: By "not germane", do you mean it  
15 was irrelevant?

16 MR. MAC MILLAN: I think in the context of what the  
17 press conference was scheduled to accomplish, I would say "yes",  
18 irrelevant.

19 MR. GORINSON: Do you have a copy of that press  
20 conference transcript with you today?

21 MR. MAC MILLAN: Yes. I believe I do. Yes.

22 MR. GORINSON: Would you turn to page 32 of that  
23 press conference?

24 MR. MAC MILLAN: Yes.

25 MR. GORINSON: There beginning at line 8, you

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1 said the third significant factor was the inappropriate em-  
2 phasis by the operators on pressurizer level indication only.  
3 Is that correct?

4 MR. MAC MILLAN: That is correct.

5 MR. GORINSON: And on page 25 of the press confer-  
6 ence, starting on line 10, you said, the fourth significant  
7 event and probably the most important in the whole sequence  
8 was the decision on the basis of that information to cut back  
9 the high pressure injection pump. Is that correct?

10 MR. MAC MILLAN: Yes.

11 MR. GORINSON: You did know at the time you had that  
12 press conference that the Dunn memorandum had specifically  
13 identified the possibility that operators might err relying  
14 on a high pressurizer level and cut back on high pressure  
15 injection.

16 MR. MAC MILLAN: I was aware of the Dunn memorandum  
17 and its content, yes.

18 MR. GORINSON: And you knew that Dunn had identified  
19 the problem of premature termination of HPI?

20 MR. MAC MILLAN: Yes.

21 MR. GORINSON: And you knew he had identified it as  
22 a matter raising serious concern?

23 MR. MAC MILLAN: Yes.

24 MR. GORINSON: I have no further questions, Mr.  
25 Chairman.

1 CHAIRMAN KEMENY: Thank you, Chief Counsel.

2 Mr. MacMillan, I have read the transcript of your  
3 press conference a couple of times and I would like to try to  
4 reconstruct your thinking in your analysis in that press con-  
5 ference on the specific point Chief Counsel brought out; your  
6 identification of the throttling back of the high pressure  
7 injection system as being the most significant factor.

8 Incidentally, I am not questioning your statement  
9 that that was the most significant factor, but I believe in  
10 the press conference you said on more than one occasion that  
11 the operators had sufficient information available to realize  
12 they should not be doing this. I know that is not verbatim,  
13 but is that substantially correct?

14 MR. MAC MILLAN: Yes. The comments that I made at  
15 the press conference, we had identified six significant factors  
16 in that sequence and as counsel has just indicated the third and  
17 the fourth factors were attention to pressurizer level alone,  
18 and, secondly, on that basis, the premature shutoff of high  
19 pressure injection flow. Now, our preliminary assessment is  
20 that had that high pressure injection flow been left on and  
21 continue to pump water into the reactor coolant system that the  
22 pressure and the steam fraction in the system -- the pressure  
23 would not have decayed to the point where it did. The steam  
24 fraction would not have reached the level at which it reached  
25 causing the cavitation reactor coolant pumps and subsequent



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1 termination of their operation. So, the cutback on that high  
2 pressure injection flow we felt -- I feel and continue to  
3 feel -- was the most significant factor.

4 Now, specifically with respect to your question  
5 about the available information to the operator, there were  
6 procedures in the control room, emergency procedures, available  
7 to the operator which specifically indicate that high pressure  
8 injection flow should be left on until pressurizer level can  
9 be maintained stable and reactor coolant system pressure  
10 maintained above the set point for the high pressure injection  
11 pump, which is approximately 1,600 pounds per square inch.

12 That instruction and the cautionary note that is  
13 part of that emergency procedure was not followed by the opera-  
14 tor. In addition to that, to the best of my knowledge, in the  
15 training which he received, he had been coached in observing  
16 more than one variable in a situation of this sort and it is  
17 particularly true where the performance of the level and the  
18 pressure might have looked strange to him. It was something  
19 that he hadn't seen or had not been specifically trained in  
20 at the time when you should be looking for other sources of  
21 confirmatory information and there were other sources available  
22 to him. In fact, immediately adjacent to the pressurizer level  
23 are the reactor coolant system pressure indicators.

24 Knowing that those procedures were in existence in  
25 the control room and that, in fact, those procedures, had they

1 been followed, would have eliminated any concern expressed by  
2 Mr. Dunn in his memorandum, is the basis on which I felt that  
3 there was information available to the operator at the time of  
4 the incident, which would have allowed him to arrive at the  
5 conclusion that he should have kept the high pressure inject-  
6 ion flow on.

7 CHAIRMAN KEMENY: So, therefore, you feel that it  
8 was a transient in which the pressure became low and the  
9 operators instead of concentrating on the pressurizer should  
10 have been reading the pressure and temperature indications in  
11 the system and from that know that the high pressure injection  
12 system should be kept on.

13 MR. MAC MILLAN: I wouldn't say "instead of". I  
14 think I would say "in addition to".

15 CHAIRMAN KEMENY: In addition to. I accept that.  
16 Specifically here, presumably the concern is that  
17 without doing that there was a danger of a voiding of core and  
18 it should have been a major concern of the operators under  
19 these circumstances.

20 MR. MAC MILLAN: Yes. With the pressure having  
21 dropped to the range of 1,300 or 1,400 pounds per square inch,  
22 that is an abnormal condition and one which needs to be care-  
23 fully assessed.

24 CHAIRMAN KEMENY: When we took testimony from the  
25 operators at TMI-2, their response was that they were greatly

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1 worried about the system going solid. You know, that phrase  
2 in terms of the pressurizer being filled up with water and  
3 this was the reason why they throttled back. Do you feel that  
4 that is an incorrect consideration?

5 MR. MAC MILLAN: Well, I think that was not a valid  
6 consideration at a time when reactor coolant system pressure  
7 was in the 1,300 PSI or lower range. The concern about going  
8 solid in a pressurizer is a concern about the potential for  
9 high pressure conditions developing in the reactor coolant  
10 system. And we certainly at that time in the accident did not  
11 have a situation where high pressure in the reactor coolant  
12 system was a concern.

13 CHAIRMAN KEMENY: Therefore, in effect, you are  
14 speaking here about the major worry where there may be voiding  
15 of core and would be fair to say the operators were worrying  
16 about a relative minor thing of any damage that may occur be-  
17 cause of the system going solid.

18 MR. MAC MILLAN: I think that is a fair assessment,  
19 yes.

20 CHAIRMAN KEMENY: You stated that you felt the  
21 operators had sufficient instructions on this and that may be  
22 true, Mr. MacMillan; what I find very confusing is -- as I  
23 happen to agree with your analysis -- why that was not clear  
24 to your own customer service department. I call your attention  
25 to Hearing Exhibit No. 5.

1 MR. MAC MILLAN: I am sorry.

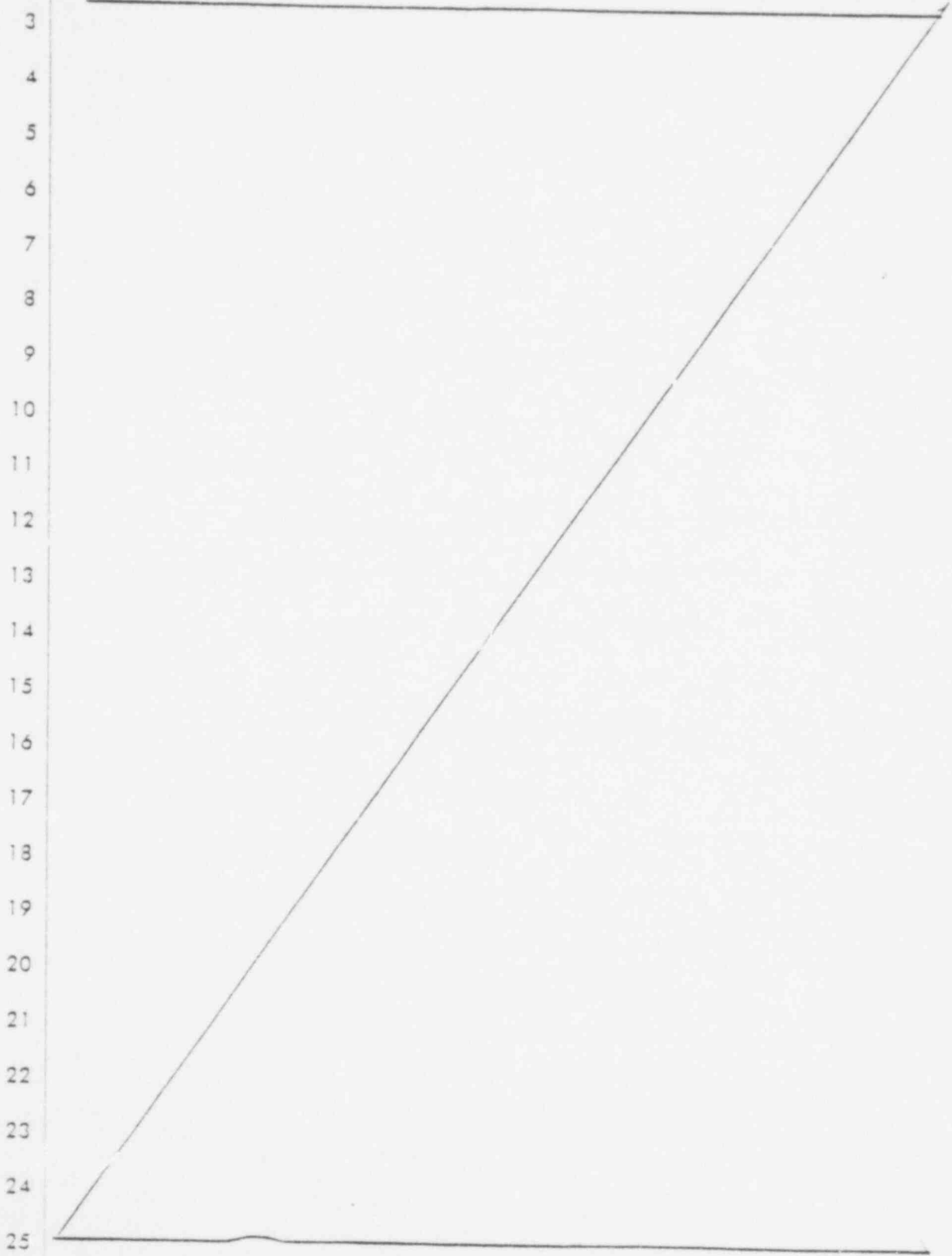
2 CHAIRMAN KEMENY: Hearing Exhibit No. 5.

