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NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF:

PUBLIC MEETING

BRIEFING ON RESULTS OF IE

INVESTIGATION OF TMI INCIDENT

Place - Washington, D. C.

Date - Thursday, 2 August 1979

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2	NUCLEAR REGULATORY COMMISSION
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, <u></u>	BRIEFING ON RESULTS OF IE
	INVESTIGATION OF TMI INCIDENT
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7 8	Room 1130 1717 H Street, N. W. Washington, D. C.
ç	Thursday, 2 August 1979
10	The Commission met, pursuant to notice, at 9:35 a.m.
	BEFORE:
	DR. JOSEPH M. HENDRIE, Chairman
	VICTOR GILINSKY, Commissioner
· ·	RICHARD T. KENNEDY, Commissioner
15	PETER A. BRADFORD, Commissioner
16	JOHN F. AHEARNE, Commissioner
	ALSO PRESENT:
ie	Messrs. Stello, Gossick, Gibson, Moseley, Allen, Martin,
5	and Bickwit.
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1 CHAIRMAN HENDRIE: May we come to order, please? 2 The commission meets this morning for a briefing 3 on the results of the Office of Inspection and Enforcement 4 investigation under the TMI accident. 5 Vic Stello, the head of the inspection office, will lead us through the briefing. 6 7 Vic. please go ahead. 8 Mr. Stello. Thank you. Mr. Chairman. 9 First, let me introduce the people who are seated 10 here at the table with me. Starting to my far left: Mr. .11 Martin; Mr. Allen; Mr. Gibson; Mr. Gossick just joined us; and 12 Mr. Moseley; and myself. 13 I would also like to identify the investigators 14 who were part of the team -- who were the team that did the 15 investigation at Three Mile Island. And they were Messrs. Criswell, Fasano, Hunter, Kirkpatrick, Marsh, Martin, Collins, 16 17 Donaldson, Essex, Jackson, Shakleton, and Uhaus. 18 I wonder if I could ask them to stand and be 19 recognized. 20 I would like to express a note of appreciation on my behalf and the commission's behalf for the many long hours 21 22 that the team put into the investigation. It involved a long 23 time away from their families and I feel a special note of thanks is due. 24 I want to make that known now. 25

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CHAIRMAN HENDRIE: I'm sure the commission joins 1 2 in thanking the members of the team for their efforts. 3 In view of the atmospheric condition, I offer the 4 team members a special invitation to dejacket before they 5 melt down. 6 (Laughter.) 7 MR. STELLO: The way in which we're going about the presentation this morning, Mr. Chairman, I'll have some 8 9 brief remarks and Mr. Moseley and Mr. Allen, the bulk of 10 the presentations will be made by Mr. Martin first, covering _11 the operational aspects dealing with those actions the

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12 licensee took during the initial 16 hours of the event up 13 through 8:00 on the evening of March 28th.

14 (At 9:40 a.m., Commissioner Kennedy enters the room.)
15 MR. STELLO: Following a presentation Mr.'Gibson
16 will take on the actions taken by the licensee to control
17 release of the radioactive material from the off-site
18 environment and to implement his emergency plan, for the
19 period of the first three days up through midnight of March
20 30.

This report — oh, the final note on the order of presentation will be to identify those items which we have characterized as potential items of non-compliance at this time.

(At 9:40, Commissioner Gilinsky enters the room.)

MR. STELLO: That was done intentionally to avoid 1 sh 2 holding up publishing this report and the information in it. 3 So that all the other people who clearly have an interest in it will have it and those items that are identified as 4 5 potential items of non-compliance will then be covered by Mr. Moseley at the conclusion of the presentation. 6 7 Very briefly, we're not prepared to take a position 8 as to which of those we will finally conclude our items of 9 non-compliance and our final enforcement action will have to 10 await that final review, which will be some time in the future 11 COMMISSIONER GILINSKY: When do you see that taking 12 place? 13 MR. STELL(): I think we'll probably need at least 60 days. And I'll want to think very carefully about whether 1.4 15 or not I'll want to see some additional information as we 16 look through this. 17 I don't know. 18 Each of these items of non-compliance, there are 19 in many of them arguments both pro and con as to whether there 20 were mitigating factors that caused the licensee to do what 21 he did. And although there is a technical violation of the 22 license condition, he clearly did the better or safer thing. 23 I don't believe in that regard that it ought to 2.4 then be listed as an "item of non-compliance." 25 So we need to study them very carefully. I hope to

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have it done in 60 days. 1 2 COMMISSIONER AHEARNE: Do you intend, or have you given consideration to the other investigations that are 3 underway and what impact they might have on the judgment? 4 5 MR. STELLO: That was my point. As we go through it, I may decide that we want to wait until other investigations 6 are over before. I reach that final judgment. 7 And if that's true 8 9 COMMISSIONER AHEARNE: Then it might be more than 10 60 days. .111 MR. STELLO: Then it might be considerably more than 12 60 days. More like six months. But I will keep the 13 commission informed if I decide that that's what's necessary and let the commission know that I'm going to wait until I 14 get that information before reaching the final decision. 15 16 COMMISSIONER KENNEDY: Vic, let me go back to what 17 I think you said. You said that in many instances, these 18 technical questions of non-compliance actually represented the 19 course followed by the licensee, which was in the interest of safety. 20 21 Is that correct? 22 CHAIRMAN HENDRIE: Or could be. 23 COMMISSIONER KENNEDY: Could be. MR. STELLO: In many instances, and I think as will 24 25 be explained today, the reasons for him taking the action were

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because he believed that that was the correct thing to do.

And in my view, I will want to weigh that very heavy before I decide an enforcement action should take place on an item such as that.

COMMISSIONER KENNEDY: Thank you.

6 MR. STELLO: Now the report clearly identifies 7 various areas of inadequacy with respect to equipment 8 performance, analyses, training, and what have you.

9 I think that many of these things you have probably 10 heard before. What will be new this morning will be a lot 11 of the reasons behind why some of the actions were taken 12 which was not available in previous presentations.

13 In spite of those inadequacies, though, I think 14 that there are probably three points that I would like to 15 make from a broad view of what I see. And that's, first and 16 foremost, that clearly, the accident was preventable. In spite 17 of the inadequacies that we have found, it was clear that the basic equipment and the basic procedures that were there, 18 19 had they been followed, the accident could, indeed, have 20 been prevented.

This does not say, and I do not wish to mean that, clearly, the operators took actions which were based on information that they had at the time they had it, which were clearly wrong.

25 If they had, though, followed the basic procedures

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and used the equipment that was in place, this accident 2 could have, indeed, been prevented.

3 A second point that I think is an important one, is the analysis that was performed by the ad hoc group looking 4 5 at the off-site exposures.

The results of this investigation support that 6 7 the conclusions that were reached, as a general principle, 8 in terms of the health effects from off-site -- and we'll 9 be getting into that in quite a bit of detail during the presentation. 10

11 Finally, I think that what is in the report provides 12 an added basis for the lessons learned. the items that 13 Dr. Mattson and his report has come out with, things that 14 ought to be done on other reactors that can make a significant improvement in safety and cause these accidents to have 15 16 considerably less likelihood of occurring in the future.

I think as a general principle, what you find in 17 18 this report supports and adds further bases to the lessons 19 learned group.

20 Let me finally note what the report is not. Remember 21 that the report is a study of the licensee's actions. There 22 are other investigations going on. Clearly, the two that 23 ought to be mentioned --- the Kemeny Commission is doing its 2.4 investigation, which will be considerably broader in scope 25 than what we have done, and your internal study group that you

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have appointed under Mr. Rogovin also will be much broader in scope.

They clearly will cover some of the same material that's covered in here; hence, there will be a need for me to want to reflect on whether that ought to be considered before we take final action. But they will clearly be brought. They will include the actions that were taken by the designers, the vendors, the builders, the reviewers in Various regulatory agencies and what they did.

10 So that those studies will need to go on. .11 COMMISSIONER AHEARNE: Can I ask a couple of questions 12 on what you just described?

13 I read through the introduction and the summary sections of the report and I want to make sure that I 14 understand your first point. If I understand what you said, 15 16 why it was preventable is the following -- that you now 17 believe that enough is known on what actually did happen in 18 the accident and enough is known about what the operators did 19 do in the accident, that you are able to reach the conclusion 20 that had the operators followed the procedures that were 21 spelled out, say the emergency procedures were adequate, had 22 they followed the procedures as they were written and the 23 equipment were allowed to perform as it was designed to 24 perform and you believe it would have performed had it been 25 allowed to, then the accident would have been prevented?

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MR. STELLO: That's correct.

2 COMMISSIONER AHEARNE: But that presupposes, to me 3 at least, the most important part of that is the assumption 4 that at the present time, you now believe that we have enough 5 information and understanding of what actually did happen 6 through the period of the accident.

7 MR. STELLO: That's correct. And there will be 8 some specific examples cited that will make that point, I 9 think, very clear.

With that, if there are no more questions, I-11 ask
Mr. Moseley to make some remarks, followed by Mr. Allen.

12 COMMISSIONER KENNEDY: A point of clarification, 13 Vic. You said that the accident could have been prevented. 14 Is that the word you mean, or "mitigated"? Or both?

MR. STELLO: Let me call what could have been prevented, the ultimate damage to the core and release of fission products.

Whether or not the conditions that would have prevailed would have still been properly called an accident is not what I'm dealing with. The relief valve was not open. That created at least the set-up for a small loss of coolant accident.

23 (At 9:50, Commissioner Bradford enters the room.)
 24 MR. STELLO: It probably would still have been called
 25 an accident, but I think that the damage that the accident,

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1 as it occurred, could have been prevented. 2 COMMISSIONER AHEARNE: As you say in your report. 3 would have prevented the serious consequences. 4 MR. STELLO: Yes. 5 COMMISSIONER GILINSKY: Let me just pin this point 6 down that Mr. Ahearne is getting at. 7 You're saying that it was not -- that damage could 8 have been prevented if the operators had displayed ingenuity. 9 But simply, if they had followed their own procedures or the 10 procedures established at that plant? .11 MR. STELLO: Okay. I don't want to steal some of the 12 thunder. 13 One of the procedures, and it will be identified in 14 - . the presentation, deals with what the operator is to do with 15 decreasing reactor coolant pressure. Had he followed that 16 procedure, done what that procedure said, it would have 17 prevented the accident. 18 He did not follow that procedure. 19 That's an example of what I mean. There are 20 others. 21 CHAIRMAN HENDRIE: It might provide more illumination 22 if we got down the line a little bit and, in effect, came back to this guestion after a while. 23 24 MR. MOSELELY: Okay. Let me start by reminding you 25 of the negativeness of all investigations. This investigation

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is not unique in that regard. The report itself, of course, sh 1 2 emphasizes those things that were wrong and the things that 3 were not so wrong or were right get little attention. 4 And I will say that our presentation today is even 5 more so in this direction because we are trying to summarize 6 and to hit the high points and, of necessity, those tend to be negative points. 7 8 COMMISSIONER KENNEDY: What does that add up to? 9 MR. MOSELEY: It adds up to the fact that the 10 impressions that one will get from listening to us and from 11 reading the report emphasized the negative aspect because our 12 investigation is trying to ferret out the negative aspects. 13 COMMISSIONER KENNEDY: Are you suggesting that 14 that impression will be, therefore, perhaps, an unbalanced 15 one? MR. MOSELEY: It will be. I think that the total 16 17 picture of the accident needs to await completion of all of 18 the investigative efforts and all the reports that will be 19 generated. 20 So it would be premature to draw final conclusions 21 in many areas based on what we have here today. 22 There is no new information that will be presented 23 here of a basic character. There are many more details, and 24 there is much more --- we have much more confidence now in 25 the accuracy of some of the previous reported information.

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But we feel that there is no startling new information that we will be presenting today.

3 COMMISSIONER AHEARNE: The \$3000 reading was a little 4 unusual?

5 MR. MOSELEY: I will come back to, as Vic mentioned 6 earlier, I will come back to the items of non-compliance. 7 And I'd like to ask, if we could, that we save the discussion 8 of those until then, rather than during the presentation 9 that the other people will be making.

10 There are 35 potential items of non-compliance 11 that are contained in the report. We've labelled them 12 potential because we haven't taken the time to wash them out 13 to make sure that they are, indeed, items of non-compliance.

14 Our focus has been on getting this actual report out 15 so that it might be used by those people who are continuing 16 to look into this accident.

50, whereas, normally, we would have done all this before the report was issued, we're sort of getting things out of our normal sequence, hopefully, to be helpful to other people.

21 COMMISSIONER BRADFORD: What is its status at this 22 point as far as other people are concerned? You've passed it 23 now to at once the Rogovin group and the President's commission 24 Others as well?

MR. MOSELEY: It's totally public. It's published

sh	1	as a NUREG-0600. It's available to one and all. It has
	2	been supplied to the other groups that you have mentioned.
	3	COMMISSIONER GILINSKY: Let me just ask one more
	4	question. Is this a summary volume or is this the entire
	5	report, because it doesn't have back-up material.
	6	MR. STELLO: It does not contain the interviews and
	7	there are about 200 interviews that have been transcribed.
	8	And we're going to have to deal with that because it's a
	9	considerable volume of paper.
	10	COMMISSIONER GILINSKY: I haven't had a chance to
	.11	look at it, the whole of it, carefully, but I don't think that
	12	it contains various memoranda that might otherwise be in there,
	13	procedures at the plant and so on.
	14	MR. STELLO: Oh, no. They're identified as references
	15	but they are not attached.
	16	Let me ask a question: Are all the references except
	17.	for the interviews in the PDR, do you know?
	18	MR. MARTIN: The PDR?
	19	MR. STELLO: The Public Document Room.
	20	MR. MARTIN: No, sir.
	21	COMMISSIONER GILINSKY: It would seem to me that it
	22	would be useful to bind them up in an appendix.
	23	MR. MARTIN: If I may address that point, we have
	24	collected the references together that have been used in
	25	support, or identified as references in that report, and
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identified them in addition to the total set of files that sh 1 2 were developed during the course of the investigation. 3 Those references have been prepared for shipment 4 to Region 1 to be held with the historical file of all the 5 documents that we reviewed during the course of the 6 investigation. 7 MR. STELLO: Clearly, the intent is to make them 8 publicly available, bind them up, issue them as a NUREG, and 9 make the 2000 copies that will be needed. 10 I want to go back to the volume of paper and see if .11 that's necessary. 12 Yes, we'll bind them up, have them in one place, 13 and make sure that they re available. 14 MR. MOSELEY: With that, I'd like to pass to Jim 15 ' Allen. 16 MR. ALLEN: I'd like to briefly comment on the 17 effort that was involved and the conduct of the investigation 18 during the four-month period of the investigation. 19 Practically, 3100 man-days of effort were expended by the 20 investigators and the investigative team and its administrative 21 support functions. .22 . Of this, approximately 2400 man-days were expended by the team itself in conducting over 200 personal interviews 2.3 24 or reviewing logs, charts, records, observing facilities and 25 equipment, evaluating the results of these efforts, and in

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the preparation of report drafts and the final investigation preport.

The remaining 9.00 man-days of effort were expended in the administrative support of the investigation by regional and headquarters administrative staffs. Such support included transcription and editing of over 300 tapes and the drafting preparation and reproduction of the final investigation report.

9 The investigation team itself consisted of 14 10 office of inspection and enforcement personnel assigned from 11 various regional offices and headquarter staffs. The team 12 was constituted in two groups of 7 personnel each according 13 to their area of expertise to examine the operation or 14 radiological aspects of the accident.

For a short period of time, the 14-man I&E team was assisted by several members of the staff of the office of the inspector and auditor in conducting personnel interviews and establishing a system for editing taped transcripts.

During the entire period of the investigation, the team operated out of three mobile trailers located at the Three Mile Island observation center on the island itself.

As Mr. Stello described earlier, the I&E investigation was limited to the following two aspects of the accident: those related to operational actions by the licensee during the period before the initiating event until

6283.01.15 approximately 8:00 p.m. on March 28, when primary coolant sh flow was re-established by starting a reactor coolant pump; and two, those steps taken by the licensees to control the release of radioactive material to off-site environs and to implement the emergency plan during the period from the initiation of the event until midnight on March 30th, which encompasses a period of the major release of radioactivity. At this time, Mr. Martin, would you please describe the operation? MR. MARTIN: May I have the first slide, please? (Slide.)

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By way partially of review, and partially to clarify some 1 2 points, I'm going to have to review a number of issues. I 3 hope to do so very briefly, but just to recharacterize the nature of the accident and the sequence, the summary I'm 4 5 presenting now does not differ in terms of the major event 6 that took place throughout the 16-hour period of the 7 accident as covered by the Operations Group, from that that I presented in my briefing of May. There's additional 8 clarification on points but no major changes in terms of the 9 10 major event that took place.

11 The conditions of the plant prior to the turbine 12 trip is the reactor was operating at about 97 percent power, 13 with the integrated control system in full order, 14 automatic. It was basically a normal, routine operational 15 period of 97 percent power, normal makeup and letdown was 16 enacted and used on the plant.

17 The plant was only in one identified action 18 statement under their technical specifications. This was an 19 open valve on the borated water storage tank with 20 recirculation of its content. There's nothing unique or 21 unusual about that set of circumstances.

22 COMMISSIONER GILINSKY: Could you explain to me 23 what an action statement is?

24 MR. MARTIN: In a technical specification, for 25 example, you'll have a limiting condition for operation.

1 This is a mandatory requirement. In the case of the borated 2 water storage tank, there are a minimum of four conditions 3 which must be met, the quantity of water in the tank, the 4 boron concentration, certain valves closed. These are a 5 series of conditions which are required to assure that that 6 particular system or component is in an operable state, 7 ready for use in the event of an emergency.