3 I described precisely the conditions of that memoran-  
4 dum and Dr. Hallman, who is a nuclear engineering with a Ph.D.,  
5 given exactly those circumstances worries about the system  
6 going solid.

7 MR. MAC MILLAN: I think that the concern that was  
8 raised by the service department personnel was not specifically  
9 related to an accident condition in which you had a small  
10 break or a small LOCA in the reactor coolant system. I believe  
11 the concern that they had expressed was related to other kinds  
12 of transients or accident conditions such as a steam line break,  
13 where, in fact, the reactor coolant system was intact. And  
14 under those circumstances where you could also get high pres-  
15 sure injection flow in the absence of a leak in the reactor  
16 coolant system, I believe their concern was that might be a  
17 condition under which you could, in fact, have a condition of  
18 high pressure and a solid pressurizer. So, I believe that  
19 they were looking at the recommended supplementary instructions  
20 in the broadest context of other kinds of operating conditions  
21 in which the operator might find himself and were raising the  
22 concern about in those other conditions, not the small break  
23 condition, but in those other conditions, would these instruc-  
24 tions cause the operators to do something that would be detri-  
25 mental to the equipment. So, I believe that it is in that

1 broader sense that they had raised their concerns about the  
2 content of the supplementary instruction.

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1                   CHAIRMAN KEMENY:  However, Mr. MacMillan, we also  
2 heard testimony from B&W employees yesterday that in the early  
3 stages of an accident, it is not poss' . . . to tell which of  
4 two kinds of accidents you may be     , or it may be very diffi-  
5 cult to tell, and that was the purpose of the Dunn suggestion,  
6 that it is better to warn operators to keep the high pressure  
7 injection system on rather -- even if you take the dangers of  
8 some damage.

9                   MR. MACMILLAN:  Yes, I understand that, and I  
10 believe, beyond that, that is the reason why the operating  
11 emergency instruction for the small break in the reactor  
12 coolant system specifically has the precaution in it that you  
13 should continue the high pressure injection operation until  
14 you can maintain a stable pressurizer and reactor coolant  
15 system pressure above the trip point for actuation of high  
16 pressure injection of approximately 1,600.

17                   Those are two key operating parameters which should  
18 be monitored in an early stages of an accident before action  
19 is taken to cut back on high pressure injection.

20                   CHAIRMAN KEMENY:  Nevertheless, the fact is that  
21 Hearing Exhibit No. 5 specifically says that in response to a  
22 recommendation to instruct operators that once the high pres-  
23 sure injection system comes on, it should be kept on until  
24 roughly the conditions you have described occur, with which  
25 we agree.  And in the next to the last paragraph, there is

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1 indication that we have been warned. The reference suggests  
2 -- I quote: The reference suggests the possibility of uncover-  
3 ing the core if present HPI policy be continued.

4 In spite of those two factors in there, your Cus-  
5 tomer Service Department, one of the highly qualified experts,  
6 would not transmit those instructions until the dangers of  
7 going solid have been explained to him.

8 I am simply suggesting not that your analysis is  
9 wrong, but is it conceivable there may have been a somewhat  
10 oversimplified statement, if a person as qualified as Dr.  
11 Hallman, under these very specific circumstances, worries  
12 about the effects and doesn't quite understand what the  
13 effects would be of going solid, that perhaps the operators,  
14 in the heat of an accident, might have similar confusion in  
15 their minds?

16 MR. MACMILLAN: I guess I couldn't discount that  
17 possibility. I believe you have put your finger on an impor-  
18 tant factor, and that is that there was in fact a valid tech-  
19 nical dispute, if you will, between knowledgeable engineers  
20 in the Engineering Department and qualified technical people  
21 in the Service Department as to what the content of these  
22 instructions ought to be in order to accomplish the desired  
23 objective, and it took some time to get that resolved, much  
24 longer than I would like to have had us take in order to do  
25 that.

1           So I believe there was a valid basis for the techni-  
2 cal dispute, and it took -- as I say, took some time to  
3 resolve that.

4           CHAIRMAN KEMENY: Thank you. Governor Rabbitt?

5           COMMISSIONER BABBITT: Mr. MacMillan, are you  
6 familiar, generally, with the testimony that you gave to the  
7 Udall committee? I believe that was in May of this year.

8           MR. MACMILLAN: Yes, I am generally familiar with  
9 that.

10          COMMISSIONER BABBITT: Do you have a copy of that  
11 with you?

12          MR. MACMILLAN: No, sir, I don't.

13          COMMISSIONER BABBITT: Just generally, as I recall,  
14 you discussed before that committee the events surrounding  
15 the Davis-Besse transient and your response to it. Do you  
16 recall that?

17          MR. MACMILLAN: I remember that that was a point of  
18 discussion, yes.

19          COMMISSIONER BABBITT: Now, at that time you were,  
20 I believe from your previous testimony here, aware of the Dunn-  
21 Taylor memorandum of February 9 and the Hallman to Karrasch  
22 memorandum of August 3, 1978, is that correct?

23          MR. MACMILLAN: This is at the time of the Udall  
24 testimony?

25          COMMISSIONER BABBITT: Yes.



1 MR. MACMILLAN: Yes, sir.

2 COMMISSIONER BABBITT: Now, if I could turn your  
3 attention, and I will give you this copy, if you need it, of  
4 the Udall testimony, page 221, in response to a question about  
5 your response to the Davis-Besse transient, you gave this  
6 response: You said, "Mr. Chairman, the events that I have  
7 described as our response to Davis-Besse we felt were fully  
8 responsible for correcting that problem and assuring the  
9 probability of its occurring again was minimal."

10 Do you recall that testimony:

11 MR. MACMILLAN: Yes.

12 COMMISSIONER BABBITT: Do you honestly believe that  
13 testimony was truthful, in light of your knowledge of those  
14 memoranda?

15 MR. MACMILLAN: Well, let me respond in this way.  
16 The events that I had described at the Udall hearing in the  
17 previous pages of this testimony indicate the actions that  
18 were taken specifically with respect to the pilot-operated  
19 relief valve and the assessment of what had caused that valve  
20 to stick open, what modifications had been made in order to  
21 assure that that -- to reduce the probability of that happen-  
22 ing again, and the assessment about whether that was appli-  
23 cable to other operating units, which in this case we felt it  
24 was not because it was a Crosby valve, whereas all other  
25 operating units had Dresser valves; and in the assessment of

1 the condition of the equipment, whether or not it might have  
2 been damaged in that transient.

3 To that extent I felt -- and feel today -- that the  
4 actions that we took in that regard were responsible and  
5 reduced the probability of their having a stuck-open relief  
6 valve situation develop again at Davis-Besse.

7 COMMISSIONER BABBITT: Mr. MacMillan, calling your  
8 attention to the next paragraph of your testimony, in the  
9 second sentence, referring to the Okony incident and presum-  
10 ably to Davis-Besse, you say, you said at that time, "The  
11 actions that we took, the investigation we conducted, and the  
12 modifications in both the equipment and procedures were re-  
13 sponsive to the evidence that we had at the time about the  
14 reliability of that valve."

15 And you say that, "We had taken the appropriate  
16 action, not only at Okony but at the other units which incor-  
17 porated that valve." Now, doesn't that seem to suggest to the  
18 Udall committee that you had taken all the appropriate action?

19 MR. MACMILLAN: Well, let me qualify that comment.  
20 I can dig back in the testimony and try to find where we said  
21 this, but the procedures that I was referring to there,  
22 Governor, were the procedures for maintaining the pilot-  
23 operated relief valve. At the time of the Okony III occur-  
24 rence, we not only modified the valve itself in order to  
25 improve its reliability, but we also recommended to Duke and

1 our other units incorporating the Dresser pilot-operated valve  
2 modifications in their maintenance procedures for the periodic  
3 servicing of those valves, and those were the procedures that  
4 I was specifically referring to in that testimony.

5 COMMISSIONER BABBITT: Notwithstanding that you  
6 say, "The events that I described as our response to Davis-  
7 Besse..."? Well, I think I make my point.

8 One other question, Mr. MacMillan. In your pre-  
9 pared statement to the Udall committee, you refer to your  
10 objections to the regulatory approach of the NRC, referring  
11 to it as excess conservatism and unnecessary revisions.  
12 Could you just generally elucidate your philosophy of how the  
13 NRC regulates and how that would be better, how it could be  
14 better done, from your point of view?

15 MR. MACMILLAN: Well, let me make sure I understand  
16 or that we have clear between us the basis or the context of  
17 those comments. I believe those were directed to the consid-  
18 eration by the NRC of the continued operation of the other  
19 units incorporating Babcock & Wilcox nuclear steam systems.

20 Now, immediately after the Three Mile Island acci-  
21 dent, we went through a series of meetings and the issuance  
22 of a series of bulletins to our operating customers and pro-  
23 vided supplementary operator training that I mentioned earlier  
24 on our simulator, and with those instructions and with that  
25 supplementary training and with the precautions that we had

1 registered with our other operating units, I took the position  
2 and stated before the Nuclear Regulatory Commission, at the  
3 time they were deliberating on the continued operation on the  
4 other units, that it was my judgment that, having taken those  
5 corrective measures, that the nuclear plants could be operated  
6 safely and could continue in operation.

7 Now, the Regulatory Commission required other changes  
8 be made, and those are a matter of record, as they applied  
9 specifically to each of the units, involving reliability of  
10 auxiliary feedwater, changing the -- going to an automatic  
11 shutdown of the reactor on loss of feedwater flow or turbine  
12 trip, some additional analyses and that sort of thing.

13 We undertook those as recommended by the Regulatory  
14 Commission and have subsequently satisfied their requirements  
15 in that regard.

16 COMMISSIONER BABBITT: I was intending to invoke a  
17 broader response from you; that is, what would you advise  
18 this Commission with respect to ways in which the regulatory  
19 philosophy of the NRC could be changed to make it more satis-  
20 factory from your perspective?

21 MR. MACMILLAN: Well, that is an extremely broad  
22 charter, and I am not sure that I am really prepared to make  
23 that kind of an assessment or make specific recommendations  
24 in that regard.

25 We are involved on a broad scale in the industry,

1 under the joint sponsorship of both the Edison Electric Insti-  
2 tute and the Atomic Industrial Form in the assessment of the  
3 lessons learned from the Three Mile Island accident, and in  
4 the process of doing that, are looking at the appropriate  
5 interface and interaction between the licensees, the utilities,  
6 and their suppliers, which would include the nuclear steam  
7 supplier, and the Regulatory Commission, in events that may  
8 take place in the future of the industry.

9 I think that deliberative process needs to run its  
10 course before we make any substantial recommendations relative  
11 to how the regulatory process might be modified. I just don't  
12 feel that I am prepared at this point to come forward with  
13 those kinds of recommendations.

14 COMMISSIONER BABBITT: Would you be willing to  
15 submit something to that effect in writing?

16 MR. MACMILLAN: Yes, sir.

17 CHAIRMAN KEMENY: Commissioner Lewis?

18 COMMISSIONER LEWIS: Mr. MacMillan, would you char-  
19 acterize for us the impact of media coverage of the TMI II  
20 incident on Babcock & Wilcox. What has it done to you in  
21 terms, as a company?

22 MR. MACMILLAN: Well, that's a very broad question.  
23 I think --

24 COMMISSIONER LEWIS: Is it affecting you in terms  
25 of finances?

1 MR. MACMILLAN: Let me -- maybe I could answer that  
2 question in several parts.

3 COMMISSIONER LEWIS: Okay.

4 MR. MACMILLAN: In the early days and weeks follow-  
5 ing March 28, 1979, we were under very heavy pressure from  
6 many media source. to speak out and indicate our assessment  
7 of the situation, what was done, whether we thought things  
8 were right or wrong. Those were very difficult times for me,  
9 personally, and for employees of the company who felt that  
10 there were misrepresentations, there were errors in fact that  
11 were being published and transmitted by the media, and yet  
12 we felt that it was appropriate for us in that circumstance  
13 to -- the word has been used, "stonewall it" with the media.

14 It retrospect, I think that was the appropriate and  
15 the proper action for our company under those circumstances.  
16 And so, in a very personal sense, that was a time when it was  
17 a very difficult and very frustrating experience for me and  
18 for the employees of the company who were working their hearts  
19 out, conscientiously, to bring the situation under control  
20 and to take those actions which would assure the long-term  
21 recovery of that unit.

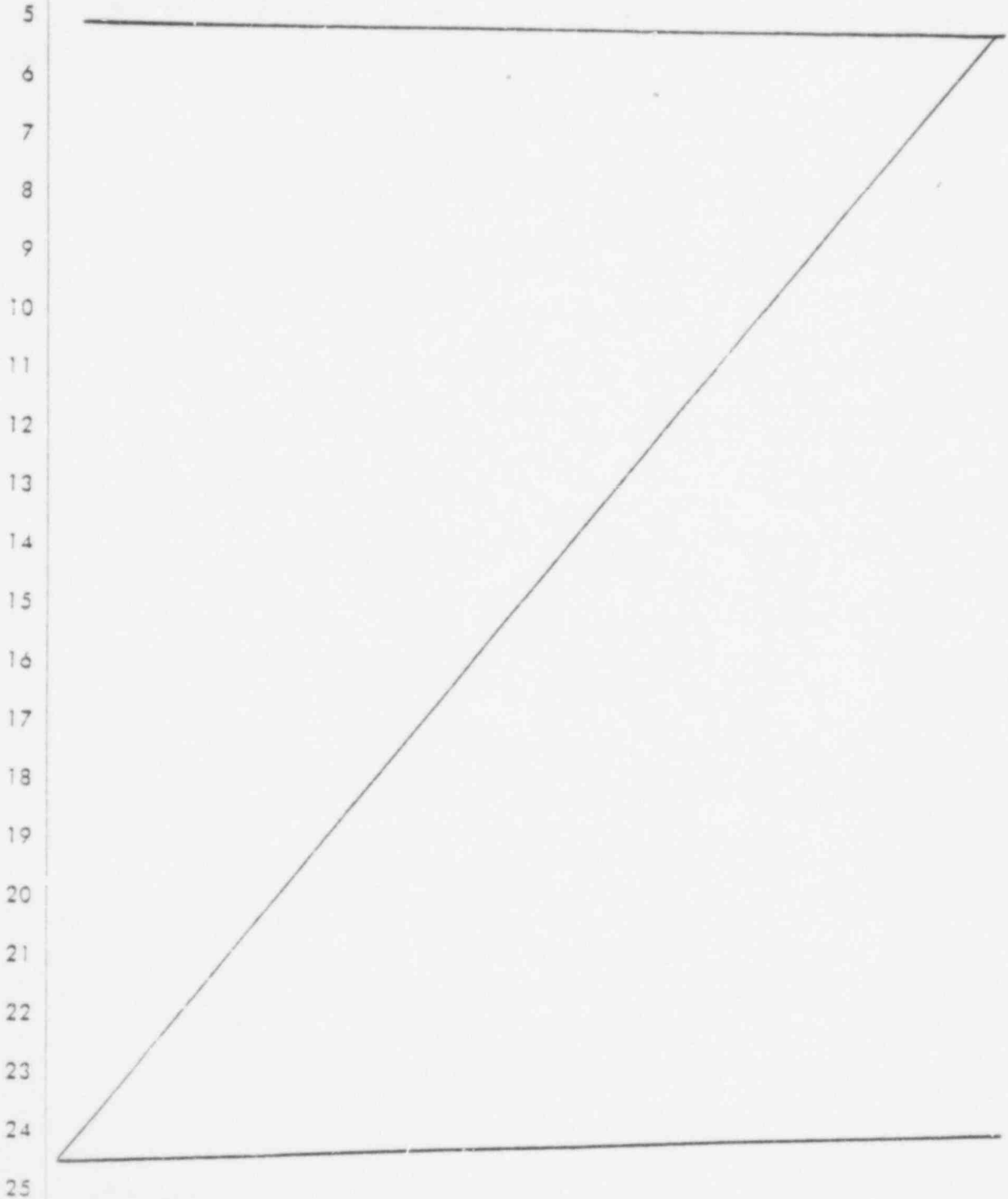
22 COMMISSIONER LEWIS: Mr. MacMillan, may I just inter-  
23 rrupt you because I would like to pursue that one point.

24 MR. MACMILLAN: Yes.

25 COMMISSIONER LEWIS: You say that you were

1 consciously willing to allow misinformation to be spread  
2 abroad by the media, that you felt that it was not your role  
3 at that time to correct what you perceived to be misinforma-  
4 tion. Am I correct in interpreting you that way?

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1 MR. MAC MILLAN: What I said was we had elected not  
2 to be responsive to the inquiries of the press on a broad  
3 scale, and in the process of doing that, recognize that there  
4 were errors that were being reported and that because of the  
5 policy we had decided to adopt, we were not in a position  
6 to set the record straight.

7 COMMISSIONER LEWIS: You didn't consider it extremely  
8 important that the public get the right information at that  
9 time.

10 MR. MAC MILLAN: We had, as I said, decided that it  
11 was important for us to support the utility, that statements  
12 to the press should come from the utility as a licensee,  
13 and subsequent to that, at the request of the NRC, should  
14 come from the NRC. And I would have to say to you I don't  
15 think it would have been appropriate for us or helpful for  
16 the general public if we had come forward and had conducted  
17 a public debate of the pros and cons or the issues associated  
18 with Three Mile Island.

19 COMMISSIONER LEWIS: Would you tell me what speci-  
20 fically, in terms of your knowledge then, was misinformation?

21 MR. MAC MILLAN: Well, that covers again a very  
22 broad scale.

23 COMMISSIONER LEWIS: Give us some examples.

24 MR. MAC MILLAN: I can give you a few examples. I  
25 can remember watching the television one evening and having



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1 an interview shown on television. There was a man who lived  
2 near the site who said he knew that something was wrong on  
3 the site. He could taste that metallic radiation. Now,  
4 that isn't responsible news coverage. That is not presenting  
5 the facts to the general public. The entire issue of the  
6 gas bubble and the hydrogen -- potential for hydrogen  
7 explosion, I think not entirely because of the media in this  
8 case, but by the combination of media and other news sources,  
9 I believe presented a very distorted and incorrect represen-  
10 tation of the situation. It was, one, a very serious and  
11 one, a somewhat frivolous, but still indicative of the kinds  
12 of concerns that we felt, as responsible people in the  
13 operation.