There are then action statements in the event that 8 9 any one or more of those specific requirements or limiting. condition for operation cannot be met, as in a malfunction 10 .11 or as a component breakdown or an electronic difficulty, 12 something of that sort. Depending upon the specific component or malfunction, or the number of malfunctions 13 • 14 involved, there is a defined action statement which says 15 . that if for example, a valve which normally would be required to be closed by the condition for operation has to 16 17 be opened for some reason, there is a period permitted for 18 that valve to be open and still not considered to be in 19 violation of the basic requirement. That's the action 20 statement.

Therefore, in this particular case, with that valve being open, they are permitted up to 72 hours to return that valve to a closed state, to return the BWST back to meeting the full requirements of the limiting condition for operation, and, for example, perhaps a simpler example

would be to diesels on a system. If one diesel breaks down, they have a period of time within which to get that second diesel back into operating condition. If it is not met, then they must take the series of subsequent steps which usually includes shutdown of the plant.

5 So, there was one such action statement in 7 effect. They were recirculating the BWST contents that 8 would ve expired at 3:00 p.m. on March 29th had the accident 9 not occurred.

10 The reactor coolant system, unidentified leakage. 11 There are leakage requirements on the reactor coolant system 12 for the plant. The reactor coolant system unidentified 13 leakage was found by the investigation to actually be in 14 excess of technical specification limits due to a procudural 15 error.

16 The limit on unidentified leakage is 17 approximately, not approximately, it is one gallon per 18 minute. When the procedure error was corrected by us and we 19 recalculated the leakage of, I believe it's approximately a 20 week prior to the incident, the unidentified leakage values 21 varied in the range of slightly in excess of 1 gpm to 22 approximately 2-1/2 gmp.

23 So they were in excess of their unidentified 24 technical specification requirements in that regard. 25 During the hours immediately prior to the shift,

1 we also noted during the review of the log book, and this 2 would be 3-1/2 to 4-1/2 hours prior to the actual accident, 3 the rate at which they were adding water to the makeup 4 system, and to the reactor coolant system, increased 5 substantially. They typically would add about 26.00 gallons of water per shift to the operating plant, to make up the 6 7 water loss rates, the major loss rate being through either the pilot-operated relief valve, the EMOV or one or more of 8 9 the safety valves.

10 I'm not sure where precisely that leakage was 11 coming from, but there was leakage coming from that area, 12 and it was collected by their system. It was within 13 limitations; it was within the prescribed limits for 14 identified leakage, that is, it was identified as to the 15 general source, not the specific valve.

16 They were within their limits and as a consequence 17 of that limit they had to make up about 26.00 gallons per 18 shift. It appears that just before the accident that 19 leakage rate jumped to a rate of approximately 3600 gallons 20 per shift. That is, had the shift gone to completion, they 21 increased the rate at which they were adding water.

We do not and have not been able to ascertain the reason why that has occurred. The records for that period of time are not available, and of course the accident ensued for shortly thereafter.

1 COMMISSIONER AHEARNE: When you say the records 2 are not available, do you mean they're gone? 3 MR. MARTIN: The subsequent leakage rate 4 calculation that would be done on the following shift had 5 the accident not occurred, which would identify the source, 6 never got to come to pass. By that I mean there are no 7 records. 8 COMMISSIONER BRADFORD: But when you say, the 9 reason why, surely someone can explain to you why they re adding 3600 instead of 2600. 10 11 MR. MARTIN: We know that the reason they were 12 adding it is because their makeup tank level as part of their volume control system was showing the need to add 13. 14 water. What they needed it for, in the sense of where the 15 additional water was goind, we are not able to determine. 16 COMMISSIONER BRADFORD: You say in the report that 17 operation of the unit during the period March 25 to 28th had 18 an unidentified leakage rate in excess of a gallon 19 permitted, is under consideration as a possible item of 20 non-compliance. Can you talk about that consideration? 21 COMMISSIONER AHEARNE: They're going to cover all 22 of those at the end. 23 COMMISSIONER BRADFORD: Okay. 24 MR. MARTIN: You will find that wording consistent 25 throughout the report.

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1 COMMISSIONER BRADFORD: That's what I wanted to 2 think about. 3 COMMISSIONER AHEARNE: I think they intend to cover that. 4 5 COMMISSIONER BRADFORD: Including the definition 6 of the phrase? 7 MR. MOSELEY: Yes. sir. 8 CHAIRMAN HENDRIE: Vic noted at the beginning of 9 the presentation that this report is presented in order to make the information in it available publicly well in 10 11 advance of a determination of specific items of 12 non-compliance. It's going to take him about 60 days to 13 shake those down, and that it's possible that on some or all 14 of those he might conclude that he would want to see the 15 results of some of the other investigations that are going 16 on, particularly, I.think, the Commission's own special 17 inquiry, in which case it would be longer. 18 So that when one comes here to items which are 19 potentially items of non-compliance, that language is used 20 just to indicate that this report does not constitute a set 21 of findings on that. .22 COMMISSIONER BRADFORD: What I'm interested in is, 23 the sequence at least from consideration to determination. 24 CHAIRMAN HENDRIE: Well, in the first instance the 25 director's analysis and the staff's analysis of the

potential non-compliance items, of which there is a list presented at the back of the report, on which we'll hear more from Norm later on.

4 MR. MARTIN: As you may recall, in the discussion 5 or briefing in May the exhaust tailpipe temperatures on both 6 the safety valves and the EMOV were running above 7 procedural limits. I include that only as part of the 8 general restatement of the general conditions.

9 Nothing has changed in that. They were running above the procedural limits then established, and no new 10 11 procedural guidelines had been established by the plant 12 management to inform the operators of what sort of collective actions to take in light of the fact that now the 13 14 temperatures were-close to the action levels, that their 15 procedural guidance would have indicated the point at which 16 they should take action.

17 So this was an operating procedure which had, 18 because of plant conditions, generally fallen into a disuse 19 kind of level. The staff on duty met the technical 20 specification requirements; in fact, they exceed the 21 technical specification requirements for staffing. There 22 was one shift supervisor assigned to Unit 2. There was an 23 additional shift supervisor assigned to Unit 1. The reason 2.4 for the additional shift supervisor was the fact that Unit 1 25 was coming out of a refueling outage and that was additional

1 management staff assigned because of the increased activity 2 during the refueling outage. Normally there would have only 3 been one shift supervisor at the plant.

4 COMMISSIONER AHEARNE: By staff on duty, you mean 5 both plants together?

6 MR. MARTIN: There would have been only one shift 7 supervisor for both units, except for this unique 8 circumstance of Unit 1 coming out of a refueling outage. 9 That shift supervisor assigned to Unit 2 was in the office 10 in the control room, immediately adjacent to the control 11 room at the time of the accident.

12 There were a shift foreman as required, who is a 13 senior reactor operator licensed individual as is the shift 14 supervisor; there were two control room operators in Unit 2 15 which is the normal staffing for the singular Unit 2; and a 16 total of eight auxiliary operator available at the plant.

17 And that does meet or exceed the staffing 18 requirements. Two of those auxiliary operators and the 19 shift foreman, as you may recall from the May briefing, were 20 working in the area of the condensate polishing units --21 these are basically a dimineralization system for 22 purification of feed water to the steam generator, and they 23 had been working there approximately 11 hours at the time, for the purpose of trying to clear a trench for operation of 24 25 resin, and to clear a resin block that had occurred.

1 COMMISSIONER AHEARNE: Those three people 2 specifically had been there for about 11 hours? 3 MR. MARTIN: I'm sorry, that operation had been in 4 effect for about 11 hours. Those men had been there since 5 the start of that shift which was at 11:00 p.m. the previous 6 meeting. 7 (Slide.)

8 MR. MARTIN: Okay. The turbine trip occurred, as 9 I'm sure we all can remember, at 37 seconds after 4:00 10 a.m. on that morning, on March 28th. The turbine trip was 11 caused by loss of all feedwater, which I may not restate 12 later on, but that loss of all feedwater on this plant is an 13 analyzed accident for the facility, as it is for all such 14 facilities.

15 The cause of the feedwater loss has not been 16 definitely determined by this investigation. We have looked 17 at the work that has been done by the licensee, through the 18 courses of our interviews with the staff, the people that 19 were involved, the operators, the auxiliary operators and 20 everyone else who has worked with those condensate polisher 21 units.

We have not been able to ascertain the exact cause. We do feel the most probable cause is associated with some malfunction of the isolation valves on the condensate polisher units, possibly, if not even probably,

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due to the introduction of water into the air system. But we cannot, you know, definitely ascertain that was the cause.

4 COMMISSIONER KENNEDY: And this could have been 5 associated, then, with what was going on to produce the 6 blockage?

7 MR. MARTIN: Yes, sir. That was the hypothesis we 8 presented back in May, and I think it is the most likely or 9 the most probable hypothesis and would probably stand the 10 test of time. But we cannot make a direct finding in that 11 area.

12 COMMISSIONER AHEARNE: But that particular point, 13 I gather, Vic, is not necessary still for reaching your 14 conclusion, that is, your conclusion was even if all 15 feedwater had been lost, so that why 'it was lost isn't 16 important to reaching the conclusion, that had procedures 17 been followed, et cetera --

18 MR. STELLO: That's correct.

MR. MARTIN: We wanted to try to ascertain it, to be able to assure that there was no other surreptitious cause of the accident occurring. But we were not able to do that in that regard.

All right, a detailed sequence of events, of course, is in Appendix 1-A, and I will not even presume to try to go through that or any portion of it, but if I may

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take a few moments, I would like to just re-remind you of certain highlights into which some of our further comments may be brought into focus.

4 COMMISSIONER BRADFORD: What did you mean by the 5 phrase, surreptitious cause?

6 MR. MARTIN: I chose that word very poorly. What 7 We wanted to do, over the period of this investigation we 8 have always been sensitive to the fact that there is a 9 concern that the reason for the trip or the reason for 10 actions taken or the reason for the accident, the reason for 11 the closed emergency feedwater valves, and a number of 12 things was an overt act of an individual.

So we were sensitive to that possibility throughout this entire investigation, and we have not found anything throughout the entire four months of interviews and other things that would lead us to believe that there was anything there that we should turn over to another investigating agency, federal agency, that is, an improper act, an overt act, a criminal act, an act of sabotage.

Now, it would have been, I think, for the public good very worthwhile if we had been able to ascertain absolutely that that was the cause, and in certain areas we have not been able to do that.

But we have also not found anything that would lead us to believe that anything overt took place. So I am

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in the position of being able to tell you, I cannot rule out absolutely certain things, but we certainly did not find any evidence of anything other than what we are proposing as the most likely hypothesis.

All right, if you recall the basic aspects of the sequence and part of the initiating event is after the turbine trip, the EMOV failed to reclose — that ultimately resulted in a large loss of reactor coolant system inventory.

May I have the next slide, please?

(Slide.)

12 MR. MARTIN: Then that caused the particular parameter that caused a great deal of confusion and 13 14 disruption to the operators and many of their actions, is 15 the unanticipated high indicated level in the pressurizer. 16 And that fact will pervade the actions that the operators 17 take throughout the course of the event. The continuing 18 high level of the pressurizer despite a loss of inventory, 19 the reactor coolant system pressure did continue to drop 20 during the early phases to a low point of about .660 psi was 21 reached at about 2.3 hours.

22 . That was the point at which the EMOV was diagnosed 23 as being open, the EMOV was closed and reactor coolant 24 pressure system started to recover. The reactor coolant 25 pumps were tripped at 74 and 101 minutes into the accident,

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1 and natural circulation was not established. As a result of 2 the conditions that existed at the time the pumps were 3 tripped --

4 COMMISSIONER GILINSKY: Could I ask you about the 5 reactor coolant pumps? As I read the report, it seems to be 6 saying that they should have been tripped at some earlier 7 point; is that right?

8 MR. MARTIN: May I ask you to defer that question? 9 I am going to treat that one specifically in about one more 10 slide. I'll be coming to that point. The open EMOV, as you 11 recall, was isolated at 2.3 hours. By 2-1/2 hours, the 12 core had been uncovered to some degree, fission product 13 released and hydrogen generated because of the metal-water 14 reaction.

15 And in the remainder of the sequence, let me just 16 generally characterize it. There was a period of time in 17 which the emergency staff attempted to repressurize to fill 18 the loops, to be able to establish natural convection and to 19 be able to run coolant pumps. They then depressurized the 20 system to attempt to use the decay heat system. And then, 21 in the final 2-1/2 hours or so of the 16 hour accident 22 sequence, they repressurized the system and finally sent a 23 reactor coolant pump into operation.

24 COMMISSIONER AHEARNE: I gather that there are no 25 significant new developments in chronology?

1 MR. MARTIN: That's correct. From that standpoint 2 of the significant actions and the general course of events 3 that was chosen by the emergency team that was directing activities, there were no major changes from our May 4 5 presentation. 6 May I have the next slide, please? 7 (Slide.) 8 MR. MARTIN: When we looked at the shift crew 9 actions, those things that we considered to be the most 10 significant shift crew actions that occur, I think I would .11 like to ask you to recognize the first two items that we 12 have on the slide and that is. I believe mind-set was the 13 term that was used in the introduction. I think it adequately characterized ---14 15 COMMISSIONER GILINSKY: Could you just say a word 16 about the training of the operators who were on duty at the 17 time, as a preface to this. 18 MR. MARTIN: Okay. If I include the shift 19 supervisor assigned to the Unit, the two control room 20 operators and the shift foremen, those -- I'm trying to go 21 down all of those men, those four individuals that I 22 described, licensed operators assigned specifically to Unit 23 2 were ex-Navy-trained individuals. They had gone through 24 an abbreviated auxiliary operator training program because 25 of their extensive prior Navy experience. They went through

the complete operator training program for the licensee, and then all were licensed either at the senior reactor operator or reactor operator level.

I'm trying to run down the list very quickly.
COMMISSIONER GILINSKY: Were they trained on
simulators?

7 MR. MARTIN: Yes, it was the complete training 8 program which included training on the simulator.

9 COMMISSIONER AHEARNE: You said that they had
10 attended from for five to nine weeks?

MR. MARTIN: They had a complete training program. None of them had recieved an abbreviated course. When I mention the abbreviated course, there is a progression from auxiliary operator to control room operator, and for people with prior nuclear experience --COMMISSIONER GILINSKY: That have previously been

17 operators in the Navy?

MR. MARTIN: Either in the Navy nuclear program or at another reactor but that is the only place where the abbreviation occurs, not in the control room operator.

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1 COMMISSIONER AHEARNE: In looking through the list 2 in your document, it appears that they all have a very 3 extensive amount of experience. 4 MR. MARTIN: Yes. sir. I think the total 5 experience of those four people in that room would probably 6 total 20 or so man-years of experience at TMI and something 7 close to 40 to 45 man-years of total applicable nuclear 8 experience. 9 COMMISSIONER KENNEDY: How would this be classed. 10 would you judge, with the average plant? .11 MR. MARTIN: I saw nothing uniquely increased or 12 decreased in terms of the total amount of experience 13 available on the shift at that time. COMMISSIONER KENNEDY: So it's fairly typical? 14 MR. MARTIN: I would say so. Yes, sir, based on 15 .my experience. I think that that's a correct statement? 16 17 . All right. With regard to the shift crew actions, recognizing the mind-set and that they were repeatedly 18 19 trained to avoid solid pressurizer operation at all times, 20 never to take the plant solid where you lose the ability of 21 the bubble to mitigate pressure transients, and the second 22 one — part of their training was that whenever there is an 23 RCS inventory loss, they would expect to see a reducing 24 level or a reduction in level in the pressurizer. 25 Therefore, if they see reduction in level, they can couple

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that to inventory loss. So with that mind-set --1 2 COMMISSIONER GILINSKY: When you say "trained", 3 does that include "instructed" in the procedures on this 4 plant? 5 MR. MARTIN: This would include instruction in procedures. This would include the instruction on the 6 7 simulator. This would include class instruction. 8 COMMISSIONER GILINSKY: Were there specific 9 written instructions on this plant? 10 MR. MARTIN: I believe the answer is yes. I .11 cannot recall it off the top of my head. 12 COMMISSIONER GILINSKY: Does that mean, in effect. 13 that there were conflicting instructions on keeping our 14 pressure injection on and avoiding pressurizer --15 MR. MARTIN: No. sir. I would not say so. I 16 would say the guidance, as it was presented in those 17 procedures, was where to achieve pressurizer levels. But 18 the clear primary instructions addressed recovery of 19 pressure and recovery of level in the reactor coolant system 20 in the event of a loss of coolant system pressure. I do not 21 believe -- in my view I would not consider them to be conflicting requirements in the way in which they were 22 23 presented in the procedure that the men were using at that 2.4 time in recovering from this particular accident. 25 CHAIRMAN HENDRIE: In terms of the written

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procedure?

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2 MR. MARTIN: Yes, in terms of the written 3 procedures they utilized.

4 CHAIRMAN HENDRIE: But apparently in terms of the 5 shift work practices and operating practices, they did focus 6 very heavily on that pressurizer level to the exclusion of 7 apparently other indications.

8 MR. MARTIN: That's correct, sir. That was a 9 primary parameter that their training, not their procedural 10 requirements as such, but their training led them to always 11 key on pressurizer levels.

12 COMMISSIONER AHEARNE: Was the training that 13 explicit, or it went so far as to do just what you said? 14 MR. MARTIN: I would say it was consistent and 15 explicit. It was consistently reiterated and explicit. 16 COMMISSIONER AHEARNE: But that was a dominant

17 instrument.