14 COMMISSIONER LEWIS: The reason I'm pursuing this,  
15 Mr. MacMillan, is that a lot of reporters did try to get  
16 to your company to get more information. The reporters  
17 themselves were very confused, as was the public. And yet  
18 you say that you very consciously decided that even though  
19 all these things were being said that you knew were wrong,  
20 you were not going to try to correct it. How do you per-  
21 ceive your responsibility in a situation like that to  
22 clarify, to give the correct information to the public?  
23 Isn't that high up on your list of priorities?

24 MR. MAC MILLAN: I think it's important that the  
25 public be given correct information. I think in the situation

LA 3 1 at Three Mile Island that the appropriate source of that  
2 information was either the utility or subsequently the NRC.

3 COMMISSIONER LEWIS: And if they are wrong, you  
4 didn't feel you had a responsibility to correct them?

5 MR. MAC MILLAN: Well, I think you would recognize  
6 that there is no way for John MacMillan to address the press  
7 on a very specific issue of narrow -- a specific and narrow  
8 issue of incorrect information. When you get involved in  
9 the interface and relationship with the press, you cannot  
10 circumscribe effectively the content of the press inquiry.  
11 And we felt that, in that circumstance, the sources of  
12 information should, as I said, be the utility and the NRC.  
13 Now, we did feel compelled, as I indicated earlier, to, in  
14 the long term, after the situation had had a chance to be  
15 evaluated, to come forward and indicate our assessment of  
16 the situation and give the media at that time a full and open  
17 opportunity to ask whatever questions they might have on  
18 any aspect of the incident or its impact on B&W.

19 COMMISSIONER LEWIS: You're speaking about the  
20 June 5th news conference.

21 MR. MAC MILLAN: Yes, ma'am.

22 COMMISSIONER LEWIS: Well, let's get to the June 5th  
23 news conference. You didn't really offer the information that  
24 you were aware of the Dunn memorandum. Am I correct?

25 MR. MAC MILLAN: That's correct. We did not

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1 volunteer that information at the press conference.

2 COMMISSIONER LEWIS: How would you characterize  
3 that withholding of information, in hindsight, now that it's  
4 out in the open and we all know there is a Dunn memorandum?

5 MR. MAC MILLAN: I think I said earlier that the  
6 objective of the press conference that we had set, and I  
7 think we had announced equally to the press, was to review  
8 the events that took place at Three Mile Island and our  
9 assessment of those events. That is what we did at the  
10 June 5th press conference, and revealed the series of cir-  
11 cumstances that took place there and our assessment of what  
12 we thought were the most significant of those circumstances.  
13 And I believe in the context of that objective, as I think  
14 I said earlier, the Dunn memoranda was irrelevant.

15 COMMISSIONER LEWIS: Let's speak frankly about it.  
16 Your purpose really was to put B&W in the best light possible,  
17 which is normally the way a corporation operates when it calls  
18 a news conference. All right?

19 MR. MAC MILLAN: I wouldn't object to that.  
20 Obviously that's one of the reasons to have a news conference,  
21 yes.

22 COMMISSIONER LEWIS: All right, fine. And had you  
23 revealed the fact that several engineers inside your company  
24 had forewarned that this kind of thing could have happened,  
25 it would not have put your company in the best of lights.

LA 5 1 I'm not blaming you for it. It's just a fact of life. Is  
2 that correct?

3 MR. MAC MILLAN: Well, that, I think, is the  
4 conclusion you have stated. I don't -- again, I think within  
5 the context of what we had set as the objective of that  
6 press conference, that we did, in fact, report the conditions  
7 that took place. And, again, I'll repeat, in recognition of  
8 the fact that there were emergency procedures in force in  
9 the control room and information available to the operators,  
10 which, had it been followed, would have eliminated any  
11 concern of the type raised in the Dunn memorandum or raised  
12 in the Michelson report, which was discussed at the press  
13 conference, those concerns would not have been a valid  
14 concern.

15 COMMISSIONER LEWIS: So you're really dismissing  
16 the validity of the Dunn memorandum. You didn't really think  
17 that was particularly important.

18 MR. MAC MILLAN: I think what I said was it was  
19 not germane or relevant to the purposes of and the information  
20 that we were presenting at the press conference.

21 COMMISSIONER LEWIS: All right, Mr. MacMillan, may  
22 I just move on to something else? How do you see the purpose  
23 of your job? What is the chief priority of a man in your  
24 position?

25 MR. MAC MILLAN: Well, I guess I would state that

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1 in the following way. The purpose of the Nuclear Power  
2 Generation Division is to supply our customers, in this case,  
3 the utilities, with nuclear steam system equipment and the  
4 fuel and the services that go with that equipment, in order  
5 to allow them to generate safe, clean, economical power for  
6 their consumers, and that in the process of doing that, to  
7 generate a profit and a return on the investment of the  
8 stockholders in the company and to provide opportunity for  
9 our employees to use their skills and capabilities in a  
10 meaningful way to the betterment of our society.

11 COMMISSIONER LEWIS: So, in effect, as the man at  
12 the top, you set the tone, the priorities for those branches  
13 of your division that operate below you. Am I correct in  
14 saying that?

15 MR. MAC MILLAN: I accept that full responsibility,  
16 yes.

17 COMMISSIONER LEWIS: Okay. Would it be fair to  
18 say that, given your sense that your first job is to make a  
19 profit -- and nobody's criticizing that, we understand that's  
20 the purpose of it -- you would be more concerned with the  
21 availability than with safety?

22 MR. MAC MILLAN: Absolutely not. Safety is a primary  
23 concern in the nuclear business and in specifically the business  
24 of the Nuclear Power Generation Division of Babcock and Wilcox.  
25 We have integrated the concern for safety directly with the

LA 7 1 design. The individual engineer doing his design work must  
2 be fully aware and cognizant and sensitive to the safety of  
3 the equipment that he is designing. And there is no separa-  
4 tion of design and safety. They are integral. And the  
5 safety of the equipment that we supply is paramount, and we  
6 generate -- I personally try to set a climate, establish an  
7 environment within our division, not only in terms of our  
8 internal relations, but in our external relations with our  
9 customer, of an open environment, encouraging engineers who  
10 have safety concerns to register those, to express those, to  
11 have them addressed, and have them resolved. And so to state  
12 or insinuate that we would sacrifice safety in the interest  
13 of profit is entirely incorrect.

14 COMMISSIONER LEWIS: Well, I understand that you're  
15 making that statement now, Mr. MacMillan. But, you see, here  
16 we have evidence of Mr. Kelly and Mr. Dunn writing a series  
17 of memos 18 months before Three Mile Island. They were  
18 setting up a red flag and saying here is something that is  
19 dangerous, that had Davis-Besse been at full power, this  
20 could have been a very, very serious thing. And nothing  
21 happened. Your own people say these memoranda fell into the  
22 crack. Is this a fluke, or does it indicate that in the  
23 way the system works, the concern was more to, you know,  
24 let's get the equipment going, let's sell more equipment,  
25 rather than exercising concern over those memoranda and the

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1 implications of those memoranda.

2 MR. MAC MILLAN: Well, let me state very directly  
3 and candidly, I think it's regrettable that more timely  
4 resolution of what I consider to be a valid technical  
5 difference or dispute between the parties you've talked with  
6 in these hearings, I think it's regrettable that wasn't  
7 resolved much more quickly and escalated to a conclusion and  
8 the appropriate action taken.

9 I believe that the events that took place do  
10 indicate the opportunity within the organization for engineers  
11 who have a safety concern to raise those, to bring them to  
12 the attention of our licensing and safety people, and to  
13 have action taken, which they felt had been taken. And there  
14 were omissions in communication. There were assumptions  
15 made that had no basis for being made, as to whether or not  
16 the problem had been resolved. There was a lot of time  
17 consumed in getting that issue resolved. I would have to  
18 say that I believe that one reason that this particular  
19 problem was not felt to be as urgent or pressing as in  
20 hindsight it might appear to be is that there were existing  
21 recommended operating procedures and emergency procedures  
22 which covered this concern. And so it wasn't a case of no  
23 information being available in the field. It was a case of  
24 the recommendation that we reinforce those. I think that's  
25 entirely regrettable.

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1 I don't believe that there is evidence to indicate  
2 that the reason that this issue was not brought to a timely  
3 resolution is because we were busy off selling additional  
4 equipment. I believe there were genuine misunderstandings.  
5 There were genuine gaps in communications. And I'm concerned  
6 about that. I'm not proud of that performance on the part  
7 of our organization. I've made that clear to my managers.  
8 And you heard Dr. Roy earlier discuss some of the things that  
9 he's doing to try to sharpen up our business operations in  
10 that area.

11 COMMISSIONER LEWIS: Thank you.

12 CHAIRMAN KEMENY: Professor Pigford.

13 COMMISSIONER PIGFORD: Mr. MacMillan, do you recall  
14 on the date March 30, the information that was given out  
15 from the Nuclear Regulatory Commission concerning the  
16 existence of a hydrogen bubble that was growing in oxygen  
17 concentration and would become possibly explosive?

18 MR. MAC MILLAN: I have a general recollection of  
19 that, yes. My time frame in the Three Mile Island accident  
20 sequence has some milestones in it. I would happen to be in  
21 Florida at the time the incident took place. I arrived,  
22 after some difficulty, in the office on Friday morning,  
23 March 30th. I left at 8:00 on Monday morning, April 2nd, to  
24 go to the site and spend the next six weeks there. So I  
25 have some time segments that I remember. And I do recall,



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1 in the time frame from Friday, March 30th, through about  
 2 Sunday, April 1st, that concern being expressed about the  
 3 noncondensable gas bubble, the hydrogen content of that  
 4 bubble, and the concern raised by the NRC of the possible  
 5 presence of oxygen, and therefore a concern of either  
 6 combustion or detonation.

7           COMMISSIONER PIGFORD: Then my question will refer  
 8 either to your own personal knowledge at the time or the  
 9 knowledge of the people or organization that you developed  
 10 since then. And we've learned from your response to the  
 11 Udall committee that a Mr. Nitty, who works for Mr. Roy, had,  
 12 in fact, supplied, both to Met. Ed. and to NRC, data that  
 13 showed that, in fact, that bubble was not explosive or about  
 14 to become explosive. And it appears now at that was, in  
 15 fact, the correct information. Then, given that, that this  
 16 information had been supplied by the person in your organi-  
 17 zation and it was in contradiction to what was being given  
 18 apparently to the public, did anyone in your organization  
 19 attempt to correct that information, that incorrect infor-  
 20 mation, that had come from NRC?

21           MR. MAC MILLAN: Let me tell you, from my personal  
 22 recollection, Professor Pigford, I had several discussions  
 23 with Don Nitty regarding the hydrogen bubble and the potential  
 24 for oxygen present in the reactor vessel. And Don Nitti was  
 25 very strong in his conviction that the excess hydrogen level

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LA 11 1 and in the presence of the intense gamma field in that reactor  
2 vessel, there just was no opportunity for any significant  
3 oxygen to be in the reactor vessel and therefore no need to  
4 be concerned about the potential inflammability or explosion  
5 within the reactor vessel.

6 I was -- I overheard, let's say. I was not a party,  
7 but I did overhear a discussion by telephone between our  
8 technical people and the Nuclear Regulatory Commission per-  
9 sonnel, in which that point was made very forcefully. And  
10 I think there has been reported to me on occasions subsequent  
11 to that additional discussions, where we endeavored to bring  
12 that conclusion to the -- and the supporting evidence to the  
13 attention of the Nuclear Regulatory Commission, in subse-  
14 quent days, as they gathered more information from other  
15 sources. And I believe Roger Matson has subsequently testi-  
16 fied when he asked different questions, he then got answers  
17 which agreed with the early position taken by Don Nitti,  
18 that within the reactor vessel, there could not be suffi-  
19 cient oxygen to be of any concern as far as explosive.

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1 COMMISSIONER PIGFORD: I am speaking of March 30  
2 when the tension was rising and the NRC was making it known  
3 they were greatly concerned about this explosiveness. Now, yes,  
4 the record shows now that Mr. Nitti did indeed communicate his  
5 results to Mr. Novak in NRC, but my point is, when it was  
6 learned that the NRC view of it was being given to the public,  
7 was there any attempt by B&W or, to your knowledge, Metropolitan  
8 Edison to give the facts as you knew them on that day, March  
9 30?

10 MR. MAC MILLAN: As far as I know, there was no  
11 attempt by Babcock & Wilcox to make any public statement or  
12 make any corrective statement to the public. I simply don't  
13 know whether Metropolitan Edison made an effort or not.

14 COMMISSIONER PIGFORD: And the following day, apparently,  
15 as you say, it began to get resolved by NRC having then reassessed  
16 the information.

17 MR. MAC MILLAN: My timeframe is not entirely clear  
18 there, but it was in the period, certainly in the week follow  
19 March 30. I have forgotten exactly -- it seems to me that was  
20 still kind of an open issue at the time that I arrived at the  
21 site on Monday, and it wasn't until along about Tuesday or  
22 Wednesday when the -- I believe the press release that was  
23 issued by the Regulatory Commission read to the effect that  
24 "There is an emerging technical consensus that the problem was  
25 overstated by the Commission."

1 COMMISSIONER PIGFORD: Now, Did Mr. Denton of the  
2 Nuclear Regulatory Commission request that B&W send someone  
3 to the site to help GPU in carrying out the operation?

4 MR. MAC MILLAN: As far as I know, he did not make  
5 that request. I know he did not make that request to me, and  
6 as far as I know, he did not make that request to others. We  
7 were requested by our customer, Metropolitan Edison and GPU,  
8 to bring people to the site to help support that operation, and  
9 in fact it was in response to a four o'clock in the morning  
10 Sunday -- excuse me -- Monday morning phone call that I and  
11 two others immediately were dispatched to the site in order to  
12 head up a team of people at Three Mile Island to support on  
13 the scene the efforts of the utility.

14 COMMISSIONER PIGFORD: Do you happen to know if the  
15 utility made that request to you as a result of a request to  
16 them by the Nuclear Regulatory Commission?

17 MR. MAC MILLAN: I don't know that.

18 CHAIRMAN KEMENY: Mr. Taylor?

19 COMMISSIONER TAYLOR: Mr. MacMillan, do you have a  
20 copy of the transcript of your June 5 press conference?

21 MR. MAC MILLAN: Yes, sir.

22 COMMISSIONER TAYLOR: Would you turn to page 37,  
23 please?

24 MR. MAC MILLAN: Yes.

25 COMMISSIONER TAYLOR: I would like to read the second

1 paragraph there. It says: "Of course, we don't know what the  
2 condition of the reactor core is. Currently the evidence is  
3 that the temperature of the cladding got very hot." And I  
4 would like to focus on the next sentence: "The same evidence  
5 indicates that the uranium oxide fuel itself did not melt, and  
6 so that we don't know precisely what the configuration is, but  
7 the evidence indicates there was significant core damage during  
8 the process of this event, although no melting of the uranium  
9 fuel."

10  
11 Now, I presume that the reason you made that state-  
12 ment at the press conference was because you believed, or believe  
13 now, that the difference between a situation where the fuel  
14 melted and didn't melt is important. Is that correct?

15 MR. MAC MILLAN: Well, I think that the reason the  
16 statement was made was because there had been some speculation  
17 as to whether or not there had been fuel melting, and I felt  
18 that we, at least on the basis of the evidence that we had at  
19 that time, which Dr. Roy reviewed with you earlier as to the  
20 fission product content of the reactor coolant system, reactor  
21 coolant samples, that there was no evidence of uranium oxide  
22 core melting.

23 There is clear evidence that the cladding got to a  
24 very hot temperature and oxidized substantially, may even have  
25 melted in some cases.

COMMISSIONER TAYLOR: So is it correct then that the

1 basis for your statement was the data on which it was based  
 2 then was the measurements of the concentrations of samples of  
 3 various fission products in the core cooling water?

4 MR. MAC MILLAN: Yes, sir.

5 COMMISSIONER TAYLOR: That was the basis for saying,  
 6 "We have no evidence for the melting of the fuel."

7 MR. MAC MILLAN: You probably know a good deal more  
 8 about this kind of thing than I do. I am told by our radio-  
 9 chemistry people that the content of the fission products in  
 10 the reactor coolant system and the relationship between various  
 11 isotopes of some of those fission products can give indication  
 12 as to whether those fission products were released from the  
 13 gap between the pellet and the cladding, or whether they may  
 14 have diffused and migrated through a very high temperature liquid  
 15 or molten fuel, and that by the relative concentrations of  
 16 those you can get a rough assessment as to whether or not the  
 17 temperatures of the fuel had approached or exceeded the melting  
 18 point.

19 COMMISSIONER TAYLOR: Is it your understanding that  
 20 there is a sharp change as one goes up to the temperature at  
 21 which the fuel actually melts, changes its state -- that there  
 22 is a sharp change in going from solid to liquid in terms of the  
 23 transport of these materials out of the fuel?

24 MR. MAC MILLAN: You have already exceeded by technical  
 25 knowledge in this area, but if that is an important concern I

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1 can get an answer to that question.

2 COMMISSIONER TAYLOR: Well, that is something that  
3 we in the Commission are trying to get pinned down. Now, I  
4 would like to go a little bit further in the basis on which  
5 you apparently quite confidently -- or certainly, as it reads --  
6 were positively saying, "There was no melting of the fuel,"  
7 were there any calculations that you were aware of, whether  
8 at B&W or anywhere else, that suggested that there was melting  
9 of the fuel? Were you aware of any such calculations?

10 MR. MAC MILLAN: I am not aware of any such calcula-  
11 tions.

12 COMMISSIONER TAYLOR: And you are not aware of any  
13 today, is that correct?

14 MR. MAC MILLAN: That is correct.

15 COMMISSIONER TAYLOR: Are you aware of the existence  
16 of a combination of zirconium oxide and uranium eutectic which  
17 melts at about 3,500 degrees Fahrenheit? I mean does that  
18 phrase, "eutectic" and the sense that it does melt at lower  
19 temperatures ring any bell?

20 MR. MAC MILLAN: I think that the first time I recall  
21 hearing about that was when I believe you raised that question  
22 earlier in some of the hearings here with the Nuclear Regulatory  
23 Commission. Prior to that, I was not aware of it.

24 COMMISSIONER TAYLOR: Do you happen to know whether  
25 there are any people in your organization that are examining

1 the consequences of the existence of that utectic, in terms of  
2 the nature as well as the extent of the core damage? Do you  
3 know whether that is being looked at now at B&W, in other  
4 words?

5 MR. MAC MILLAN: I don't know that.

6 COMMISSIONER TAYLOR: This may sound like a question  
7 in semantics, but I am interested in your answer to the following  
8 question: Suppose it developed -- I might say as indicated in  
9 a preliminary way by the only calculations that I have seen of  
10 what happened to the core -- suppose it turned out that substan-  
11 tial quantities of this utectic formed -- remember, it is a  
12 combination of zirconium oxide and uranium oxide in the fuel --  
13 in a melted form, and by substantial quantities, let's say  
14 more than a ton of uranium oxide -- suppose that that had  
15 become involved in this process and had melted?

16 How would you answer the question then "Did any of  
17 the fuel melt?" Would you answer it yes or no?

18 MR. MAC MILLAN: I guess in the broadest sense, I  
19 would have to say if in fact that happened, that a utectic in  
20 large quantity was formed, that that could be interpreted as  
21 a melt in the broadest sense; but it should be made very clear,  
22 I think, that that does not necessarily indicate that the fuel  
23 temperatures approached the melting point of uranium oxide by  
24 itself.