18 MR. MARTIN: Yes, sir. So there were four 19 conditions, we believe, that contributed to the sequence of 20 the accident as it occurred_over the 16 hour period. Now, I 21 think at this point I would like to stress that we will 22 discuss through this what the rationale of a number of the 23 operators were in taking the actions that they took, but not 24 that this was knowingly or intentionally done to aggravate 25 the accident but, we believe, did in fact aggravate the
1 course, the sequence, or the duration of the accident. 2 Okay, the first one has to be the throttling of 3 the high pressure injection to minimum values. From the onset of the accident and for a period of three and a half 4 5 hours, the operating staff reduced high_pressure injection 6 flow to a minimum. We found that the average flow over this 7 three and a half hour period was a net input to the reactor 8 coolant system of 70 gallons per minute from the borated 9 water storage tank. In fact, if one subtracts the two periods during that three and a half hour time frame at 10 11 which the high pressure injection was operating fully 12 automatically and therefore at maximum output rate of 13 approximately 1000 gpm, the net flow for the remainder of 14 that period for the majority of the three and a half hours 15 was actually trimmed down to approximately 25 gpm. So the 16 operators had severely throttled high pressure injection 17 flow for about three and a half hours.

18 The second_item was the continued operation of the 19 reactor coolant pumps below pressure limits. The same 20 procedure requirement that the operators were using at that point called for tripping of the reactor coolant pumps in a 21 22 situation of dropping reactor coolant system pressure at 2.3 1200 psi decreasing. When pressure is dropping, they ought 24 to trip the pumps before passing through 1200 psi. 25 COMMISSIONER GILINSKY: Now this is a point you

1 have not made to us before, as I recall. 2 MR. MARTIN: That's correct. sir. 3 COMMISSIONER AHEARNE: It's a similar point. 4 though, that Mattson made to us. 5 MR. MARTIN: Now their procedural requirements are 6 that they should have tripped the pumps. Now that condition 7 was satisfied approximately 15 minutes after the start of 8 the accident. Now, I do understand and I am aware that there is some debate going on as to the advisability of 9 10 continuing or not continuing to operate those pumps. I know 11 that an I&E bulleting has been issued recently relative to 12 that matter, and from that standpoint what we are 13 addressing, are not trying to enter into that particular debate, was that in this condition they had a reactor 14 ' coolant system pressure loss underway. 15 16 They had a procedural requirement at that point 17 that they should have tripped the pumps, and that point was 18 reached within 15 minutes. COMMISSIONER GILINSKY: Now, how would it have 19 20 been beneficial to trip the pumps? 21 MR. MARTIN: If I may address -- by the continued .22 operation of the pumps. And based on the flow indications 23 that were received, it would appear that there was a 24 distribution of voids by continuing to operate the pumps in 25 a saturated fluid condition. And that distribution

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1 continued throughout the reactor coolant system. As soon as 2 they tripped the pumps, it would appear that all those 3 voids coalesced, and they immediately lost natural 4 convection possibility and immediately started a temperature 5 transient.

6 COMMISSIONER AHEARNE: But if they had tripped — 7 while you're raising that they didn't follow the procedure, 8 at least the implication or inference is that had they 9 followed the procedure, it would have been advantageous. 10 And so, what is it that would not have — or what is it that 11 Would have happened that would have been advantageous had 12 they tripped them at that 15 minute point?

MR. MARTIN: I'm getting into an area where I would_really feel much more comfortable if I were supported by substantially more analytical work. We do know physically what occurred. To conjecture what might have occurred, from my standpoint as a field investigator --

18 COMMISSIONER AHEARNE: Okay. Then I would turn to 19 Vic, because I think this begins, at least —— it sounds like 20 it's getting into the area that you referred to in the 21 beginning, had they followed the procedures.

MR. STELLO: This isn't what I had in mind when I made that statement, however. This is an example of what I have in mind when I suggest that I want to study very hard whether this ought to be an item of non-compliance. You raise a question --

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COMMISSIONER AHEARNE: So the point here is that they didn't follow the procedures, but you're not yet sure whether or not --

MR. STELLO: Had they not followed the procedures. would the accident have been more severe or less severe is the issue.

7 COMMISSIONER AHEARNE: And you're not sure yet? 8 MR. STELLO: And I don't think there is an answer 9 to that question, nor do I think we will be able to answer 10 the question. Because again, you have to ask, well, if the .11 operator had tripped the pump, would he have done something 12 differently than what he did do. Since he now will have 13 been presented with some new facts and information would 14 have been different, would he have done something different? And that's so. 15

16 COMMISSIONER AHEARNE: But then as the point 17 you're making that this is an item where they didn't follow 18 procedures -- and the significance is totally restricted to 19 that, that they didn't follow procedures --

20 MR. STELLO: They didn't follow the procedures, 21 and this is an example of one which is a potential item 22 of non-compliance. They kept the pump running. There's a 23 substantial argument that can be made that says the fact 24 that the pump was running in this instance clearly kept the 25 core cool. The forced circulation mode, at least instincts

tell you, if you want to keep the core cool to remove heat, keep a high forced circulation flow rate.

3 COMMISSIONER GILINSKY: I thought that up until 4 now we were told that the operator should not have turned 5 off the pumps when they did. Sometime later on.

6 MR. STELLO: And subsequent to that, we've been 7 going back and looking and asking the question and have 8 issued new instructions suggesting that they ought to trip 9 the pumps early, with some other provisions.

10 COMMISSIONER GILINSKY: Let me go back to this 11 list. You've got it listed under conditions which 12 contributed to the accident, and it's in with throttling the 13 high pressure injection and failure to isolate.

MR. STELLO: We discussed this yesterday and came to the conclusion we were hard pressed to say it contributed to the accident. And I was trying to leave you with the conclusion that had they not tripped it. I don't believe you can say that it would have been the accident less or more severe, if they had tripped it 15 minutes --

20 MR. MOSELEY: I think when we talked about it 21 yesterday, Vic, we concluded that it's appropriate to leave 22 it in that list because, as a matter of fact, the core 23 damage did follow shortly after that and, indeed, tripping 24 it at that point in time did cause the bubble formation. 25 COMMISSIONER AHEARNE: But Norm, this is 15

minutes in. Are you saying the core damage occurred shortly 1 2 after that? 3 MR, MOSELEY: No. What the statement savs is -- I 4 guess the statement is misleading -- it is misleading. 5 CHAIRMAN HENDRIE: The pumps were tripped 1.00 6 times ---7 COMMISSIONER AHEARNE: Yes, I know. But at this 8 point that the procedure would have had it tripped, was it ò 15 minutes? 10 CHAIRMAN HENDRIE: Yes, just so. MR. STELLO: And you cannot conclude that had they .11 12 tripped them at 15 minutes, that the accident would have 13 been either more or less severe. COMMISSIONER AHEARNE: So it's sort of a three 14-15 prime ---16 MR. STELLO: When we went through it yesterday, we 17 were arguing as to whether it ought to or ought not to be, 18 and we left it in there, quite frankly, because I don't 19 think we really had enough time to change the slides and 20 make more copies. 21 CHAIRMAN HENDRIE: Good. Onward. I don't want to 22 slight anything, but ---23 MR. MARTIN: I see the time is moving. 24 The third item was the failure to isolate the EMOV 25 in light of the evidence that was available. The area that

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1 we feel contributed most significantly to this was the fact 2 that the continued operation for a long period of time with 3 EMOVs at high temperature lacked now the specificity to the 4 operators of having clear evidence of when they should 5 isolate the EMOV. However, we could not ascertain during 6 the course of the investigation an adequate explanation, in 7 our view, as to why it took as long as it did in light of 8 the evidence, which was dropping reactor coolant system 9 pressure, the ruptured disk on the reactor coolant drain 10 tank, and the like.

11 COMMISSIONER AHEARNE: You're saying that there 12 were enough secondary indications that should have led the 13 operators to conclude that the EMOV was open?

14 MR. MARTIN: Yes. Okay. The item was the failure 15 to establish the conditions for natural circulation between 16 the tripping of the first set of reactor cooling pumps and 17 the second set of reactor cooling pumps. That was, again, 18 during the period during which high pressure injection was 19 maintained a minimal amount, and it was a period in which 20 there was a constant degradation of the flow, reduction in 21 the indicated flow rate out of the second set of reactor 22 coolant pumps. The operating staff was addressing, looking 23 towards the putting of the pumps or putting the plant into natural circulation. 24

But at that particular period of time, the

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combination of reactor coolant system pressure and temperature were outside of the established limits for successful establishment of natural circulation, and the operators did not take action during that period of time to bring the reactor coolant system into those established limits.

COMMISSIONER GILINSKY: Do you believe they could
 have gotten to natural circulation at that point?

9 CHAIRMAN HENDRIE: Let's ask first whether they 10 could have gotten the system apparently within the 11 pressure-temperature range. The system had voids. Whether in 12 fact you could have made the circulation go is a second 13 question.

MR. MARTIN: I would prefer to answer that in such 14 15 a way that I really cannot. I don't know if they would have 16 been able to. But had they increased high pressure 17 injection substantially to bring it into the 18 temperature-pressure bounds that were required, they may 19 have been presented with new evidence, such as the behavior 20 of the system, which indicates that the plant was not solid, 21 as they thought it was -- a different pressure behavior. 22 therefore perhaps a different level behavior, a different temperature behavior -- and then once given that set of 23 24 circumstances, I don't know how the operators would have 25 acted.

1 But the point was that we're trying to stress here 2 is that they did not take -- although they were 3 aniticipating and moving toward going into natural convection -- they did not take the steps to bring it into 4 5 the appropriate bounds, to successfully establish it. 6 Whether or not it would have been possible, I can't really 7 address, depending on what actions they would have taken. 8 Basically, they tripped the pumps, and they just 9 hoped that natural circulation would follow. Yet they were 10 outside the bounds for it to have done so. 11 COMMISSIONER AHEARNE: But is D, then, 12 substantially different than A, B, and C? 13 MR. MARTIN: Yes, sir, because of the time frame. 14 That is, they were moving in between the tripping of the two 15 sets of pumps. They were moving towards a condition in 16 which they were thinking in terms of establishing natural 17 circulation, and they did not take steps to do so. 18 COMMISSIONER AHEARNE: But the steps that you 19 pointed out they might have taken is, essentally, if they 20 didn't do A ---21 MR. MARTIN: It is hard for me to keep from 22 interrelating all of these, because clearly high pressure 23 injection being throttled to a minimum would have been 24 related to D as well. 25 All right. Now there were two actions that

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occurred.

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2 CHAIRMAN HENDRIE: There are other things 3 connected to system pressure, so it isn't just high pressure 4 injection that you might have exercised to try to get within 5 the natural circulation operating envelope.

6 MR. MARTIN: There were two actions taken by the 7 operating staff in the early hours that, as we can see, did 8 not contribute at all to the accident as it evolved. We 9 point them out because we consider them to be essentially 10 two significant events, had a different course of action 11 evolved suddenly and unexpectedly.

12 The first is that after automatic initiation of 13 high pressure injection, the system calls for the emergency diesel to start up, and should they be needed to provide 14 15 electrical power, they would already be operating and ready 16 to run. They did so. They started with the first high 17 pressure injection, and they ran for 28 minutes. They then 18 shut down the diesels, as is appropriate under procedural 19 controls. They shut down the diesels because they were 20 running_unloaded. Therefore, they were running a risk in 21 putting them in a position where they would not start again 22 if they were needed for an unloaded operation.

But when they shut the diesels down, they did not reset the start mechanism. So, as a result, those diesels could not have started on automatic initiation, had there

been a need for them during a power failure, if a power failure had occurred.

3 Now, none had occurred throughout the course of the accident. They did have normal power. If there were 4 5 one to have occurred, the diesels would not have started and would not have picked up the load. That occurred about 30 6 7 minutes into the incident. About five and a half hours into 8 the incident, an engineer, I believe it was, spotted the 9. flag indicator showing that the diesels were in this rather 10 unusual condition and, therefore, not capable of starting. 11 And it was decided that they would put them at least into a 12 position where they could manually start them.

13 So they took certain actions.

14. CHAIRMAN HENDRIE: From the control room, that is?
15 MR. MARTIN: From the control room, yes, sir.
16 COMMISSIONER AHEARNE: Why didn't they put them
17 back into the automatic start?

18 MR. MARTIN: Why? At the five and a half hour 19 point, at about 9:30 in the morning, the reason they didn't 20 put them back to the automatic start mode was that they felt 21 that their power grade was very reliable. They didn't have 22 power. They didn't need the diesels at the 9:30 time frame 23 to shut the diesels down, if they started, means sending a 2.4 man out to the auxiliary building when they auto-start on a 25 high pressure injection system. They can't stop them in the

control room. They must send a man to the auxiliary 1 2 building, which by then was radioactive. 3 COMMISSIONER AHEARNE: So when they stopped them 4 at the 30 minute point, it was by sending someone down? 5 MR. MARTIN: That's correct. Now we have not 6 ascertained who stopped them at the 30 minute point, who 7 ordered them to shut down, and who ordered them to be put in that position. I can only address the rationale that was 8 9 given at the 9:30 frame, 9:30 in the morning, when they gave 10 manual start capability back into the control room. 11 COMMISSIONER GILINSKY: What would have been the 12 significance of the unavailability of the diesels? 13 MR. MARTIN: If there had been a power outage, it 14 would have required someone to go down, reset the diesel 15 fuel racks, get the diesels started, and then let the system start to pick up itself. It would have introduced a time 16 17 lag into those safety related systems that are fed from the 18 diesels over and above what would normally be included in a 19 normal startup. 20 COMMISSIONER GILINSKY: That couldn't be done from 21 the control room? .22 MR. MARTIN: No, sir, not when they start under 23 emergency starting conditions of that sort. Then the only 24 way they can be tripped is from outside, and then might be

25 reset from outside to return the capability for automatic



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COMMISSIONER BRADFORD: Let me take you back to 3(b) for a minute, failure to establish conditions for natural circulation. You concluded in the report that the people in the control room were in fact not trained in the methods of establishing natural circulation.

MR. MARTIN: That's correct, they had not received specific training.

COMMISSIONER BRADFORD: But what really contributed to the accident was less their failure to do it than their failure to be trained to do it.

MR. MARTIN: I think both contribute to the actions that were taken. Perhaps that would be conjectural on my part. They are both facts that, one, they did not take the actions, and two, they were not trained. And I would not want to rank the relative contributor of one to the other.

COMMISSIONER BRADFORD: I ask it only because of the overriding conclusion of what's really disturbing here is the failure of the operators to do certain things. If this is one of those things, if the report separately concludes that they weren't trained to do it, then what may be really disturbing may reach back into the training program, mather than simply lie with these particular operators.

MR. MARTIN: I think training has a very substantive role in this accident. I think certainly the mind set with regard to pressurizer level that we discussed previously is

heavily related to training activities. So training, I think, 1 2 plays a very significant role, the training of the operators 3 p hys a very significant role in the actions that they took. COMMISSIONER GILINSKY: Well, did the operators Δ 5 understand that they were outside the natural circulation regime, the pressure-temperature region in which you could get 6 natural circulation? 7 MR. MARTIN: I know a number did. I also know that 8 Ģ some of the people in the control room had pulled the NPSH 10 curves to the pumps because they were worried about suction 11 pressure. I should address it in the report, and what I'm 12 afraid of doing is giving you a very pat answer and not in 13 exactly the wording which is used inside. 14 COMMISSIONER GILINSKY: You said earlier that they turned off the pumps and hoped, was I think the word you used. 15 16 MR. MARTIN: There was basically a hope that 17 natural circulation would occur. 18 COMMISSIONER GILINSKY: Knowing they were outside 19 the regime for natural circulation? 20 MR. MARTIN: Could I turn to one of the members, who 21 I think might answer better, and just remind me whether or not 22 they had -- Norman or Tim, did they have the PT curves out for natu al circulation? 23 24 VOICE: Yes, they did. The pressure-temperature

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relationship for tripping the reactor coolant pumps

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is on the same curve as the natural circulation requirements are presented. So by being outside as they approached the limits to trip the reactor coolant pump, they also were exceeding the limits where natural circulation could have possibly been established.

6 MR. MARTIN: So they did have the appropriate table. 7 COMMISSIONER BRADFORD: But these are people--you 8 say the shift personnel associated with the accident had not 9 received specific training on the natural circulation aspects 10 on the site, either at the facility or at the simulator. So 11 who knows what they recognized under the pressures of the 12 accident.

MR. MARTIN: It is true they did not receive specifictraining.

15 CHAIRMAN HENDRIE: Had the unit ever been on natural16 circulation cooling before; do you know?

MR. MARTIN: I don't know that, sir. I would assume
at least during the preoperational test program, but that's
an assumption.

20 COMMISSIONER AHEARNE: Did your group make any 21 judgment -- you pointed out there were a number of procedures 22 they didn't follow, and had they followed these procedures the 23 serious consequences wouldn't have occurred. Do you know 24 enough about what they do, what kind of training they went 25 through, to say that, had they followed the level of the

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training that they had been given, what would have happened? That's I think what Mr. Bradford's point is, that it's one thing to have a set of procedures and a piece of equipment, and it's another thing to be trained on how to use them.

5 MR. MARTIN: It's my conclusion, based on the 6 training that we understand them to have received and our review of their training, that their fundamental training and 7 level of knowledge should have been sufficient for them to 8 ò recognize that they were in a very adverse set of circumstances, 10 moreso than an unusual trip; and that , coupled with the 11 instructional guidance they had and the procedure they were 12 using, which was the procedure on the loss of reactor coolant 13 or reactor coolant system pressure, they should have recovered 14 'from the coupling of that level of education and the procedural 15 instructions that were available. They should have recovered 16 from the transient as they got into it.