25 COMMISSIONER TAYLOR: Well, suppose that there were



7  
1 indications from calculations and eventually some kind of  
2 measurement that in fact the fuel did approach the melting  
3 point of uranium oxide, and also formed a large quantity -- by  
4 large, I mean tons or more -- of this melted utectic; would  
5 that change your view in some qualitative way of what you would  
6 then say about the nature and extent of the core damage and  
7 the danger to the public at the time when that liquid material  
8 and those high temperatures were reached, presumably, on March 28?

9 MR. MAC MILLAN: Well, I was, as I say, not on the  
10 scene on March 28. I believe that the considerations and the  
11 deliberations that were taking place at that time, as I under-  
12 stand them and as they have been told to me since that time,  
13 would not have been significantly different had the conclusion  
14 been that there might have been a utectic formed in some sub-  
15 stantial quantity.

16 The main thrust of the operations at that time and  
17 in the week subsequent to that were directed toward establishing  
18 a stable cooling condition for the reactor core and being sure  
19 that in consideration of other contingencies that might develop  
20 in the form of either a further equipment failure or other  
21 loss of support services, that we had appropriate means to  
22 maintain that cooling configuration in the core.

23 COMMISSIONER TAYLOR: Do you think that knowledge or  
24 an estimate to the effect that quite a lot of the upper part  
25 of the core had gone through this melting phase -- and by

1 "melting," I mean changing from solid to liquid, whether in  
2 conjunction with some other material or not, but becoming  
3 liquid -- that in the act of doing that and then refreezing  
4 after coolant water came back into the core, might there have  
5 been any different considerations about the safety advisability  
6 of methods for cooling the core, disposing of the waste heat  
7 which, as I remember, were subject to quite a bit of discussion  
8 during the time before the utility choose the specific cooling  
9 method that is now being used -- do you think that knowledge of  
10 a substantial amount of changing of phase of some substantial  
11 upper part of the core might have affected that decision?

12 MR. MAC MILLAN: It would be my opinion it would  
13 not have. I was personally involved in the considerations and  
14 the deliberations with respect to what cooling mode should be  
15 utilized. I was involved in the discussions of the concern  
16 about recriticality due to some shift or change in the configura-  
17 tion of the reactor core, and we had to assume in that situation  
18 that we had a core that had been substantially damaged in the  
19 upper portion, very probably that cladding in that region had  
20 oxidized and even crumbled to dust in the form of zirconium  
21 oxide, that very likely some of the uranium oxide pellets had  
22 fallen down and been collected on the grid plates, we had to  
23 assume in the criticality calculations that we made the worst  
24 probability; that in fact that core would get together in its  
25 most reactive configuration.

1           And we did have some evidence, you may recall from  
2 the sequence of events in the weeks following the incident  
3 there, the accident there, that one of the reactor coolant  
4 pumps stopped and our hearts skipped, and the second pump was  
5 started and it came on and it ran, and in the subsequent hours  
6 we determined that there was in fact a shift in the pattern of  
7 temperature coming out of the reactor core as measured by the  
8 thermocouples in the core discharge region, indicating certainly  
9 a change in the coolant pattern flow through the core, and  
10 perhaps even some rearrangement physically of the core itself.

11           And so the assumption had to be made in the delibera-  
12 tions that we were involved in that the core was subject to  
13 some reconfiguration and that we certainly wanted to have that  
14 factor in mind when we came up with our final conclusions.

15           We didn't, for example, want to turn additional  
16 pumps on because that could have caused some other redistribution  
17 which might have been a less satisfactory cooling configuration  
18 than we had, and so the inclination was to leave the core and  
19 the cooling configuration in a stable mode and not disturb or  
20 try to distort.

21           I think you asked earlier about the possibility of  
22 trying to pull a control rod out. There had been some consid-  
23 eration of should we try to get some reactivity measurement  
24 of that sort, and I would say it was very brief, it was not  
25 given very extensive consideration, but one of the concerns was

1 again the core configuration and the potential for rearrange-  
2 ment of that core.

3 COMMISSIONER TAYLOR: And what really is the main  
4 source of concern in the rearrangement? Do you think there is  
5 any possibility that in a rearrangement of any kind that it is  
6 at all credible that the activity would go up substantially?

7 MR. MAC MILLAN: There is a possibility it would  
8 go up, but I don't think it would go up to the extent that  
9 we would be concerned about it, because as Dr. Roy said, we  
10 made criticality calculations, the NRC made criticality cal-  
11 culations, aimed at determining the appropriate boron level  
12 in the reactor coolant which, as you have indicated earlier,  
13 is the only real variable that we have to work with at this  
14 point in order to increase reactivity. And we did make the  
15 conservative assumption there that the core would get in its  
16 most reactive configuration, and we had to have enough boron  
17 on there to handle that.

18 COMMISSIONER TAYLOR: Well, in that case, why not  
19 pull on the control rods and put it on a ramp and measure the  
20 reactivity? Why don't you just go ahead and do that?

21 MR. MAC MILLAN: Well, I guess we would want to  
22 balance the value of the information obtained from that: what  
23 does it tell you, what you do different if you had made that  
24 measurement, as contrasted with being in a situation where you  
25 know you have a stable configuration, a stable cooling mode,

1 and that by very conservative calculation an ample margin of  
2 subcriticality. It is a kind of don't-kick-the-sleeping-dog --

3 COMMISSIONER TAYLOR: Well, that kind of suggests that  
4 you do have some questions about a change in the configuration  
5 into a less controllable state. And I guess I would like to  
6 know whether it is your concern about ability to cool it, or  
7 whether there is some residual concern about getting closer  
8 to critical, or even to critical, even though that concern may  
9 be very low; that you just don't want to jiggle it.

10 MR. MAC MILLAN: That is a good way to put it. We  
11 just don't want to jiggle it, and it is not --

12 COMMISSIONER TAYLOR: I guess I am trying to find  
13 out why not.

14 MR. MAC MILLAN: It is not a concern about recritical-  
15 ity because, as I said, we have made very conservative calcula-  
16 tions there, and that the boron concentrations that we have  
17 feel comfortable with the degree of subcritical margin.

18 COMMISSIONER TAYLOR: Now, I have just another ques-  
19 tion on the matter of temperatures. It may sound like trying  
20 to beat a dead horse. But let me tell you why I am concerned  
21 about the way I read your press conference in terms of your  
22 statements about the core damage. And that is, the only temp-  
23 eratures that you referred to, I believe, were several pages  
24 before, page 37, in which you said that the cladding temperatures  
25 were between -- or, I guess, estimated to be -- between

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2 and 3,000 degrees Fahrenheit.

MR. MAC MILLAN: Yes, sir.

COMMISSIONER TAYLOR: There are no other temperatures mentioned anywhere in the press conference. At that time, in fact by April 15, there were already reports being circulated around by NRC, calculations, perhaps somewhat simple-minded, but their effort to try to get some idea of what temperatures were in fact reached. And if you looked at the temperature as a function of time that they plot on the basis of their calculations for the upper parts of the core which were uncovered the longest, and ask what would the temperature be at the time when the core was recovered, those temperatures down to about a foot are 5,000 degrees Fahrenheit.

Now, I have noticed, I have to say, that those curves are not quite connected with 5,000 degrees for some reason or another; the extension of the curve stops, not because the core got recovered -- I don't know why they stop -- all I know is that there are no temperatures indicated in any graphical form above about 4,500 degrees. If one puts a ruler on it and extends it, one sees 5,000.

Now, as many people have said, the melting point of the fuel, not the eutectic, is 5,200 and there is some uncertainty in that.

So as of April 15, one part of the official community was saying, "We think that if we take into account the reaction

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1 energy of the zirconium and the water and say that was an  
2 additional source of energy besides the decay heat, we calculate  
3 temperatures that are so close to the melting temperature of  
4 the uranium oxide that it is very hard for me to imagine anyone  
5 with any confidence saying, 'We know it didn't melt.'

6 But in addition to that, those same calculations --  
7 and I gather these are being borne out by other people who are  
8 doing the same thing -- say that at much lower temperature,  
9 that is, 3,500 degrees -- I think there is much more assurance  
10 that those temperatures was reached -- there were tons of  
11 utectic formed; how many, I think no one knows. I believe the  
12 lowest figure that corresponds to the calculations is one ton  
13 of uranium oxide involved in the utectic. But that, in fact,  
14 really did melt.

15 So I find it strange that early in June, the general  
16 impression that not only nothing melted, but got nowhere near  
17 melting, was -- I am not questioning that it wasn't in your  
18 mind at the press conference, but that it was in your mind at  
19 a time when that was very distinctly not the impression on the  
20 part of other people that quite a long time before that had  
21 come to a quite different conclusion.

22 And I guess what I am concerned about now is the  
23 internal communications of the people involved in the accident  
24 and what happened after the accident, after TMI-2. There is  
25 something missing, if these differences in opinion or in

1 conviction about what happened that are this large exist.

2 But I gather that as far as you are concerned, the  
3 evidence of the fuel melt by any mechanism as a change from  
4 solid to liquid, that that evidence is in the direction of  
5 substantiating your statement, there was no fuel melt in the  
6 TMI core. Is that correct?

7 MR. MAC MILLAN: I ought to say that I am not aware  
8 of these other calculations that you are talking about. I was  
9 not aware of them at the time of the press conference. The  
10 comment that I made at the June 5 press conference was based  
11 upon the radiochemical analysis of the reactor coolant samples  
12 that had been taken and the deduction from those and the  
13 isotopic content of those samples that did not indicate a  
14 presence of melting.

15 Now, if subsequent analyses have in fact demonstrated  
16 that is not the case, then I was in error, I am not familiar  
17 with that. I stated the situation as I understood it at the  
18 time. I would reiterate, I don't believe that the knowledge  
19 of that possibility would have caused us to take any different  
20 action in the response and recovery operations at Three Mile  
21 Island in terms of determining the appropriate cooling configura-  
22 tion for the core or in the calculation of the subcritical  
23 margin for the core in its most reactive configuration and the  
24 establishment therefrom of the appropriate boron levels in the  
25 reactor coolant.