COMMISSIONER GILINSKY: Could I just ask your are members of the team that conducted this investigation -- have any of them held operator's licenses?

20 MR. MARTIN: Running down through the list, yes, yes.
 21 MR. STELLO: How many of you have operator's licenses
 22 or have ever had one? Raise your hands.

(A show of hands.)

MR. STELLO:

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MR. MARTIN: And myself.

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COMMISSIONER GILINSKY: Three.

The other point that we were able to MR. MARTIN: ascertain is that during the early phase of the incident, during the period of decreasing reactor coolant system pressure, again, because of the conviction that the reactor coolant system was solid or had adequate inventory, again because of the pressurizer level, the core flood tanks were isolated 7 during the period when it was approaching the injection point for the core flood tanks. And we then re-isolated, clearly, 10 at some point later on, because those were used later during 11 depressurization.

12 The only reason we bring those up is, again, there's 13 a second example of an action taken that had a leak out of the 14 EMOV or at some other point, got worse, and had there been 15 rapid depressurization those core flood tanks would have been 16 isolated for a long period of time.

17 Okay. Once the management staff arrived and set up ì8 the emergency team that directed both operational and off-site 19 activities. And Al, of course, will address the major portion 20 of the emergency plan implementation. But with regard to the 21 actions taken on operational decisions, basically, an internal 22 command team was set up to provide advice to the station 23 manager on plant conditions.

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the directions that they took was that they appeared to utilize

Our basic understanding of the actions they took and

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the operating plant parameters very well in the decisions that 1 they reached, with four specific exceptions that we would 2 3 comment on.

One is the disbelief by them of the high system, Δ process system of in-core temperatures. This information was 5 6 being presented to them in about the 8:00 a.m. to 9:00 a.m. time frame. What we have not been able to ascertain at this 7 point -- let me back up a little. 8

We have been able to ascertain what data was accumu-9 10 lating and what those numbers were. We have talked to the 11 people who took that data, the high in-core temperatures that 12 were monitored during that period, and some of the process 13 system.

14 What we have not been able to ascertain is, because 15 of the existence of this, if you will, an inner circle or 16 caucus to make operational decisions and pass information to 17 the plant manager, we are not able to ascertain how much of 18 that information actually got to the plant manager. The plant 19 manager recalls being given a few data points with largely diverse numbers, whereas our report, which shows a total listing 20 21 of all the data available, would show overwhelming evidence of 22 something else.

We were not able to ascertain how mouch data in fact 23 actually got to the plant manager. So in this regard, the disbelief may well have been based on the lack of a substantial

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1 number of data points.

COMMISSIONER GILINSKY: When was the period of major core damage. What I am getting at here is, suppose the plant managers or NRC knew at 8:00 a.m. that temperatures in excess of 2,000 degrees were being read, which I gather was 6 the case, or between 8:00 a.m. and 9:00 a.m. Could actions 7 have been taken at that point to mitigate the extent of core damage?

9 MR. MARTIN: My understanding is that the major 10 extent of core damage occurred in this 6:30 to 7:30 time frame, 11 two and a half hours. These were, I think, readings taken 12 after what I believe is the assessment for the major period 13 of core damage.

14 The answer is yes. Any time you would MR. STELLO: 15 have put on more water and got more water in the core, you 16 would have mitigated the amount of damage that the core had. 17

(At 10:45 a.m., Commissioner Bradford left the room.) 18 COMMISSIONER GILINSKY: I'd say it depends on what 19 time we're talking about, doesn't it?

20 MR. STELLO: It doesn't depend on that at all. The 21 accident was finally terminated by putting more water through 22 the core. Had that been done at any time earlier than that, 23 it would have caused less damage to occur.

COMMISSIONER GILINSKY:

The question is how much

24 eperal Reporters, Inc.

25 In other words, when was the period of major damage? less.

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MR. STELLO: Almost in proportion to the amount of time earlier you did it.

COMMISSIONER AHEARNE: Could you give a between? CHAIRMAN HENDRIE: There were a couple of bad patches, one in about the third hour, as I recall, after the tripping. The HPI had been throttled back, way back, continuing to lose water out the relief valve. The coolant pumps were tripped. 8 MR. STELLO: Between 6:00 and 7:00 a.m.

CHAIRMAN HENDRIE: Yeah, between 6:00 and 7:00 a.m., 9 10 because the first strong indication of fission products loose 11 in the system turned up about what, 6:15, 6:20, something like 12 that, 6:30. And then it seems to me, then after that there was a period in which they increased the pressure by running 13 the HPIs a little harder and the pressurizer and so on, and 14 that may have probably inhibited void formation to some degree 15 16 in the core and may have improved the cooling situation.

17 But there was a later period which went on for four or five hours when they were trying to get depressurized down 18 19 into the residual heat removal system pressure rating range. And I would think that would be also a time when you would 20 have had very substantial void formation. 21

22 (At 10:46 a.m., Commissioner Bradford returned to the 23 room.)

24 MR. STELLO: There were several periods of core Ace-Federal Reporters, Inc. 25 uncovery and they clearly contributed to more core damage with

each of them.

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COMMISSIONER GILINSKY: So what you're saying is, 2 had one taken note in this 8:00 to 9:00 a.m. period of high temperatures and believed them and acted on that information, one could have significantly reduced the damage that ultimately 5 took place? 6

MR. STELLO: Surely. Don't pin me down to time. If 7 it had been taken earlier, it would have reduced damage in 8 proportion to how much earlier it was taken. Clearly, if it ς were taken at 6:30 you may have been at a point where the 10 fission product inventory conceivably could have been limited 11 to perhaps failed pins. 12

COMMISSIONER GILINSKY: Right. But the information 13 was available at 6:30. 14

COMMISSIONER AHEARNE: When was the first contact? 15 CHAIRMAN HENDRIE: Well, the core thermocouples went 16 over and began to print their off-scale marks. It must have 17 been when, around 6:00 o'clock? 18

MARTIN: There were some computer entries --MR. 19 MR. STELLO: If you were getting core damage, you 20 would have had to have the in-core thermocouples indicating 21 high temperature. 22

COMMISSIONER GILINSKY: And these were observed at 23 roughly that time? 24 Ace-Federal Reporters, Inc.

> MR. MARTIN: These were on the plant computer No.

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1	in the 8:00 to 9:00 time frame, was when a more systematic
2	evaluation of going and culling out data from the plant
3	computer, taking data from the buffer, converting it to
4	temperatures outside of the range. That's the more systematic.
5	We have been able to find computer data points in which there
6	were high values listed, but we don't know that there was a
7	systematic effect attempt on the staff to program them up.
8	COMMISSIONER GILINSKY: Were any amounts measured of
9	those?
10	COMMISSIONER AHEARNE: I think the question is when
וו	was the earliest time that a high temperature was actually
12	called up?
13	COMMISSIONER GILINSKY: I'm sorry, I understood you
14	to be saying
15	MR. STELLO: Let me try it again. The in-core
16	thermocouples are on the computer, and they go off-scale at
17	about 700 degrees. There were times subsequent to that that
18	people saw very high temperatures that were measured directly
19	in the cable spread.
20	COMMISSIONER GILINSKY: You were saying that was
21	8:00 to 9:00 o'clock.
22	MR. STELLO: The point I'm trying to make is, once
23	the thermocouples have gone off-scale on the computer is an
24 Ace-Federal Reporters, Inc.	indication of a superheat condition, at which time you could
25	have decided, I didn't have enough water in the core, and began

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adding more water at that time. 1 Sure, but did anyone notice 2 COMMISSIONER GILINSKY: 3 those values going off scale? COMMISSIONER AHEARNE: That's my question. When was Å the earliest time that they actually measured or noticed the 5 ъ high temperature? 7 That's the trick. MR. STELLO: 8 COMMISSIONER GILINSKY: I was simply picking up on 9 his remark that they knew about high temperatures between 10 8:00 and 9:00 o'clock, and I was asking you if they acted on 11 that information, could they have significantly reduced the 12 amount of ultimate core damage. And you're saying yes. 13 MR. STELLO: Yes. You know when they first observed .14 the thermocouples going off-scale on the computer, the first 15 time they called it up. 16 MR. MARTIN: The first entry that we have down, 17 based on the data records, there was one singular one and I 18 know we have it in the report and I don't recall the time. But 19 the first time at which there was a repeated entry was starting 20 at 6:55 a.m. on one in-core location, 657720. 21 COMMISSIONER GILINSKY: This is off the computer? 22 This is off the computer. MR. MARTIN: COMMISSIONER AHEARNE: Did that mean it had been 23 24 called up? eral Reporters, Inc. 25 MR. MARTIN: In this case they had been called up.

1 This is a case in which, if it goes off scale, it rings a 2 question mark; then as soon as it comes back on scale, it 3 prints out the current value as it comes back on scale. We Δ tracked through the computer and found what the time history 5 was of those various points when that was occurring. 6 COMMISSIONER GILINSKY: Let me pin this down. Are 7 you saying at 6:55 someone on the staff was aware --8 COMMISSIONER AHEARNE: No, he didn't say that. ş MR. MARTIN: No, sir, I wasn't saying that. I was 10 saying at 6:55 a.m. the computer was starting to alarm and 11 print out data. If an individual during that 6:55 --12 COMMISSIONER GILINSKY: When was the first time 13 someone in that control room knew about the high temperatures? 14 MR. MARTIN: I would say in the time frame of 8:00 a.m., 15 knew about it, was paying attention to it, and moving to take 16 some actions. It was approximately 8:00 a.m. 17 COMMISSIONER GILINSKY: When was the first time they 18 knew about temperatures over 2,000 degrees? 19 In that same time frame. MR. MARTIN: It's in the 20 8:00 to 9:00. We're basing it on interviews. We don't have 21 hard data. This is an interview, and it was in the 8:00 to 22 9:00 a.m. time track that that information was accumulated 23 off of the computer, because when you look at temperatures 24 that high, you cannot read them off of the computer. You must

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go down and make measurements.

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COMMISSIONER GILINSKY: No, I understand that.

MR. MARTIN: So it's in the 8:00 to 9:00 time frame. COMMISSIONER GILINSKY: You mentioned about not being clear whether this information was available to Met Ed management.

MR. MARTIN: To the emergency director in his capacity of directing the activities. His interviews and our discussions with him would indicate that the information as it came in to him was that there were a few temperatures registering in these values, and there was a range from zero to 2600 degrees, and only a few temperatures. The data we have would suggest that a lot more data was taken.

COMMISSIONER GILINSKY: You don't seem to make anything in the report, at least I don't find it, about their not reporting the separation to the NRC. And I don't see that listed as a potential noncompliance.

Do you not regard it as falling in that category? MR. MARTIN: No, sir, we did not view the reportability of this incident and its several factors as a reportable item of noncompliance, because they have submitted basically a report on this accident.

I think what you are speaking of perhaps is notifying us of that during the course of the accident as an item of noncompliance?

COMMISSIONER GILINSKY: Yes.

1 MR. STELLO: It's an interesting point. I'll think 2 about it. I don't think we're prepared to give you an answer. 3 And now that you've raised the question, there are several 4 others that might fall into that out of the hydrogen -- I'll 5 have to give it some more thought. 6 I don't know if there's a particular license require-7 ment that would fit or not. But I want to give it some more 8 thought. The answer is I don't know. . 9 COMMISSIONER AHEARNE: I'll try once more to get an 10 answer to the question, which is, as far as you can tell, when 11 was the first time that they knew of the high temperature. I 12 mean, I understand your point that the computer itself has this 13 information. But that's an automatic reaction, not a called-up. 14 Can you tell when it was first called up? 15 MR. MARTIN: It's addressed in here. But in any 16 event, at the point at which information was sufficiently 17 collected together that it was felt that it was important 18 enough to try to get it to the emergency director was in the 19 8:00 to 9:00 o'clock time frame. That would be the period of 20 time in which those people handling that data felt that it was 21 important to pass that information through. 22 Do I interpret correctly that, COMMISSIONER AHEARNE: 23 as opposed to some of the other items that you mentioned, where 24

the operators did not follow procedures, there's no specific

procedure to be followed if the temperatures go off-scale or

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if a large number of temperature readings go off the computer scale, or if there are indications of very high temperatures? That's correct, sir, because for all MR. MARTIN: the analyses that were performed as part of their training and development of procedures, this sequence of events was not one that occurred. So therefore they have no operating procedures to address when things go off scale. There was no anticipation that they would go off scale. COMMISSIONER AHEARNE: So that nothing -- in other words, once it got into the situation where the thermocouples were reading that high, they were going into areas that they had nothing spelled out to follow? MR. MARTIN: That's correct. ce-Federal Reporters, Inc.

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1 I will summarize the other two points. Pressurizer 2 behavior was misunderstood by the emergency team as well as the 3 emergency staff. It really addresses the same issue as was 4 addressed previously on the mind set. Also, the behavior of 5 the core flood tanks during that period of approximately later 6 on in the day when they attempted to pressurize and concluded 7 from the core flood tank discharge behavior that the core was 8 covered because of the way in which the tanks behaved, also 9 indicated a misunderstanding on their part as to, one, the 10 piping configuration, and two, whether or not the core flood 11 tank behavior would in fact be indicative of core coverage. It 12 might be, but it does not assure it; and they felt assured that 13 it was.

COMMISSIONER KENNEDY: You said a misunderstanding on their part of the piping configuration.

16 MR. MARTIN: There are two aspects. It turns out that 17 there are loop similar to the loop seal which has become a 18 topic of discussion relative to the pressurizer. There are also 19 loop seals in the lines from the core flood tanks. So, from 20 looking at the behavior of the core flood tank purely from a 21 static behavior, not considering even the deynamic aspects of 22 adding water to a hot core, but even from a static behavior it 23 would be difficult to assure core coverage just by virtue of 24 the loop seals. The

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The people in the emergency croup at that point did

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not in fact realize that that piping had been run with loop seals. So, that was a contributing factor, but not the only factor. Okay.

Á CHAIRMAN HENDRIE: Let me ask with regard to the item 5 before this last one. When the alarm printer shows an item 6 like one of those in-core thermocouples, what does it do? Does 7 it print it out? Just ding a bell or light a light? 8 It just prints it out. MR. MARTIN: 9 CHAIRMAN HENDRIE: It just prints it out? 10 MR. MARTIN: It prints it out. As I recall the 11 sequence -- and I will be glad to have someone from my team 12 correct me if I am mistaken -- but as I recall, when an in-13 core thermocouple goes off scale, it prints the question mark 14 to show that it's bad. And then when it comes back on scale, 15 it prints when it is cycled through and sought again by the 16 computer sequencing system. It prints the returning number as 17 it comes back on scale.

COMMISSIONER AHEARNE: But if it's still a question mark, it's still off scale?

MR. MARTIN: It would not print again. It would just print as it goes off scale. It would print the question marks and, I think, gives a bad term next to it, just prints "Bad" or "Such and such bad."

COMMISSIONER AHEARNE: Now, how much of a time lag at Ace-Federal Reporters, Inc. 25 that point was the printer?

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	1	MR. MARTIN: The times we're looking at, some of those
	2	were in the 6:55 to 7:00 range. If the operator pressed "Alarm
	3	suppress," and I was going to get into that discussion of the
	4	computer output, but if the operator had pressed "Alarm sup-
	5	pressors," we think he might have done that about 6:48. There
	6	would not be much time lag in any case if he had not. Up until
	7	about 6:48 we think the computer was running something like
	8	an hour and a half behind real time.
	9	COMMISSIONER KENNEDY: Is that a normal state for
	10	that computer?
	11	MR. MARTIN: No, sir, that was because of the high
	12	number of alarms coming in and just the time it takes for that
	13	typewriter to print across each line with the alarms coming in.
	14	That time lag would grow with time as the number of alarms
	15	increased.
	16	CHAIRMAN HENDRIE: Apparently, the first printer
	17	indication that the in-core was beginning to go was 30 and a
	18	few minutes. The first entry I find in the event description is
	19	No. 149 at 31 minutes.
	20	COMMISSIONER GILINSKY: Does that mean that the printe:
	21	was, in effect, not contemplated for use in accidents dealing
	22	with accidents, where you would have a lot of alarms and where
	23	it would fall well behind real time?
Ace-Federal Reporters,	24 Inc.	MR. MARTIN: I really don't know what the design basis
	25	was for bringing in that particular design of computer. I know
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COMMISSIONER GILINSKY: Just so that it doesn't get in the way.

3 CHAIRMAN HENDRIE: That it doesn't get in the way. MR. STELLO: For the sake of adding even more discus-4 sion to this item, I will take the risk to note that a particu-5 lar parameter that should have been a parameter that the staff 6 was aware of at the plant and the operators should have been 7 following would have been the system temperature, and you're 8 focusing only on the in-cores. 9 If you look at Item 208, the system temperature, at 10 11 about that time it starts to go up, and 14 minutes thereafter it's off scale, and that's at 6:00 a.m., 12 13 To answer your question, again, they clearly -- ' 14 COMMISISONER AHEARNE: They had an indication. 15 MR. STELLO: They should have been watching that one, 16 because they were trying to decide whether they had natural circulation. That's how you do decide, by looking at the inlet 17 18 and outlet temperatures. 19 COMMISSIONER AHEARNE: Even at an earlier time, a. point that the chairman mande, event 149. 20 21 MR. MARTIN: I looked at that. However, I think there is not another one; I think that was a singluar one. I don't 22 think it was bad, really, but it was a singular one. It was not 23

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time frame before a large number of such printouts started to

the start of a large number in closed sequence. There was some

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the licensee now is considering changing over to a high-speed
 printer type system to increase the rate at which alarms can
 be printed out.