1 COMMISSIONER TAYLOR: I understand. Thank you.

2 CHAIRMAN KEMENY: Two more commissioners have asked  
3 for the floor. May I just remind the Commission that several  
4 of you urged us to save ample time for our executive session  
5 this afternoon. Commissioner McPherson was first.

6 COMMISSIONER MC PHERSON: Thank you, Mr. Chairman.  
7 Mr. MacMillan, just to go back once again to the securing of  
8 the high pressure injection system and the rules that were  
9 out and available at that time.

10 Mr. Dunn's memorandum says about the Davis Besse  
11 incident: "The incident points out that we have not supplied  
12 sufficient information to reactor operators in the area of  
13 recovery from a loss of coolant accidents."

14 Do you agree with sentence as of that time? Do you  
15 think that was true as of February 1978?

16 MR. MAC MILLAN: Well, I think that is what the  
17 memo says; I think that is what Mr. Dunn felt --

18 COMMISSIONER MC PHERSON: I am asking you whether  
19 you believe that.

20 MR. MAC MILLAN: At the time he wrote the memo, and  
21 the evidence of having had those instructions in the field and  
22 having had one circumstance where they were not followed, I  
23 think I would have to agree, raised a question of whether or  
24 not sufficient information had been supplied to the reactor  
25 operators. But then again, I would repeat that the recommended

1 procedures and the procedures in force at Three Mile Island  
2 at the time did have these precautions for the operators.

3 COMMISSIONER MC PHERSON: Well, that sounds like  
4 double-talk to me, frankly. You say that they were out there,  
5 the procedures were in place, and yet you agree with Mr. Dunn  
6 that we have not supplied sufficient information to reactor  
7 operators in the area of recovery from loss of coolant accidents.  
8 Which is which?

9 MR. MAC MILLAN: Well, I think what I was trying to  
10 say, Mr. McPherson, is that I can understand how Mr. Dunn  
11 would feel on the basis of the analysis that he had done, that  
12 supplementary information ought to be provided to the reactor  
13 operators. We in fact did issue supplementary information and  
14 supplementary training for the reactor operators in the period  
15 following March 28, 1979.

16 COMMISSIONER MC PHERSON: Yes. Mr. Dunn's memorandum  
17 was written on February 9, 1978. The Davis Besse event took  
18 place in September 77. And the supplementary information and  
19 instructions went out in April of '79, 19 months later.

20 MR. MAC MILLAN: Yes, sir.

21 COMMISSIONER MC PHERSON: That, you said earlier,  
22 was a regrettable delay. You also said that the Dunn memorandum  
23 and the Kelly memorandum point out that there is an opportunity  
24 for safety concerns to be raised within B&W.

25 Obviously, having an opportunity to raise safety

1 concerns and having anybody listen to them or respond to  
2 them are different things. They were in this situation. Many  
3 of those, there has been testimony to the effect that many  
4 of those on the distribution list of this memorandum don't  
5 recall it at all. And apparently, as Commissioner McBride  
6 said yesterday, that the large number of people on the distribution  
7 list without any action line, without any responsibility being  
8 imposed on any one of those persons in the body memorandum  
9 seems to have had the effect of causing everybody to think  
10 that someone else was doing something about it.

11 So an opportunity to raise safety concerns is meaning-  
12 less unless there is some action. You are a manager, and  
13 you obviously know that. What have you done since the 28th  
14 of March to improve the response side in addition to the  
15 opportunity side of this equation?

16 MR. MAC MILLAN: I would like to respond, first of  
17 all, to the comment relative to the opportunity not being  
18 a sufficient condition, that there has to be action taken in  
19 the resolution of those. And as I have said, I think it is  
20 regrettable that that resolution took as long as it did in this  
21 particular case.

22 The point that I was really trying to get at in  
23 making that point was that there is no evidence that I know of  
24 in the conversations, in the questions, in the inquiries that  
25 I have conducted, nor in the testimony which I have heard

1 presented, to indicate that there was any intentional effort  
2 to suppress or to discourage people from raising these concerns.  
3 But in fact, the environment is one in which our engineers  
4 are encouraged to raise these concerns.

5 I think the thing that we need to do, and certainly  
6 one of the lessons to be learned from this sequence of events,  
7 is to sharpen up on the resolution of and the disposition of  
8 the concerns that are raised.

9 And what I have asked Don Roy, our Engineering  
10 Manager, to do is to evaluate the mechanism by which and the  
11 procedures by which safety issues are raised and action is  
12 taken either to resolve them or to dispose of them in a timely  
13 fashion.

14 COMMISSIONER MC PHERSON: And have you given him a  
15 deadline in which to respond to that?

16 MR. MAC MILLAN: I have not, and I think he needs to  
17 have his people take a look to see what the magnitude of the  
18 surgery may be in order to accomplish that before we set deadlines  
19 for that.

20 COMMISSIONER MC PHERSON: The point is not merely one  
21 of chastizing your organization, Mr. MacMillan. You are a  
22 major supplier of nuclear power generation systems, and there  
23 are a lot of these things around. There are other things besides  
24 operator incomprehension with respect to turning off the conditions  
25 in which the water ejection system should be turned off. There

1 are other things that doubtless are percolating in the systems,  
2 that have caused concern to other Mr. Dunns and other Kellys.  
3 And my concern is that those memoranda are sitting around in  
4 B&W and Westinghouse and Combustion Engineering and elsewhere  
5 at various bureaucratic levels, while people attend to "higher  
6 priority matters," even though this one has to do with the  
7 potential of uncovering the core, which I assume is among the  
8 highest priority matters; that they are sitting around and  
9 not getting responded to; that there are no deadlines; nobody  
10 has to do anything by a certain time.

11           Someone writes a memorandum in November of '77, five  
12 months later that is escalated by someone else who writes two  
13 memoranda, six months later someone else with an action responsi-  
14 bility along the line writes back and says, "Well, we haven't  
15 done anything about that because there are a couple of concerns  
16 that we don't think got resolved about going solid."

17           Eight months later, there is finally action. Oh,  
18 in between, two guys met in the hallway and talked about it.  
19 Nineteen months altogether.

20           Now, there are probably other such things around, and  
21 I don't envy you the job of trying to establish a system under  
22 which these matters come up and get resolved, but I would surely  
23 think that it has got to involve, whatever you introduce has  
24 got to involve deadlines and the imposition of specific  
25 responsibility on people to respond to such things by a certain

1 period, get it resolved. If it is decided -- if it had been  
2 decided in this case, as you said in your press conference on  
3 June 5, that those instructions had been given, that they were  
4 adequate, that the operator simply didn't carry them out, if  
5 you had decided that, so be it. A repeated history of operator  
6 failure in this regard would suggest that you were wrong, you  
7 would have been wrong if you had decided that, but nevertheless  
8 that would have been a decision. To leave it in the fudge of  
9 bureaucracy is what is really unacceptable in a field like this.

10 General Motors makes automobiles, doesn't make sure  
11 that everybody who drives them can drive them competently and  
12 under emergency situations, but you are not in that ballgame.  
13 It is a very different one, clearly. And one really can't  
14 have what you can almost describe as U.S. Government bureaucratic  
15 methods within your kind of enterprise.

16 Thank you.

CHAIRMAN KEMENY: Do you wish to respond, Mr.

MacMillan?

MR. MAC MILLAN: I respect your concerns. I share your concern in many areas. I believe I said so the other day that I am not proud of the performance on this specific issue. I don't have evidence that there are large numbers of other issues that remain unresolved, but I think it is incumbent upon me, as the responsible manager of the division, to assure myself that we have instituted a system by which these issues can be addressed forthrightly and in a timely way.

I always worry a little bit about arbitrary deadlines, which have no relationship to the character of the problem nor the magnitude of the work that may be required to resolve it because sometimes those just are not effective in accomplishing the objective. I am sensitive to your concern that there need to be established some guidelines by which we can perform in resolving these and I know, as a fact, that Mr. Taylor, who is in charge of licensing and who testified earlier in the proceedings, has set for himself and for his people the timely resolution and some targets for accomplishing the resolution of preliminary safety concerns that are raised from wherever they occur in the organization.

And we do need to sharpen up, as I indicated earlier, in the timely resolution of these issues.

CHAIRMAN KEMENY: Governor Peterson.

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1 COMMISSIONER PETERSON: Thank you, Mr Chairman.

2 Mr. MacMillan, a few minutes ago you pointed out  
3 that during the cooling of the reactor that the flow of water  
4 from one of the coolant pumps conceivably because of shifting  
5 of debris in the reactor core that blocked the flow water and  
6 your heart skipped. What did you envision might happen that  
7 caused your heart to skip?

8 MR. MAC MILLAN: Let me first correct the sequence  
9 of events. The reactor coolant -- this is now about -- I  
10 don't remember exactly -- about two weeks after the accident.  
11 The reactor coolant pump did not quit because of some blockage  
12 in the core. The reactor coolant quit because of an interlock  
13 that had been -- that had tripped the reactor coolant pump off  
14 the line. The second pump was put on the line and subsequent  
15 to the second pump being put on the line, we observe a change  
16 in the cooling pattern in the reactor core, which we know is  
17 at least a cause of a change in the flow pattern through the  
18 core and, perhaps, an indication of some change in the geometry  
19 of the fuel within the core.