I also know that the operators did not make use -- I believe I mentioned this back in the May briefing -- that the 'operators did not noutinely make use of the computer as a realtime working device because of the fact that once you got into a period of high alarms -- that might be any trip barring an accident, but any trip -- the printer immediately starts running behind. So they don't use it as a real-time device.

11 COMMISSIONER AHEARNE: I gather also then that the NRC
12 never required it to be a high-speed printer.

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 . COMMISSIONER GILINSKY: I was about to ask that.

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 COMMISSIONER AHEARNE: Is that correct?

MR. MARTIN: I believe that's correct.

COMMISSIONER GILINSKY: We not only didn't require a high-speed printer, but presumably didn't expect them to use this to deal with accidents.

MR. MARTIN: We did not expect. I don't think that
we would address that.

21 CHAIRMAN HENDRIE: This is part of the stuff provided 22 to the plant which is outside the limits of the safety review 23 generally. One could only look at this to make sure that it 24 didn't have an interaction possibility electrically back in the 25 safety circuit. pv8

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aware of the pressure spike. This was about 2:00 in the after-They were aware that a pressure spike had occurred. noon. They did not interpret this in terms of hydrogen or hydrogen release or hydrogen detonation.

It was coupled simulataneous with the opening of an EMOV. The shift supervisor who was on duty coupled that to the opening of the EMOV and steam release into the building, not 8 another cause.

9 And there was, in fact, a further confuion added, 10 because roughly 30 seconds after that, two electrical buses 11 short-circuited and tripped out. That -- those trips were proba 12 probably caused because of the equipment wetted down by the 13 building spray operation.' That introduced the belief that maybe 14 it was the electrical problem that triggered it.

15 But nonetheless, there was a recognition of a pressure 16 spike having occurred, by the operating staff. It was not 17 related to hydrogen. The reporting, once it was related to the 18 possibility of hydrogen spike, was reported, we think, promptly, 19 once they determined that condition.

20 COMMISSIONER GILINSKY: Let me pursue that point. 21 First of all, the question of whether it should have been 22 reported to the NRC in the first place when they became aware of 23 it. But, as I understand it -- and please correct me if I am 24 wrong -- toward the end of the second day they did relate it Ace-Federal Reporters, Inc. 25 to hydrogen and they did think in terms of a hydrogen explosion

occur. But that was a singular printout.

The next area ---

3 MR. STELLO: Maybe I ought to add a personal note. My experience in the operations center led me to believe that they 4 5 really didn't believe, even later in the morning and later in 6 the afternoon, they just didn't believe the temperatures, they 7 just didn't believe them, they didn't believe that they were They knew about them. I know they knew about them later 8 real. 9 because we talked an awful lot about them. And I don't think 10 they believed them.

COMMISSIONER AHEARNE: Are the thermocouples traditionally -- that is, thermocouples in reactors traditionally -instruments that do malfunction on this large scale?

MR. STELLO: I am not an expert in the area, but I asked a question, and the answer that I got was that thermocouples generally, if they're reading, they're correct. When they fail, they usually fail off scale. One way or the other.

COMMISSIONER AHEARNE: So, the disbelief wasn't related to a conclusion. There is a set of instruments that usually fail. It was more disbelief that the phenomenon that the instruments were predicting couldn't happen.

MR. STELLO: Well, the answer that I got in one instance is, "I believe my core is covered; and if my core is covered, I wouldn't be getting these kinds of temperatures." Ace-Federal Reporters, Inc. 25 That's the kind of logic I have been getting. Can you shed any

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logic on the way the operators did in fact feel? Did they real really have a disbelief that these in-core thermocouples and the system thermocouples were correct? Can you add anything more to that?

5 MR. MARTIN: No, I really can't add any more to the 6 general sense that you just gave. There was a conviction that 7 the core was covered; therefore the system temperatures cannot 8 be real. Therefore, that served as the basis for discounting 9 temperaturs.

COMMISSIONER AHEARNE: But they were not in any way, as far as you can tell, based upon any kind of experience that the thermocouples were instruments whose readings they shouldn't pay any attention to?

MR. MARTIN: What they used to further support that rationalization was that the thermocouples are not safety grade, and the system RTDs, the readings were being taken on them outside of the ranges of their calibration. And that was supportive rationalization to their basic conclusion, which was that the core was covered, therefore I can't have those temperatures.

Okay, I think we have discussed previously about the pressure spike in the building not having been pursued. We did look into that further because of questions that were raised during the last briefing. And we do believe that the interpretation given by the staff at the time, the operating staff were

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1	in the containment. Yet, the NRC was not informed until the
2	morning of the following day.
3	MR. MARTIN: I believe that's right. It was late in .
4	the evening that they had come to that conclusion. And that
5	would be late on the evening, I think, of the 30th, and promptly.
6	MR. STELLO: The 29th, on Thursday.
7	COMMISSIONER GILINSKY: And the NRC was informed on
8	the morning of the 30th.
9	MR. MARTIN: That's right.
10	COMMISSIONER GILINSKY: I must say I don't regard that
11	as promptly.
12	COMMISSIONER AHEARNE: Considering we had people
13	there, it was certainly not due to an absence of phone communi-
14	cation.
15	MR. MARTIN: In our view of that, we did not conclude
16	a fault or an improper behavior in that area as compared to the
17	requirements you have introduced.
18	COMMISSIONER GILINSKY: Isn't there some general
19	requirement that information which is of high safety importance
20	ought to be communicated promptly to the NRC? You keep refer-
21	ring to "requirements." This doesn't specifically violate some
22	specific requirement.
23	MR. STELLO: We're going to take a real hard look and
Ace-Federal Reporters. Inc	make sure that we look with a view in mind of wondering whether
25	there is or there should be, maybe if there isn't there ought to

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But all I can ask is that you give us some time to go back be. and think about it.

None of us sitting here at this table went through the thinking process of immediate notification for issues such as the two that we already discussed -- the in-core temperatures 5 and hydrogen pressure. We'll go back, we'll look. 6

COMMISSIONER AHEARNE: At least from your understand-7 ing as you know now, you don't know of anything -- if I turn 8 that around the other way, would it be fair to say that as far 9 as I&E practice says, that the licensees are not given the feel-10 ing that they must report anything that is out of the ordinary 11 with respect to safety issues? 12

MR. STELLO: Right now, licensees are clearly on 13 notice to let us know anything out of the ordinary, far less 14 significant than these issues, but with respect to the specific 15 question can an enforcement action be taken in light of the fact 16 that they didn't tell us in a more general way --17

COMMISSIONER AHEARNE: I recognize the final stage of î8 the enforcement action. I was just actually backing up earlier. 19 Is there anything that would have led the licensees in general, 20 from, say, I&E's approach to licensees or NRR's approach to 21 licensees, that if there is something that could be potentially 22 serious in a safety matter, to immediately let us know, even if 23 there isn't some specific requirement that -- or some specific 24 requirement linked to it? 25

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1 MR. STELLO: I think, as a general matter licensees 2 do that. But what we're dealing with here is not licensees, 3 it's individuals that have some cases of information which may 4 or may not have been "communicated" to that individual who has 5 that responsibility and that sensitivity. 6 I think licensees, people who are in charge of that 7 responsibility, have that sensitivity; whether it exists within the organization where all people would have that sensitivity 8 9 is another matter. 10 I think when the people on site are made aware of 11 these at management levels, they did make us aware of it. 12 COMMISSIONER AHEARNE: In general, in the review of 13 the operators and management people, what kind of a sense did 14 you come away with as far as did they feel it was solely their 15 responsibility to handle this accident? 16 MR. MARTIN: Yes. And I think I will probably touch 17 on that on the very next topic I was going into. 18 MR. BICKWIT: Before you go, could I just refer you 19 to a section of the regulations, 2121. It talks about notifica-20 tion with respect to the facts, and it says initial notification 21 required by this paragraph shall be made within two days fol-22 lowing receipt of the information. I am not familiar with the 23 history of this regulation, on how to interpret it, but that 24 would seem to approximate a requirement of the regulations. Ace-Federal Reporters, Inc 25 COMMISSIONER AHEARNE: Of course, that regulation,

1 like, I think, most of them, are really geared more to a situa-2 tion that is under control, rather than the stages of an acci-3 dent.

MR. MOSELEY: Could I contribute a little bit, or try 4 I think that historically in IE and the relationships with 5 to. licensees, it's been that regulations are not specific on 6 individual detailed events related to a larger event. 7 I think our intention -- because this is the largest accident that has 8 Ģ ever occurred, we really haven't been faced with this kind of an' 10 issue in the past. I think it is something new that needs to 11 be looked at, and we need to come up with something. But, by 12 and large, our approach -- and, I think, the licensee's approach 13 -- has been that the regulations address themselves to the 14 event itself and it doesn't get down to the nitty-gritty, to 15 individual things; and in all other events that I am aware of 16 this has teken care of all of it because the event is over.

COMMISSIONER AHEARNE: At least my understanding is that the regulations didn't have embedded in them the concept that there was going to be a crises management over some extended period of time.

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MR. MOSELEY: That's true.

COMMISSIONER GILINSKY: Let me say it seems to me, to raise the question whether the management had this information would seem to suggest that if they did that it would have been transmitted to us; if in fact the management didn't have this

FAT2 76 1 information -- the plant management -- it seems to me it makes 2 it far worse: it suggests that the plant is out of control. 3 So, I regard that as a mitigating factor. Δ You refer somewhere else here in connection with 5 procedures regarding some of them as improperly adopted, that 6 it's indicative of a serious breakdown in licensee knowledge 7 level of the facility. That's the sort of thing that seems to 8 me to be at issue here. 9 MR. STELLO: That is at issue, and it is a potential 10 item of noncompliance. 11 CHAIRMAN HENDRIE: Pray go on with speed. 12 MR. MARTIN: With the off-site interfaces, I think I 13 would like to, perhaps recognizing that Item 1 is the licensee 14 corporate staff --15 Could you put the next slide on, please. 16 (Slide.) 17 Remembering the licensee corporate staff, Babcock & 18 Wilcox, and the NRC as interfaces in which there was an attempt 19 for active interfaces in those areas. Burns & Roe was the 20 architect engineer. There was functionally no interface. They 21 offered whatever help, and no help was requested from them. 22 In terms of the licensee corporate staff, the diffi-23 culty there appeared to be a rapid transmission of up+to-date cur-24 rent information, basically speaking. And I think this addresses Ace-Federal Reporters, Inc. 25 an issue that was questioned before. In an accident of this

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sort, the responsibility is resting with the emergency team that's present on site. None of them, of the analyzed accidents, really brought into focus the possibility of such a protracted event taking place where one would hope to establish an ongoing contact on a minute-to-minute basis with support organizations, but that the accident would rapidly take you virtually into a recovery phase in a very short time frame.

So, the mechanism of contacting was basically by tele-8 phone, and it suffered from time delays. The usage of the 9 10 lines over which long-distance phone calls could be available 11 made, along with the various other contacts that could be 12 rquired, resulted in a condition where Babcock & Wilcox could not be contacted directly from the site because there were not 13 14 phones available at that point that could make the long-distance 15 calls, so they had to make a local call to a local B&W employee 16 at his home off-site, and he would relay messages to B&W.

17 COMMISSIONER AHEARNE: How many lines were there going 18 off-site?

end#5 20 terms of the specific number of lines.

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COMMISSIONER AHEARNE: Could I then now ask the question I just asked a minute ago? In the context -- I recognize when it first started that all of these previous training, they didn't have this understanding of procedures or whatever you want to call it, that they should bring in support organizations. I also gather that would also extend to give the NRC a lot of detail.

But this began to extend over a lengthy period of time. As you went through with the management and the operators, what would you say was their view of what their role ought to be with respect to us, say, during that day? Was it still, here's a peripheral function that we have to try, when we have time, to examine?

14 MR. MARTIN: I think basically, in terms of the 15 data, they were very promptly informing us of data for the 16 purpose of letting both the region and the headquarters staff 17 know what the condition of the plant was and what data was 18 available. When it came to issues of plant, what the licensee 19 plans were, there was a distinct time shift between actions 20 taken within the inner circle of the emergency command team, 21 that organizational structure, and the time at which those 22 things would be passed on to the NRC for people other than 23 the people on site. Even for the people on site, there was a 24 time lag with regard to NRC people of knowing what planning 25 was involved.

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The time lag did not exist with regard to data, as far as we can tell. As far as we have been able to establish, we do not believe the presence of the NRC or interfaces that occurred between NRC headquarters or the region and the operating staff really affected the course of any actions or decisions reached by the licensee during the course of handling that accident.

8 There may have been issues in which he considered 9 one or more additional aspects or topics, but we can find 10 nothing in which there was a major change in the course of 11 events.

COMMISSIONER AHEARNE: Do I gather, then, also by that time lag that you're talking about, there wasn't either an attempt to incorporate us into that small core planning team, nor he belief that there should be?

MR. MARTIN: I believe that would be a correct
appraisal. If I may, I also believe that we found no evidence
of any attempt specifically to forbid.

COMMISSIONER AHEARNE: I understand that. But it still sounds like they were continuing this sort of two-day reporting requirement philosophy, that it was their job to handle this and they would let us know. I'm not necessarily criticizing them. I'm just trying to make it clear.

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COMMISSIONER KENNEDY: Is there a job to handle? I want to be sure we understand.

80 COMMISSIONER AHEARNE: As I said, I'm not trying to 1 2 criticize. I'm just trying to make clear. 3 COMMISSIONER KENNEDY: I'm sure we understand what we're saying. Noncompliance is something different. 4 5 COMMISSIONER AHEARNE: I'm not implying anything. The second question: You said that there was never 6 7 any time lag in the data transmission? 8 MR. MARTIN: Very little. If I said never any, I 9 don't mean it that way. 10 COMMISSIONER AHEARNE: That will bring me back to 11 those high temperature readings, what you said was transmitted 12 to the management team between 8:00 or 9:00 o'clock. 13 MR. MARTIN: Some amount of it, an undetermined 14 amount of the data. 15 COMMISSIONER AHEARNE: Were those high temperature 16 readings transmitted to us? 17 MR. MARTIN: No, sir, they were not. 18 COMMISSIONER AHEARNE: I didn't think so. 19 MR. MARTIN: What I meant about the data when I said 20 that, I obviously was not clear enough. I meant plant parameter 21 system data. Now, that accumulation of data was, if you will, 22 taken, accumulated outside of the normal instrumentation 23 displays, and fed towards the emergency command center, and 24 then not utilized. So it was not in the normal availability deral Reporters, Inc. 25 of knowledge available in the control room, and it was that

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general knowledge I was referring to in terms of being generally available to the Commission.

Okay. I think that generally characterizes the interfaces. There were time delays to some extent. The 5 elected significant events, there were just three items, and I bring these up because they have been discussed previously.

7 With regard to the closed emergency feedwater valves, we were not able to ascertain exactly who, how or why 8 | 91 they were closed prior to the start of the accident. I think 10 you're all aware of the apparent conflicting information --11 well, it's not conflicting information. The surveillance 12 procedure lends itself to the possibility that they could 13 || have been left close after surveillance. The operator who 14 said he was associated with that procedure said he specifically 15 remembers opening those valves and they were closed at the 16 start of the accident. We cannot tie those together and make 17 a definitive statement as to who closed them or how they were 18 closed.

19 COMMISSIONER AHEARNE: Is there a written record of 20 the reopening of the valve after the maintenance?

21 MR. MARTIN: No, sir. That's one of the issues that's 22 addressed in the report, in the sense that those aspects of the 23 surveillance procedures are not retained.

24 Another aspect in the report is that they are also egeral Reporters, Inc. 25 not reviewed, not necessarily independently, and there is no

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independent inspection effort used.

COMMISSIONER AHEARNE: Do we have any requirements, general procedural requirements either that it be reviewed or that they be retained?

MR. MARTIN: Yes, sir. And that's addressed in the report as items which are also under consideration.

7 COMMISSIONER AHEARNE: So we do have requirements. 8 MR. MARTIN: And they have it in their program. Ģ Okay. The second item was the emergency director 10 did leave the site at about 2:00 o'clock in the afternoon. 11 He had deferred his leaving of the site until later, having 12 objected to being ordered to leave the site earlier in the day 13 to brief the lieutenant governor. He did leave the site. Ιt 14 is our view that he took all the prudent steps that one would 15 expect to take precautions, to let people know where he was, 16 to put a person in charge. It was not that there was no one in 17 charge.

18 COMMISSIONER AHEARNE: Who ordered him to leave the 19 site?

MR. MARTIN: The vice president for generation ordered him to appear at the lieutenant governor's office to brief him. We felt that he took prudent steps in preparation to do so.

COMMISSIONER AHEARNE: Now, is that type of an Acc.-Federal Reporters, Inc. 25 action, the action of emergency director and the station

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1 manager leaving, something that we would approve, disapprove, 2 comment on?

MR. MARTIN: I think we might comment on it. It would not be something -- we were not aware that he was off the site. I could find no evidence that any of our staff were aware that he was away from the site at the time. He did maintain contact with the site. He did return to the 8 site.

9 We cannot -- to evaluate the impact of his not 10 leaving might have been -- what the effect of his leaving might 11 have been on the course of the accident might have been, we 12 don't know.

COMMISSIONER KENNEDY: What you do say is remaining on site might have altered subsequent actions that might have been taken, this in regard to the pressure spike.

16 MR. MARTIN: Yes, sir. I was going to get to that, ._ 1: that aspect. The other aspect, that as soon as he and the · J . . vice president for generation returned to their respective : : stations, one to the site and one to the observation center, 20 i. it was shortly after the briefing on the status of the plant 21 that followed their return that the decision to repressurize 22 . the plant and start a reactor coolant pump occurred. Now, would that have occurred two and a half hours earlier if they 2.1 were not gone from the site would be conjectural.

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There were certainly conditions changing during that

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two and a half hours, but not dramatically or drastically. So again, they left the site and took precautions, and then returned when the new course of action was chartered. Ιt might have occurred earlier. We don't know how to answer that.

6 The third item was, there was concern during the 7 last briefing on the availability --

8 COMMISSIONER KENNEDY: One other question in that 9 regard. Was there anyone else who, in your view, might have 10 taken care of the problem in terms of the organization as it 11 stood at that time?

12 COMMISSIONER AHEARNE: I guess you're not really 13 sure.

14 CHAIRMAN HENDRIE: You might have to ask the 15 lieutenant governor. My understanding was, though, it was a 16 fairly urgent request from the state capitol to report.

17 MR. MARTIN: I think the feeling was that there was 18 a request from the lieutenant governor to the licensee to get 19 some straight first-hand information, and it was the 20 vice president's view that the best man to do that would be the emergency director on the site. 21

Finally, with regard to the plant computer records 23 and accuracy, I would like to just readdress the point that I 24 made at the last briefing on this. We do not feel, based on 25 a rather extensive look into the records, that any records

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were purposefully thrown away, lost or destroyed, to hinder our investigation. We really don't think we were hindered at all.

There is one mass of data missing for about an hour and a half, and we really think, although we cannot prove it, but our strong inclination is to believe that an operator hit 7 a button on that computer which essentially clears the memory 8 to get everything up to date, which is a very appropriate action for him to take.

10 COMMISSIONER AHEARNE: About 6:40 or something like 11 that?

12 MR. MARTIN: This is the 6:40-6:50 time frame. We 13 believe this occurred, but we cannot find the operator and 14 we cannot make sure that this did indeed occur.

15 COMMISSIONER AHEARNE: I assume this means that you 16 asked all the operators who were there?

17 MR. MARTIN: They don't remember or they don't 18 remember whether they did it. It would not have stuck out in 19 their minds as anything significant. They just would have 20 punched a button to bring it up to date and gone back to work. 21 COMMISSIONER KENNEDY: But that would have been a 22 normal thing for them to have done?

23 MR. MARTIN: Normal. There's no question of 24 propriety.

I think that concludes my presentation.

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COMMISSIONER GILINSKY: Can I ask you, is there some 1 2 particular reason why names were left out of this report? 3 MR. MARTIN: I would prefer to have management address that. 4 5 MR. MOSELEY: Yes, sir. It has been our practice in the past, to protect the privacy of people, to exclude their 6 7 names from this type of investigation. -8 COMMISSIONER AHEARNE: You say that there are no 9 records that you believe were deliberately lost? 10 MR. MARTIN: Computer records. I'm not implying by 11 that I think there are others that were intentionally lost. 12 But those are the ones that I was addressing at the time, 13 computer records. 14 COMMISSIONER AHEARNE: So for example, surveillance 15 records we were just talking about? 16 MR. MARTIN: Those were intentionally thrown away, 17 which is, you know, improper, and we've addressed it in the 18 report. But I don't think it was done -- that's the way of 19 handling it. 20 COMMISSIONER AHEARNE: In other words, it's not a selected set of surveillance records. 21 22 MR. MARTIN: They do it with them all. 23 COMMISSIONER AHEAPNE: Standard procedures. 24 MR. MARTIN: That was a practice long before the Ace-Federal Reporters, Inc. 25 investigation started.

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COMMISSIONER AHEARNE: And it sort of caused some 1 problems with the NRC audit type of procedure. 2 3 MR. MARTIN: Yes, sir. COMMISSIONER GILINSKY: Could you say something 4 5 about the previous loss of feedwater event, which was not reported to the NRC, what significance you attach to that? 6 The significance we attach to that, MR. MARTIN: 7 sir --8 COMMISSIONER GILINSKY: And in that case, the 9 10 emergency feedwater came on. It functioned. And in the review of 11 MR. MARTIN: that event, the licensee -- this was, I believe, November 3rd, 12 1978. I presume you're addressing the one that we had talked 13 about before. 14 15 COMMISSIONER GILINSKY: Yes. 16 MR. MARTIN: During that transient, what we are stating is that the licensee basically did not review the 17 plant response closely enough to have identified that fact, 18 19 if they had moved the plant into a degraded mode of operation. The degraded mode of operation means that they had moved into 20 an action statement, they are not meeting the LCO, limiting 21 22 condition for operation. Now, in such an event they should report to the 23 24 NRC that, as a result of this transient, some aspect of the Ace-Federal Reporters, Inc.

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safety-related system did not meet in accordance with the

1 design. And that's what we're addressing, that we feel that 2 they did not analyze it carefully enough and identify that in 3 fact the plant did not completely conform to its design. Δ COMMISSIONER GILINSKY: So they should have reported 5 this. 6 MR. MARTIN: That's right. 7 COMMISSIONER GILINSKY: To what extent were they 8 aware of the Davis-Besse event? 9 MR. MARTIN: We pursued that with training. 10 COMMISSIONER GILINSKY: About a year earlier. 11 MR. MARTIN: Both the Davis-Besse and the Rancho Seco 12 events, neither of those had been incorporated into the training 13 program for the operators or staff. Now, we did track that 14 there was a distribution under operating events, operating 15 experience. 11 16 MR. MOSELEY: Current events. 17 MR. MARTIN: That there is a distribution made by 18 the NRC and that some of that had gone out to the licensee. 19 But that basic information had not filtered down and been 20 1 incorporated into the training program. 21 COMMISSIONER GILINSKY: B&W didn't notify the licensee 22 about that event? 23 MR. MARTIN: No, sir. 24 COMMISSIONER GILINSKY: Could that have something ederal Reporters, Inc. 25 to do with the fact that the valves were made by different

1 manufacturers in the two cases? 2 MR. MARTIN: I'm trying to remember. In one of 3 those events, it was concluded that, because of a feedwater 4 transient that had occurred at TMI and that B&W had given 5 advice and commented on a TMI-based event, that B&W did not 6 feel it necessary to comment on a similar type of feedwater 7 event at another facility, since they had already provided 8 comments on a TMI feedwater event. 9 COMMISSIONER GILINSKY: On the TMI-2 event? 10 MR. MARTIN: It was the TMI-1 or 2. It's in here 11 under the discussion of whether or not the Rancho Seco and 12 Davis-Besse event were covered by training. And I just do 13 not remember it off the top of my head. 14 COMMISSIONER GILINSKY: Was any of the information 15 you obtained in this connection -- well, from any of the 16 interviewees conflict with testimony that was later given to 17 the Presidential Commission? 18 MR. MARTIN: I am not --19 MR. STELLO: We have an investigation that is going 20 to start to look into that question. Until it's complete, I'd 21 rather not comment. 22 COMMISSIONER AHEARNE: As far as the Davis-Besse 23 thing goes, for one more question on it: Neither the operators 24 nor the management when you talked to them, I guess, did not Ace-Federal Reporters, Inc.

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seem aware, at least aware in detail, of that event?

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COMMISSIONER AHEARNE: So that when you say that we had provided in the current events bulletin that comes out, that document that goes out, all we know is that it had been 5 sent to the plant. But as far as what happened to it and incorporation into the understanding, you couldn't find that 6 7 out.

MR. MARTIN: That's correct, they were not.

MR. MARTIN: No. We started to pursue that late in 8 the investigation, and frankly, we terminated once we estab-. 9 10 lished that it had not in fact gotten down to the training 11 level. That we were able to ascertain, that it had not reached that. 12

MR. GIBSON: Shall I begin with the radiological 13 14 aspects?

> COMMISSIONER GILINSKY: Sieze the moment.

16 CHAIRMAN HENDRIE: Yes. Just a second before you do. Let me make a comment on the schedule. The Commission's 17 18 schedule had showed us hearing a briefing on the results of 19 the investigation, the briefing we're now having, and then 20 moving on to hear presentations and discussion of the proposed 21 fiscal year '81 budget for Commission offices.

The latter discussion I propose to defer until tomorrow morning. So that for those of you that have attended 23 this morning interested not in the briefing on TMI, but only in the forthcoming discussion on the Commission office budgets,

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I apologize. If there is any rush for the rear door, I'll 1 2 understand. 3 With that announcement, why, plunge ahead on the radiological side with dispatch. 4 5 MR. GIBSON: Okay, thank you. 6 The first slide, please. (Slide.) 7 I'll begin it with a discussion of pre-accident 8 9 conditions. I will be as brief as possible so as not to 10 repeat unnecessarily information given during my June briefing. 11 The total radiation protection and chemistry staff 12 consisted of 39 individuals, four of whom were on site on the 13 morning of the 28th prior to the accident. 10 COMMISSIONER AHEARNE: Is that the normal complement? 15 MR. GIBSON: Yes, sir. 16 Seven emergency drills were conducted by the licensee 17 in 1978 to evaluate the adequacy of emergency response capa-18 bility. One of these drills was observed by an NRC inspector. 19 Critiques were held following each drill to discuss results 20 and assign action to collect problems identified. Most of the 21 identified problems were corrected to the extent that they 22 did not recur following the March 28th accident. 23 i Two exceptions were: An environmental iodine survey

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further verifying that it was operational. Once at Goldsboro,

instrument was taken from the plant to Goldsboro for use without

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it was determined not to operate properly. A similar problem had occurred during the drill. And another example is that during the previous drill the need for operations personnel to re-review criteria for declaration of site emergencies was identified and, as we will discuss later today, there was apparently still some misunderstanding on the part of operators as to when the site emergency should have been declared.

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In addition to drills, which obviously do have some training advantage, formal training is provided to instruct each member of the plant staff in his emergency duties.

11 (At 11:40 a.m., Commissioner Bradford left the room.) 12 MR. GIBSON: Such training had been provided at TMI 13. with, again, a few exceptions. One exception was that the 14 off-site monitoring team members had not been trained in the 15 use of instruments to be used for airborne environmental 16 radioactive iodine samples. And this training caused techni-17 cians to be unsure of their abilities in using the instrumen-18 tation and may have contributed to initial misinterpretation 19 of the instruments' response to Xenon.

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1 . Another example, well, to move on, routine training for 2 radiation chemistry technicians on the plant staff was not 3 up to date in that training required by the technical specification. a retraining program as required by the 4 5 technical specification had not been implemented to 6 maintain their job proficiency to comment on radiation 7 protection equipment and supplies, although equipment and 8 supplies were adequate to support normal plant operations.

9 Shortages occurred following the accident.
10 Inventories can be summarized as follows: less than half of
11 the portable radiation monitoring instruments were operable,
12 although delay in maintenance and calibration of such
13 instruments --

14 COMMISSIONER KENNEDY: Excuse me, when were we 15 first aware of that?

MR. GIBSON: We were first aware of it, we were first aware of it during the investigation. This was disclosed upon review of records of maintenance and calibration on survey instruments.

20 COMMISSIONER KENNEDY: What normal provision do we 21 have for reviewing the status of such equipment on normal 22 inspection routines?

23 MR. GIBSON: We do review this during normal24 inspections.

25 COMMISSIONER KENNEDY: When was it last reviewed

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before this investigation?

2 MR. GIBSON: It was reviewed, okay, I don't 3 remember the date. The regulatory requirements regarding 4 minimum inventories are very general.

5 COMMISSIONER AHEARNE: Are you saying that with 6 half of them not working that would have met the regulatory 7 requirements?

8 MR. GIBSON: Yes, sir.

9 COMMISSIONER KENNEDY: It would?

10 MR. GIBSON: Yes.

11 COMMISSIONER AHEARNE: Is it an overexaggeration 12 to say that the regulatory requirement allows inventory for 13 normal operations but does not handle accidents?

14 MR. GIBSON: The regulatory requirement, which is in effect a commitment in the FSAR on the part of the 15 licensee, in this case as it was generally worded, lacked 16 17 specificity. I don't remember the exact words, but it was 18 something to the effect that we'll have instruments of the 19 Various types and in sufficient quantities to support operations or something to that effect, and this is not 20 21 uncommon.

COMMISSIONER KENNEDY: If 50 percent of the total inventory is inoperable, is that then still meeting the regulatory requirement, in your judgment?

25 COMMISSIONER GILINSKY: What is the regulatory

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requirement? Is it a certain number of meters?
 COMMISSIONER AHEARNE: No.

3 MR. GIBSON: No, sir, it was a general 4 requirement.

5 CHAIRMAN HENDRIE: If the inventory is two meters 6 and one of them's down, and only one's working, why, I'd say 7 that doesn't meet the requirements. In fact the whole 8 inventory doesn't. On the other hand if it's 1000 meters 9 and 500 of them work, why that seems to me an excessive 10 requirement.

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So it's the numbers rather than having a batch of them down, although if you buy a batch of instrument, why, you generally expect to keep a little better than 50 percent availability in a good shop.

[^] 15 MR. GIBSON: Some problems have been observed in this area in the past. An outage on Unit 1 had just been 16. 17 completed during which the instruments received heavier than 18 normal use. Consequently, the number out of service was 19 higher than normal. 50 self-contained breathing devices and 20 175 full face respirators were available. The full-face 21 respirators were equipped only with particulate filters and 22 thus were not effective for iodine protection.

The number of self-contained breathing devices was later shown to be not sufficient to support entries into the auxiliary building. This problem was compounded by lack of

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facilities to quickly recharge the gas bottles on the self-contained breathing devices. There were not enough high range pocket dosimeters available to provide one for each individual or group of individuals entering the auxiliary building.

6 COMMISSIONER AHEARNE: But I think it's correct 7 that that lack doesn't violate any of our regulations.

8 MR. GIBSON: That is a true statement, and another 9 comment on radiation survey instrumentation, there was no 10 instrument available on-site which would read an exposure 11 rate greater than 1000 rem, or 1000 roentgens per hour.

And following the accident, levels in excess of this value were present, which is perhaps a Lessons Learned for all utilities. This is typical ---

15 COMMISSIONER AHEARNE: I guess it's also a Lessons 16 Learned for us.

MR. GIBSON: Yes, I would think so.

Regarding emergency equipment, four environmental 18 19 monitoring kits were in place providing supplies and equipment for use by an emergency monitoring team. The 20 iodine monitoring instrument in one of these kits was known 21 to be out of service, and the iodine instrument in a second 22 23 kit was found to be out of service at the time it was first attempted to be used, but only one kit was required by the 24 25 emergency plan implementing procedure.

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To comment on the routine environmental monitoring ł . 2 program that was in place prior to the accident, the program 3 was in place as required by technical specifications. Environmental air samplers were operating at eight off-site 4 5 locations and TLDs were in place at 20 off-site locations. 6 CHAIRMAN HENDRIE: Let's move along, please, or 7 we're never going to get out of here. I'd like to cover 8 this radiological thing in the next 20 minutes and then have Ŷ about 15 minutes to deal with the potential non-compliance 10 items, and close the briefing in the neighborhood of 12:30, 11 please. 12 Let us move rapidly along.

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13 COMMISSIONER AHEARNE: Let me ask, quickly, a 14 question. These are -- in talking about pre-accident 15 conditions, shortly before the accident, the licensee had 16 had a review of a physics program by a consultant, and that 17 consultant's report was extremely critical of the licensees 18 health physics program, the training, and the accuracy of the procedures, et cetera. A lot of the things, in fact, 19 that it calls out, you might say were precursors of the 20 21 problems that you just found.

22 We went through and watched one of their drills. 23 Did we reach similar conclusions? Had we come away with a 24 similar criticism?

25 MR. GIBSON: I must say, I have not reviewed the

283 07 06 98 kap 1 inspection report of that drill. I have reviewed the audit 2 report, and I will say that I believe the findings of our 3 investigation support many of the items in the audit report, 4 but I really cannot answer your first question. 5 COMMISSIONER AHEARNE: So we hadn't, as far as you know, reached any conclusions prior to the accident about 6 7 the weakness of the procedures, the weakness of the 8 training? 9 MR. GIBSON: We had not, as far as I know. 10 Just a word on rad waste systems. A reactor 11 building sump was aligned to pump the auxiliary building sump tank only about 800 gallons of surge capacity remained 12 13 in this tank. Auxiliary and fuel handling ventilation systems were operating normally, discharging through high 14 . efficency filters and charcoal filters. 15 16 Next slide, please. 17 (Slide.) MR. GIBSON: I'd like to talk about initial 18 19 emergency response and detection and classification of the 20 accident. The Emergency Director was responsible for 21 classifying the situation as an emergency in accordance with conditions in Table 1 of the emergency plan, by taking 22 23 accidents in accordance with emergency plan implementing procedures and his own best judgment. 24 25 The first condition in Table 1 that appeared to

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have been met was specified as Criterion C for site emergency. Conditions for Criterion C were met by 4:15 a.m. on the morning of March 28th. This site emergency criterion action level states, "that site emergency should be declared" upon loss of primary coolant pressure coincident with high reactor building pressure and/or high reactor building sump level.

By 4:15 a.m., reactor coolant system pressure had dropped from 2435 psig at the time of the trip to approximately 1275 psig.