20 I do say, my heart skipped, because we had gone  
21 through rather extensive contingency planning. What happens  
22 if we lose that reactor coolant pump? And we had a sequence  
23 of steps outlined in the control room in force in that event  
24 that that occurred. And the first thing to do was to turn on  
25 the other pump and that first step was taken and that first



1 step resolved the problem. I say my heart skipped from the  
2 standpoint that when you are in a very stable cooling config-  
3 uration and you like to stay right there. And when something  
4 happens to make that change, then it shoots the adrenalin into  
5 your system and you say, okay, we have to hop on that. We  
6 have to find out what is happening. Let's make sure that the  
7 procedures that we had outlined in the contingency plans that  
8 we had outlined were in force. Did they work or didn't they  
9 work and, as I say, in this case, the plans had been laid out.  
10 They had been implemented and they had been successful.

11 COMMISSIONER PETERSON: It is not very often we say  
12 our hearts skip because of some little change in a carefully  
13 laid plan. What if the circulation of the water couldn't come  
14 out? What if you didn't get circulation of water? What kind  
15 of a problem would have resulted?

16 MR. MAC MILLAN: Well, we had a sequence laid out  
17 at that time and I am not sure that I can entirely recite it  
18 at this time, but --

19 COMMISSIONER PETERSON: What if -- regardless of  
20 what sequence you used -- you couldn't get the water flow  
21 started?

22 MR. MAC MILLAN: If we could not have gotten any  
23 reactor coolant pumps running, the next step in the contingency  
24 plan was to initiate high pressure injection flow and to cool  
25 the core by the pumping of high pressure injection into the

1 reactor system in providing cooling from what amounts to an  
2 alternate source of water.

3 If that had not been successful, we had procedures  
4 laid out to go in natural circulation cooling. Just let the  
5 thermal effects of the water heating up in the core and being  
6 cooled in the steam generators provide the cooling mechanism.  
7 And, in fact, that is the condition of the cooling which we  
8 are presently operating in, which the unit is operating in,  
9 at Three Mile Island.

10 So, there were other ways in which to get that core  
11 cooled in that period.

12 COMMISSIONER PETERSON: Natural circulation wouldn't hav  
13 done the job, would it?

14 MR. MAC MILLAN: Oh, yes, sir. It would have.

15 COMMISSIONER PETERSON: Why didn't you use that in  
16 the first place then?

17 MR. MAC MILLAN: Because we felt that we had a  
18 better cooling configuration by using the forced circulation  
19 of the reactor coolant pump.

20 COMMISSIONER PETERSON: So, really you weren't  
21 concerned during this period. Your heart didn't have to skip.

22 MR. MAC MILLAN: Well, maybe I overstated it. Any-  
23 time you are involved in an operation of that sort and you  
24 get some unusual perturbation, it is a source of adrenalin  
25 for the system. We had the lights go out on the trailer one

1 night and there were about six of us on the staff sitting  
2 around and I have never seen six people get up so fast and  
3 head for the door to see whether the lights had gone out on  
4 the island. And I have just got to tell you that that is a  
5 situation that stimulates your adrenalin and it is that sense --  
6 not from the standpoint that that represents a condition where  
7 we would be approaching any unsafe condition.

8 CHAIRMAN KEMENY: The final questioning will be by  
9 Dr. Marks.

10 COMMISSIONER MARKS: I would like to try and explore  
11 with you what may be considered a sort of basic, philosophical  
12 position of the company with regard to its approach to the  
13 selling of these reactors. And this relates to your training  
14 of operators.

15 What is your sense of responsibility with regard to  
16 selling a reactor and making sure that your customer has oper-  
17 ators who are adequately trained to operate that reactor?

18 MR. MAC MILLAN: Well, I think that I ought to re-  
19 spond to that by first indicating the way in which operator  
20 training is developed. The utility has a prime responsibility  
21 for identifying the operators, the candidates to go through  
22 the program to qualify for their license. The utility has a  
23 responsibility for developing the program of training, which  
24 normally with a new operator and a new unit is about a two-  
25 year training program. We offer a spectrum of training programs

1 from which the utility can select portions that they may want  
2 to have us perform of that total training program.

3 The training program is reviewed by the utility with  
4 the Nuclear Regulatory Commission and at the conclusion of the  
5 training program, the operators are licensed by the Nuclear  
6 Regulatory Commission. Our responsibility, first of all, con-  
7 tractually, is to perform the training, which we and the util-  
8 ity have agreed represents the scope of training which will be  
9 provided for the operators and, in the case of Three Mile  
10 Island 2, that represented about two months of simulator train-  
11 ing at our facility in Lynchburg.

12 The remaining training in the roughly two-year pro-  
13 gram is provided by other people. We certify to the utility  
14 at the conclusion of the segment of the training that we have  
15 responsibility for that the operators have successfully completed  
16 that training and that they have met the requirements of the  
17 training program as we determine by an examination that we give  
18 the operators at the end of that segment of the training pro-  
19 gram. So, in the strictest contractual sense, that is the  
20 extent of the contractual obligation.

21 In the process of working with the utility who is  
22 buying a new unit, we do get involved in the discussion of his  
23 total training program and how our portion or the portion that  
24 we are going to put in dovetail with the balance of the pro-  
25 gram. I would say in most cases having a pretty clear

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1 understanding of what the total content of that program is.

2 The ultimate licensing and certification of the  
3 operator for the operation of the unit is the responsibility  
4 of the Regulatory Commission. Our involvement is to conduct  
5 that training which we have the capability to conduct and to  
6 certify that the operators selected by the utility have suc-  
7 cessfully concluded or completed that training program.

8 COMMISSIONER MARKS: Well, I must admit I am troubled  
9 by your answer because I don't -- I will tell you what my pro-  
10 blem is. You, in your press conference, without going into  
11 details, identified the fact that of the six significant fac-  
12 tors involved in the Three Mile Island accident, five involved  
13 the operator.

14 MR. MAC MILLAN: Yes, sir.

15 COMMISSIONER MARKS: Earlier, when you, in your re-  
16 sponse to the issue of safety, you placed great emphasis on  
17 the fact that your engineers are very safety oriented in the  
18 production of your equipment. But the weak link in the chain  
19 seems to be the operators and, I guess, from the Commission's  
20 point of view, I would like to know whether you are satisfied  
21 with the B&W's role in the overall responsibility for operator  
22 training. Because certainly this accident, regardless of what  
23 its actual cause was reflects on B&W and it seems to me that  
24 if it is, in fact, operator training that is a major contri-  
25 butor to this accident and possibly others, this has to be an

1 upfront concern and an upfront sense of responsibility equal  
2 to, certainly, your acknowledged sense of responsibility with  
3 regards to the safety of the equipment.

4 MR. MAC MILLAN: I would agree with you. I think  
5 one of the lessons learned -- I would agree with you to this  
6 extent. I think one of the significant lessons learned from  
7 our viewpoint as the supplier of the equipment for Three Mile  
8 Island is the necessity for a closer coupling between the  
9 designer of the equipment, the organization that provides the  
10 training of the operators and the operation of the unit. So,  
11 that the designer can put into a form that can be utilized by  
12 the training organization to give the operating personnel --  
13 the people who are going to run the plant -- the concept of the  
14 design and how it should be operated in a safe fashion and then  
15 to get those operators trained in place with the appropriate  
16 accessible procedures and information to allow them to run that  
17 plant with the same kind of a vision of what is important, in  
18 terms of that plant's operation, that the designer had at the  
19 beginning. So, I believe that there is a necessity for a  
20 closer coupling, a closer working relationship between the  
21 designer, the training organization and the operating organi-  
22 zation.

23 COMMISSIONER MARKS: But the way it sounds to me now,  
24 Mr. MacMillan, is that B&W really has delegated the responsi-  
25 bility for assuring adequacy of operator training to a combination

1 of the customer and the NRC.

2 MR. MAC MILLAN: The total training program --

3 COMMISSIONER MARKS: In other words you don't make  
4 a primary determination when you decide to sell your equipment  
5 that the customer has the capability of really training the  
6 operators to the very best ability to run that equipment,  
7 which you are selling them, safely.

8 MR. MAC MILLAN: At the time that we sell equipment  
9 we do not make that kind of an assessment. I think we make  
10 the presumption and I think that it is valid that the utility  
11 has the capability of formulating training for their operators  
12 and getting that training successfully accomplished so that  
13 the units can be safely operated. But that is not any kind of  
14 a formal assessment that takes place at the time that we would  
15 offer a nuclear steam system to a utility.

16 The prime responsibility in the nuclear business  
17 and -- although not legally spelled out, I suppose -- the prime  
18 responsibility for the operation of the unit is a utility re-  
19 sponsibility. The operators are utility personnel. The  
20 training program for those operators to assure their competence  
21 to run those units is a utility responsibility. There is a  
22 NRC responsibility for licensing and the examination of those  
23 operators and that is the basic framework within which the  
24 nuclear industry operates in this country today. And we  
25 operate --

1 COMMISSIONER MARKS: Do you agree with that?

2 MR. MAC MILLAN: I think the operating responsibility  
3 must be with the operating company. There isn't any way for  
4 Babcock & Wilcox or any of the other reactor suppliers to  
5 assume that responsibility. It must be managed by the opera-  
6 ting utility.

7 CHAIRMAN KEMENY: Thank you Mr. MacMillan. The  
8 witness is excused.

9 This completes this session of open hearings. The  
10 Commission will go into executive session this afternoon to  
11 determine the calling of future witnesses under subpoena. We  
12 will be announcing our schedule of open hearings early next  
13 week.

14 As you know, we have already announced that they  
15 will occur during the first three days of August. The exact  
16 schedule depends on what the Commission determines this after-  
17 noon on the number of witnesses to be called.

18 May I request from the Commissioners -- since I know  
19 a number of you have to leave by 5 o'clock today -- that we  
20 should start our executive session this afternoon no later than  
21 2:15, so that we may complete by 5 o'clock.

22 These open hearings are concluded.

23 (Thereupon, the hearing was adjourned at 1:30 P. M.  
24 on July 20, 1979.)  
25