11 COMMISSIONER GILINSKY: Does a site involve 12 off-site complications?

MR. GIBSON: Yes, sir. This pressure was below the reactor coolant low pressure trip set point of 1940 psi. And the set point for emergency cooling initiation at 1600 psig. At 4:15 a pressure rise of about 1.4 psig inside the reactor building was detected. The shift supervisor was aware of the drop of reactor coolant pressure and increased reactor building pressure.

Initially, he evaluated these conditions in relation to the emergency plan and indicated that they were not indicative of an emergency, since primary coolant system pressure had stabilized and there was no increased radiation levels either in or being released from the facility. (Commissioner Bradford entered the room at 11:50.)

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kap 1 COMMISSIONER AHEARNE: Are the criteria to declare
2 a site emergency sufficiently fuzzy that it was really a
3 judgment call of his, or did it say, if A, B, happens you
4 should --

5 MR. GIBSON: The criterion is just as I stated it. 6 COMMISSIONER AHEARNE: So your conclusion is he 7 should have declared it.

8 MR. GIBSON: My conclusion is it should have been 9 declared; however, I think it is a more complex issue than 10 attributing it to operator error. Terms such as loss of 11 reactor coolant pressure and high reactor building pressure 12 were not defined.

13 COMMISSIONER AHEARNE: There are no numbers14 associated with it? .

MR. GIBSON: No numbers, so part of the fault was with lack of specificity in procedures and also lack of understanding on the part of the operators as Bob previously discussed, as to what was really happening in the plant. COMMISSIONER AHEARNE: So it's more than hindsight that one can conclude that it should have been? MR. GIBSON: That's true.

22 COMMISSIONER GILINSKY: Are you saying that they 23 considered the question and decided not to call a site 24 emergency?

25 MR. GIBSON: Yes, sir.

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COMMISSIONER GILINSKY: At 4:15?

MR. GIBSON: Yes, sir. They considered the 2 question and at that time reactor coolant pressure had 3 stabilized somewhat. although it was low on the order of 4 5 1200 psi, but they felt they had control of reactor coolant pressure and the shift supervisor said that he did not 6 7 consider that to be a loss of pressure. even though the 8 pressure was low. He didn't consider it to be a loss of 9 pressure.

So he did not declare a site emergency at that time. Now, at 4:30 he became aware of an additional criterion, and that was a high alarm on the reactor building sump, which, because he still had no indication of any release off-site, he still did not declare a site emergency.

15 COMMISSIONER GILINSKY: Did you detect any 16 reluctance on their part to call a site emergency because 17 this might lead to unfavorable publicity or whatever? 18 MR. GIBSON: That was not explicitly stated by

19 people ---

20 COMMISSIONER GILINSKY: Did you ask? 21 MR. GIBSON: Yes, sir, I believe the investigators 22 did ask that question. Perhaps Mr. Donaldson could answer 23 that.

24 MR. DONALDSON: It was not implicitly stated. We 25 asked the questions within the bounds of the criteria as

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they were stated and tried to get their perceptions about
 what they felt these various levels meant.

3 My own evaluation would be that I don't think that 4 they did perceive the meaning of those levels. I would 5 think in my own mind that there was some reluctance on their 6 part because of the magnitude of the response that would 7 have been required to that event.

8 MR. GIBSON: A second criterion --

9 COMMISSIONER AHEARNE: In the training, do they 10 get trained at all on that aspect of it, how to interpret 11 those criterion?

MR. GIBSON: I'm not aware of specific training,
no, sir. Not on attaching numbers or more specificity to
those general terms.

15 COMMISSIONER AHEARNE: Do we in our review of 16 operators or supervisors go through any of that, as a normal 17 event?

MR. GIBSON: I'm not aware -- I'm not familiar with operator training, not that I'm aware of.

A second criterion for the declaration of site emergency was met at 6:35 when an alert alarm set point was reached on the reactor building dome monitor. This apparently went unnoticed.

24 COMMISSIONER KENNEDY: Went unnoticed?
25 MR. GIBSON: Yes, sir.

kap 1 COMMISSIONER KENNEDY: How was the data recorded,
2 and where? And thus, how did it go unnoticed?

MR. GIBSON: Okay. We don't know for certain that the alarm occurred, the trace occurred on a strip chart recorder and at 6:35 a.m. the trace passed through the alarm set point for that monitor, presumably the alarm occurred at the set point.

8 COMMISSIONER AHEARNE: So as far as what you 9 actually know, are sure happened, is that the trace went 10 through there.

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MR. GIBSON: That's correct.

12 CHAIRMAN HENDRIE: This would have been an 13 enunciator light, presumably on the panel and by that time, 14 why the whole enunciator panel must have looked like a 15 Christmas tree.

16 COMMISSIONER GILINSKY: In the summary of the 17 report, it states that subsequent to 4:15, there were 18 several radiation monitor alarms indicative of an emergency 19 situation but no emergency was declared. What times are you 20 talking about? Are you referring to these events at 6:30 or 21 something earlier?

22 MR. GIBSON: These were area radiation monitors in 23 the auxiliary building and in the reactor building that 24 would have been indicative of increasing radiation levels in 25 the plant.

1 kap COMMISSIONER GILINSKY: At about what time? 2 MR. GIBSON: After 6:00 o'clock. The site 3 emergency was declared at 6:55 after the pv reactor coolant 4 pump was restarted and distributing fission products 5 thoughout the plant, causing a rapid increase on radiation 6 monitors throughout the plant. The criteria for declaring a 7 general emergency is also stated in Table 1 of the site 8 emergency plan, and the general emergency Criterion B 9 requires declaration of a general emergency when a whole 10 body dose in excess of --COMMISSIONER GILINSKY: Would they not have 11 12 started that pump at that time? MR. GIBSON: Should they not have started the 13 14 pump? I can't answer that. 15 COMMISSIONER AHEARNE: Vic, what do you know? 16 MR. STELLO: I don't have any reason to believe 17 that based on the information that they had available to them, there was reason to not start the pump. Clearly at 18 19 some point the thing to do was to start the pump and terminate the transient. 20 So I don't attach anything of significance to the 21 22 attempt at restarting it. It was moving in a direction in 23 which it was eventually going to go. MR. GIBSON: The initial dose calculation 24 25 projected a dose that was in excess of five rem, as we will

105 5283 07 13 discuss later, but a general emergency was not declared at kap 1 2 the time because that projection was believed to be 3 unrealistically high. COMMISSIONER KENNEDY: Why was that? What was the 4 5 rationale for that? 6 MR. GIBSON: That's the Goldsboro dose of 40 r per 7 hour, that we discussed in the last briefing. The general 8 emergency Criterion A, which requires declaration of a 9 general emergency when a high alarm occurs on the 10 monitor, was met at 7:20. 11 COMMISSIONER AHEARNE: In other words, a high 12 alarm isn't the earlier one that you're talking about. MR. GIBSON: The earlier one was an alert alarm. This is a high 13 14 alarm and it was based on this high alarm that a general 15 emergency was declared at 7:24. 16 Upon declaration of a general emergency, the 17 emergency organization was activated and it was the 18 organiztion, was assembled initially as shown in the 19 emergency plan implementing the procedures. The shift 20 supervisor on duty at the time assumed the position of 21 emergency director in the Unit 2 control room until he was 22 relieved by the station manager at 7:05. 23 A radation chemistry technician was intially 24 placed in charge of the emergency control station at the 25 health phyics control point in the Unit 1 auxiliary

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1 building. He was later relieved by a foreman at 7:15 and 2 the supervisor of radiation protection at 7:35. 3 COMMISSIONER AHEARNE: The site emergency, if they declared a site emergency, did they have to notify us? 4 5 MR. GIBSON: Yes, sir. In fact, the prescribed 6 actions are very different for a site general emergency. 7 COMMISSIONER AHEARNE: But on the site, they would 8 have had to notify us? 9 MR. GIBSON: Yes, sir, and they did. 10 COMMISSIONER AHEARNE: I will leave this briefing 11 with this impression, though, and I want to make sure you 12 don't agree with it. They had several indications during that period of time, even though there was this general 13 14 fuzziness about specific numbers, between that 4:15 and • 15 6:55, there still hadn't been an accumulation of information that would not have been unreasonable for them to have 16 17 declared that. In fact, it would have been quite 18 reasonable. 19 MR. GIBSON: I would agree with that. 20 21 22 23 24 25

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(Slide.)

2 We'll discuss pathways of radioactive effluents 3 briefly. Following the turbine trip, about 8000 gallons of 4 reactor coolant were pumped from the reactor building sump 5 into the auxiliary.

6 COMMISSIONER AHEARNE: I'm sorry, Vic. Is that an 7 example of a procedure that they should have followed? 8 Declaring the site emergency earlier, is that an example of 9 a procedure they should have followed?

MR. STELLO: We have listed an item of non-compliance potentially.

12 COMMISSIONER AHEARNE: But in your list of things 13 that you had when you started, if they had followed the 14 procedures, is that one of the ones -- in other words, if 15 they had declared that they would have gotten NRC people 16 called earlier, is that one of the things you were thinking? 17 MR. STELLO: That would have made -- prevented the 18 accident?

19COMMISSIONER AHEARNE: Or made it less serious.20MR. STELLO: No.

MR. GIBSON: So 8000 gallons of water were pumped
to the auxiliary building, overfilling the auxiliary
building's sump tank and spilling into the sump.

24 COMMISSIONER GILINSKY: Are you saying that there 25 would not have been any significant difference in the course
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of this accident if site emergency had been declared at 4:15?

3 MR. STELLO: I was asked the question -- the question was whether, had they followed that procedure, did 4 5 I have that in mind when I made the statement that the 6 accident was preventable. The answer to that question is, 7 no. I did not have that in mind.

COMMISSIONER AHEARNE: The accident, the serious 8 9 consequences, would have been ---

MR. STELL(): I do not believe that had we been 10 11 notified earlier, that the severity of the accident would have been much different than it was. The mind-set of the 12 13 people that were making the decisions. I don't believe, 14 would have been changed by our interaction. When we did try 15 to interact and we did try to persuade them of a different point of view, we were unsuccessful in doing that, in my 16 17 . view. So I don't believe an earlier notification would have 18 changed that mind-set.

COMMISSIONER GILINSKY: Let's see, that also calls 19 20 into play their management at an earlier point, when they 21 called the site emergency, doesn't it?

MR. STELLO: I believe their management was being 22 23 called in independent of the declaration of site emergency 24 anyway.

MR. GIBSON: They were called. It was after 4:15.

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I don't remember the exact time — between five and six,
 something like that.

MR. STELLO: It was prior to declaring site emergency. The need for additional assistance was a decision, as I understand it, that was made independent of reaching a decision on site emergency.

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CHAIRMAN HENDRIE: Forward.

MR. GIBSON: Okay. Following fuel damage, 8 concentration of radioactivity in reactor coolant increased 9 10 by several orders of magnitude, and a flow of this highly 11 contaminated reactor coolant was maintained through the 12 makeup of the purification system for several days following the accident. This flow was the principal pathway by which 13 14 radioactivity was transferred from the damaged reactor core 15 to the auxiliary and fuel handling buildings and ultimately 16 to the environment.

17 COMMISSIONER GILINSKY: So you're confirming your 18 earlier view that it was not the flow from the containment 19 sump?

20 MR. GIBSON: That is correct.

21 COMMISSIONER AHEARNE: So lack of containment 22 ventilation wasn't —

23 MR. GIBSON: That's correct.

24 COMMISSIONER GILINSKY: Was there some way to seal 25 off the makeup and purification system?

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1 MR. GIBSON: In fact, that flow was automatically isolated on an isolation signal, but it was manually opened 2 3 up again in order to maintain inventory control over the reactor coolant system at the control pressurizer level. 4 5 COMMISSIONER GILINSKY: So as a practical matter. 6 there was not way to prevent that flow? 7 MR. GIBSON: That's true. 8 COMMISSIONER GILINSKY: To control the primary 9 system? 10 MR. GIBSON: That's correct. And so the flow was 11 maintained through the auxiliary and fuel handling 12 buildings. There was really not an alternative to that. 13 Okay. Gas is evolving from the reactor coolant 14 inside, makeup the purification system, were collected in the waste gas system. Small leaks in the waste gas system . 15 which had been of little radiological consequence prior to 16 17 the accident became importantant after the accident because of the high concentration of radioactivity. It is believed 18 19 that these leaks were the principal pathway by which 20 radioactivity entered the atmosphere in the auxiliary and 21 fuel handling buildings and was ultimately discharged to the environment from ventilation. 22 23 COMMISSIONER AHEARNE: These leaks were within 24 tech specs?

MR. GIBSON: The reactor coolant leakage,

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1 unidentified reactor coolant leakage as Bob mentioned 2 earlier, was outside of tech specs. But the tech spec does 3 not address a leak rate for gases, and we believe it was a 4 gaseous leakage that did contribute mostly to the 5 environmental release.

Now some gases did evolve from liquids spilled onto the floor, but it does not appear that this was the major pathway.

9 COMMISSIONER AHEARNE: But then are you saying 10 that even if they had identified what had been the cause of 11 the leak, as you now say, the calculations show they were 12 outside of tech specs. Even if they had identified that and 13 fixed it and put it back within tech specs, you still 14 expected that the leakage would have occurred?

15 MR. GIBSON: That's true. To discuss briefly 16 monitoring of airborne effluents, airborne radioactivity 17 monitors are installed in ventilation exhaust systems and in 18 the station vent. These were off scale, as we discussed in 19 June, because of the high radiation levels in the vicinity 20 of the detectors. The response of these monitors provided 21 little useful information during the period of this investigation. However, the samplers associated with these 22 23 monitors were used to collect iodine and particulate 24 samples, which were then analyzed in laboratories for a 25 before and after assessment of what had been released from

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the facility. Regarding quantification of what was released from the facility, the licensee did not quantify noble gas releases until after the period of our investigation. However, because of the high degree of interest in this subject, we did put information in the report regarding the licensee's assessment of a quantity of radioactivity released.

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8 We did not independently calculate the quantity of 9 radioactivity released, but we did review the methodology 10 used by the licensee and found it to be sound. And we did 11 compare the noble gas releases to a preliminary assessment 12 Which had been made by the NRC staff with that, to be 13 consistent.

14 COMMISSIONER AHEARNE: And therefore also 15 consistent with that ad hoc task force that looked at the 16 measurements?

MR. GIBSON: That is correct. I think I should say more on that point. We took the noble gas source term identified by the licensee, plugged it into a formula in 10 CFR 20 to determine compliance with 10 CFR 20, and found that the 10 CFR 20 release concentration, annual average concentration limit, was exceeded by a factor of 11.

Now this would normally imply -- the MPC in part 24 20 is generally regarded as a concentration -- if someone 25 were present in that concentration continuously for seven

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1 days a week, 24 hours a day, it would produce 500 millirems 2 per year.

Now when we came up with a factor of 11, I think a 3 reasonable question is. does that mean a person would have 4 received 11 times 500 millirems a year. The answer to that 5 question is, no, it does not mean that. It doesn't mean 6 that because of conservatism in the dose models used to 7 8 derive 10 CFR 20 MPC values and because of conservatism in 9 the atmospheric dispersion factor which we used to determine 10 compliance with part 20 and because no one leaves at the 11 site boundary 24 hours a day, seven days a week, without the protection of any shielding. 12

And when corrections are made for those conservatisms to obtain a more realistic dose, our number seems consistent with what the ad hoc committee produced. And also I would add that the ad hoc committee's estimate is based on actual doses measured by TLDs and does not take into account in its determination of doses to individuals a calculation using an atmospheric dispersion factor.

Now, our calculation is based on taking the TLD result, applying an atmospheric dispersion factor to get a source term, and then applying another atmospheric dispersion factor to project out to an individual. The combination of the two atmospheric dispersion factors introduces some additional uncertainty. So the bottom line

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is, we feel that the released quantity of noble gases is consistent with the ad hoc committee's recommendation.

Next slide, please.

(Slide.)

5 I'd like to talk briefly about in-plant radiation protection. It was in this area that many of the problems 6 7 we identified occurred. Radiation levels increased 8 dramatically inside the auxiliary building and the fuel 9 handling building following the accident. Exposure rates 10 increased by several orders of magnitude from a few 11 millirems per hour to hundreds of rems per hour. Operations 12 of valve circuit breakers and inspection of systems for 13 leakage and performance surveys were made. Positive control was not always exercised over these inputs. Although many 14 of the individuals entering the auxiliary building were 15 briefed by either the Radiation Protection Supervisor or the 16 17 Supervisor of Radiation Protection and Chemistry, not all 18 were.

Entries were made into high airborne radioactivity areas and high whole body exposure rate areas, and in one instance, a survey estimate was not used. Two individuals who entered the auxiliary building received a whole body dose of radiation in excess. Others were contaminated and received excess doses. High range pocket dosimeters could not be located and were not worn. Protective clothing was

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not readily available, such as hoods, and was not worn.

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2 COMMISSIONER AHEARNE: All of those are the kinds of things that at least the management survey or the 3 health-physics survey indicated would have been expected. 4 5 MR. GIBSON: Yes, I think so. Air sampling was 6 not performed in the auxiliary building where workers were 7 exposed during essentially the entire period of the 8 investigation, and appropriate respiratory protector devices 9 were not always worn. And records of radiation exposures 10 received by workers do not appear to be accurate.

11 COMMISSIONER AHEARNE: So the conclusion after I 12 listen to that would be that we really are uncertain as to 13 the occupational exposure.

MR. GIBSON: There is some uncertainty on that, yes, sir. We believe that we have investigated the cases where the greatest risk for high exposure existed, but we do not wish to imply that we have identified all of them. We have encouraged the licensee to go back and do further evaluations, and he is doing so.

20 COMMISSIONER AHEARNE: Have you also alerted or 21 warned the individuals that they might have been exposed to 22 substantially higher radiation levels than they were aware 23 of?

24 MR. GIBSON: The licensee has done that.
25 COMMISSIONER AHEARNE: You're sure?

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1 MR. GIBSON: I would not say it has been done in 2 every case. I know it has been done in some cases. 3 COMMISSIONER AHEARNE: Shouldn't it be done? 4 MR. GIBSON: Certainly it should be done once it's 5 determined that an individual did receive more than what he's previously been led to believe. In practice, such 6 7 determinations usually involve discussions with the 8 individual to determine which area hers been in. 9 COMMISSIONER AHEARNE: I would think we'd have 10 some kind of responsibility to at least make sure the 11 licensee has alerted its employees that they may have been 12 exposed to substantially higher levels of radiation. 13 CHAIRMAN HENDRIE: Since we don't know that he hasn't, why don't we pass on. 14 COMMISSIONER AHEARNE: I feel very uncomfortable 15 about feeling that while we've got it really pinned down --16 17 they don't have it pinned down. 18 CHAIRMAN HENDRIE: I'll comment that I was on the 19 site a couple of times, and I have had the exposure record 20 forwarded to me. I've got my little sheet that says, you 21 know, dosimeter shows so much. I would expect that he has, 22 in fact, been notified.

COMMISSIONER AHEARNE: Joe, I think we all have. Howard, what I'm really worried about is the first couple of days when I don't think that formal system was in place.

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1 MR. STELLO: Let me help maybe to verify. Did 2 they have to go back and do whole body counts on a great 3 number of those individuals to see if there was trouble in 4 those areas?

5 MR. GIBSON: Yes, sir. The whole body count would 6 indicate that there had been an uptake of radioactivity 7 inhaled.

8 MR. STELLO: Other than that, they had their TLDs 9 on.

MR. GIBSON: The problem is that not all of the II TLD results were entered into the record, and that that's a questionable area is what I think the Commissioner is considering.

14 Regarding what caused these practices, I would 15 like to first say that we have concluded that the training of the radiation protection and chemistry staff and actions 16 17 of some workers did not reflect comprehension of problems 18 such as the need to know exactly when individuals entered 19 and returned from areas of radiation hazards, the need to 20 measure and document airborne radioactivity to which workers 21 were exposed, and the need to perform detailed surveys of 22 personnel contamination.

We questioned workers regarding their training,
almost to a man. The radiation protection and chemistry
staff was dissatisfied with the amount of training they had

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been provided, and response to technical questions indicated that they did need more technical instruction. I could go on and list other examples.

4 In addition to training, we felt that the 5 management control over exposures during the accident was 6 not all that it should have been. Examples of that would be 7 that positive access control was not established to prevent 8 entry of unprepared individuals into hazardous areas. An 9 effective method was not implemented to assure that 10 individuals entering hazardous radiological environments were fully briefed as to the hazard, and the degree of 11 urgency with which the task was to be performed. 12 Equipment 13 such as high range pocket dosimeters andf survey meters were not controlled to assure that each individual entering the 14 15 high radiation area was provided with appropriate 16 instrumentation. Individuals that became contaminated were 17 not properly surveyed and decontaminated to ensure that 18 their dose would be minimized, and planning of those tasks which presented considerable potential for radiation does. 19 20 such as reactor coolant sampling, was not reviewed by 21 knowledgeable members of management to ensure that 22 reasonable precautions were to be taken.

CHAIRMAN HENDRIE: Of course, I think it's also fair to notice that some of the entries in the first three days, four days, were also being made under circumstances

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when there was concern over substantially higher doses for everybody, not only in the plant but on site within the plant limit. And so, I think these things ought to be duly noted and taken account of in emergency preparations. But —

MR. GIBSON: I think you're right.

7. CHAIRMAN HENDRIE: I think we ought to recognize 8 that some of these actions which sound couched in these phrases as thought, my goodness, how could they have done a 9 10 dumb thing like that? And the answer was, if I'd been there 11 and running it, why I'd have done the same thing on the 12 basis that it's better to take those shots and deal with the 13 plant condition and avoid much higher -- if possible avoid much higher -- doses going in and out of the plant. 14

15 COMMISSIONER KENNEDY: This may be a reflection of 16 the comment which Norm Mosely made at the outset of this 17 presentation, that if one takes only what is being 18 specifically presented here as the total, factual situation, 19 you will have an unbalanced picture. In fact, all that's 20 being presented here is the bad side.

21 COMMISSIONER AHEARNE: Both of those are correct. 22 The only caveat I'd have is that there was a study done for 23 the licensee of their health-physics program prior to the 24 accident in the absence of this kind of severe crisis 25 situation. And that pointed out just these kinds of

5283 08 14 weaknesses: poor training, uncontrolled access, mgc unthoughtabout allowing of people to go into areas without monitors, so that even in a much less pressured situation, all those weaknesses were there. So I'd certainly agree with you, Joe, that in a pressure situation you make some balanced judgements. But I think the underlying fact is that that whole system wasn't very well developed. CHAIRMAN HENDRIE: It's clear from the N consultants' report that it could stand substantial upgrading.

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COMMISSIONER GILINSKY: Let me ask this: How did 1 2 it compare with the situation in other reactors? 3 MR. GIBSON: I would say that the amount of training 4 provided to radiation chemistry people at this reactor is not that atypical of what I would expect to see elsewhere. 5 6 Perhaps a little below par, but not that much different. 7 I think the problems in this case became more 8 apparent because of the challenge to the program. 9 COMMISSIONER AHEARNE: Are you suggesting that if we 10 went out and either reviewed other plant health physics operations ourselves or hired someone to go out and review .11 12 it, that they would similarly find these kinds of weaknesses? MR. GIBSON: They might. But bear in mind that when 13 we reviewed a program during normal operations, the 14 15 regulatory requirements may, in fact, be met because the 16 program has not been challenged to the extent that this one 17 was. COMMISSIONER AHEARNE: But I'm asking a different 18 19 question. I'm asking if we were to do a review of other 2.0 plants such as Met Ed had done for their plant, either 21 ourselves doing it or hiring someone else to do it, would you expect that other plants would similarly find a large set of 22 23 weaknesses? MR. GIBSON: Yes, sir, I would. 24 25 COMMISSIONER AHEARNE: Then I guess that we ought to

1 think about doing something about that. sh 2 MR. GIBSON: The problem is the reviews that we 3 normally do are to determine compliance with regulatory 4 requirements. And the review that was done by the consultant 5 in this case was like a management evaluation. His findings 6 were not necessarily supported by regulatory requirements 7 and, in fact, were not always supported by detailed, factual bases with the opinion of the evaluator. 8 9 COMMISSIONER GILINSKY: It raises a question as to whether requirements are what they should be. 10 .11 COMMISSIONER AHEARNE: Right. 12 COMMISSIONER BRADFORD: Is that an NRC evaluator or 13 a licensee evaluator? MR. GIBSON: No. it was private. 14 COMMISSIONER AHEARNE: Met Ed had hired someone. 15 16 MR. GIBSON: Let me move on with the environmental. 17 Next slide, please. 18 (Slide.) 19 The initial off-site dose calculation was made by 20 a nuclear engineer in the unit 2 control room. It was 21 completed at about 7:10 a.m. The result was reported and .22 calculated to be 40 R per hour. The calculations were not 23 retaind and the basis of this result is not known. 2.4 Within the next few minutes, the 40 R per hour --25 COMMISSIONER GILINSKY: 40 R?

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MR. GIBSON: Per hour. That was declared at Goldsboro.

3 COMMISSIONER AHEARNE: This was the calculation. COMMISSIONER GILINSKY: When was that done? 4 5 MR. GIBSON: This was the first calculation done. which was completed at 7:00 a.m. on the 28th. Within the next 6 7 few minutes, apparently an error was noted in this calculation and it was revised down to 10 R per hour. The licensee did 8 9 not believe this number. They thought it was unrealistically 10 high. The basis of the formula being used was an assumed containment leak rate at the maximum allowable value. And 11 12 pressure and containment was 1-1/2 PSIG, as opposed to 56 PSIG. 13 . And based on that, the people in the control room 14 assumed the numbers were unrealistically high. 15 Now we have since determined that the number was 16 high because the engineer misread the monitor, the dome 17 monitor meter. And he read a number to be 30,000 millirem

18 per hour. That was actually 4.00 millirem per hour on the 19 dome monitor meter.

Now after the site emergency had been declared, environmental monitoring teams were assembled and were sent out to make measurements. The first measurement didn't come back until 7:48 a.m. This was a measurement --

24 COMMISSIONER GILINSKY: Let me ask you this. If 25 the licensee had a responsibility to give advice to the local

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1 government on whether or not an evacuation was appropriate ---2 MR. GIBSON: Yes. sir. 3 COMMISSIONER GILINSKY: Shouldn't he have gone in 4 there? 5 CHAIRMAN HENDRIE: Absolutely. 6 MR. GIBSON: And the licensee did discuss the 10 R 7 per hour number with the state. COMMISSIONER GILINSKY: They did discuss it with them. 8 9 MR. GIBSON: Yes, sir. It was about 7:22, as I recall, somewhere in that time-frame. And the first survey 10 11 result came back about 7:48. This was a result that was 12 measured on the island between the plant and Goldsboro and it showed less than one millirem. 13 And around 8:30, the first result from Goldboro 14 15 came in, which also showed less than one millirem. 16 The fact is the projection was in error. 17 COMMISSIONER AHEARNE: I guess you're also saying that the methods that they had available for doing the 18 19 calculations weren't that well developed. 20 MR. GIBSON: That's correct. They were developed in 21 the procedure that they were based on the dome monitor 22 reading because the staff monitor by this time had gone off 23 scale. And they - the procedure did not take into account --24 COMMISSIONER BRADFORD: Did the procedure start with 25 . the stack monitor, then, assuming it was on scale?

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	2	COMMISSIONER BRADFORD: Well, let's see
	3	MR. GIBSON: The procedure calls for summing the
	4	two, okay?
	5	COMMISSIONER BRADFORD: What you're saying is, though,
	6	with enough radiation going up the stack to drive that meter
	7	off scale, you could still get a reading of less than a
	8	millirem less than a mile away, which I should think would
	9	make the stack monitor reading just about useless.
	10	COMMISSIONER AHEARNE: For access.
	.1 1	COMMISSIONER BRADFORD: That's correct. But even if
	12	it were a very mild event, indeed
	13	MR. GIBSON: A millirem a mile away is really a very
	14	high number.
	15	COMMISSIONER BRADFORD: But even on site, it was
	16	still under a millirem.
	17	MR. GIESON: Yes, sir, even a millirem due to
	18	effluence on site would be a much higher than normal reading.
	19	COMMISSIONER AHEARNE: You mentioned in the report
	20	about the 12.00 millirem per hour reading in the helicopter.
	21	That definitely did happen. That was from a licensee-hired
	22	helicopter. He also had a 3000 millirem per hour.
	23	MR. GIBSON: That's true. That was on the 29th,
	24	the afternoon of the 29th.
	25	COMMISSIONER BRADFORD: What happened to that reading?

6283.09.6 126 It's in your chronology, but it's not in the report itself. sh 1 2 MR. GIBSON: I know it's in the summary and the 3 summary was written from the reports. So it's probably in 4 the report. COMMISSIONER GILINSKY: Was NRC notified of that 5 6 reading? 7 COMMISSIONER AHEARNE: I remember the 1200. 8 MR. GIBSON: I don't believe we were. 9 COMMISSIONER GILINSKY: Because that certainly was 10 a pretty strong reaction the following day to the 1200 .11 millirem per hour. 12 MR. GIBSON: Tom, do you have something to add to 13 that? 14 VOICE: I believe that region 1 was notified that it 15 was 3000. 16 COMMISSIONER GILINSKY: And did not transmit that? 17 COMMISSIONER AHEARNE: I see a nod there. The fellow 18 in the yellow shirt in front, it was? 19 VOICE: We were notified. 20 COMMISSIONER AHEARNE: Region 1 was notified. 21 VOICE: We were aware of that. COMMISSIONER AHEARNE: You did transmit that. 22 23 VOICE: Yes, we did. We had an instantaneous 24 reading. 25 COMMISSIONER AHEARNE: But you did transmit it down to

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1 Bethesda. You wouldn't know to whom? VOICE: No. 2 3 (Laughter.) 4 MR. GIBSON: Rather than go through and summarize 5 the environmental readings, which we did at the last briefing, I'll stop here, unless there are further questions. 6 7 COMMISSIONER BRADFORD: If it was transmitted down to Bethesda, it was impossible, ultimately, to get more or 8 9 less what happened to it. 10 MR. STELLO: Presumably, it should be possible. MR. MOSELEY: Mr. Chairman, could I try to run 11 12 very quickly --CHAIRMAN HENDRIE: Please do, very quickly. 13 MR. MOSELEY: Through the potential items of 14 15 non-compliance and point out that these are things that we will be evaluating, as Vic talked about earlier, and there 16 17 may be some that will be added to this list as we have 18 discussed here today. 19 (Slide.) 20 On the first slide, all of these items were items 21 that occurred before the accident. And I won't spend any 22 more time on that slide. Go to the next slide. 23 (Slide.) And in fact, on this slide, through Item 10, those 24 25 were things that occurred prior to the accident.

Next slide, please. 1 sh 2 (Slide.) COMMISSIONER GILINSKY: Can you tell us which ones 3 of these you think are of most significance? 4 5 MR. MOSELEY: No. sir. We're not prepared to do that at this time. 6 COMMISSIONER AHEARNE: Could you say which ones of 7 8 these you would have expected I&E to have picked up in its 9 inspection? 10 MR. MOSELEY: I couldn't give you a real good discussion of that. If you like, we can come back later. 11 12 MR. STELLO: There's an easier way. The first slide, 13 and I think part of the second, cover items prior to the 14. accident, only those, 'or even in that potential category. COMMISSIONER AHEARNE: That's what I'm saying. 15 16 MR. STELLO: All of those are potentially items that could have been covered. 17 18 COMMISSIONER AHEARNE: I asked that, I think, 19 slightly differently. Wouldn't you have expected it to have 20 been picked up? 21 CHAIRMAN HENDRIE: It depends on the inspection. 22 If you sent somebody up to look at QA records on a pipe 23 repair job, why, you wouldn't pick up numbers of these things. 24 If you were in for a heavier sweep of the place, why, you would. 25

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1 MR. MOSELEY: It gets to be very speculative. We 2 can go through and say, yes, these are our areas that we 3 inspect and this is how much we inspect in this area. 4 Then you've got to draw a conclusion. 5 COMMISSIONER AHEARNE: I think what you're telling 6 me, though, that you people, being experienced in what I&E 7 does, there's nothing on this list that you looked at and 8 you said, our inspector should have caught that. 9 MR. MOSELEY: There's nothing on this list. I'd 10 put it another way. There's nothing on this list that is .11 not subject to being caught by our inspection program. 12 COMMISSIONER AHEARNE: Or however. That stuck out 1.3 like a sore thumb that you really would have expected to 14 have gaught. 15 COMMISSIONER BRADFORD: Procedures on the valves? 16 MR. STELLO: Yes. I think the ones on the valves 17 ·are a violation of a technical specification. If somebody 18 looked at that procedure, I think that that would be one 19 I would expect. COMMISSIONER AHEARNE: That's the kind of thing I 20 21 was looking for. 22 MR. MOSELEY: Okay. Slide 4, please. 23 (Slide.) That finishes off the potential items of 24 25 non-compliance related to the operational aspects.

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Slide 5. please. 1 (Slide.) 2 3 All of the items on this slide relate to things you've heard, things that occurred prior to the accident. 4 Next slide, please. 5 (Slide.) 6 7 And, indeed, down through item 5, which was the 8 first item on this slide, occurred prior to the accident. 9 The remaining items in this list -- the next slide, please. 10 (Slide.) 11 Are all things that related to events that 12 occurred. COMMISSIONER AHEARNE: I gather that you don't want 13 14 us to focus particularly. . MR. MOSELEY: I'm willing to focus on any that you 15 16 have time to discuss. 17 COMMISSIONER GILINSKY: Let me ask you about one point. That is, the off-site measurements. 18 19 In the summary, you say the licensee's on-site and off-site survey team perform surveys in appropriate areas in 20 21 general, appropriate areas at appropriate times. 22 You then go on to say that they didn't perform any 23 surveys. 24 COMMISSIONER AHEARNE: At too critical times. 25 COMMISSIONER GILINSKY: At too critical times when

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most of the releases took place.

2 MR. GIBSON: Let me first characterize what the 3 surveys were. They were dose rate measurements or exposure 4 rate measurements in the field that were not for the purpose 5 of assessing cumulative dose to the public, but for 6 determining the magnitude of the release and to determine if 7 immediate protective actions were necessary.

8 Now with that in mind, the investigators looked at 9 meteorology that existed during the accident to determine 10 if there were periods of time when the plume was well 11 defined; that is, where the wind seems to be blowing at a 12 reasonable velocity in a constant direction for a period of 13 time.

And during those intervals of time, did the team make measurements where the plume was, or did he make his measurements somewhere else?

We did find that the two intervals of time listed that the licensee did not do a good enough job making measurements of the plume.

20 COMMISSIONER GILINSKY: I thought you said no 21 off-site measurements at all during this period?

22 MR. GIBSON: In the plume, I think it says. Is 23 that correct.

24 COMMISSIONER GILINSKY: In the plume. That's right.25 Sorry.

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1	COMMISSIONER AHEARNE: So he was making off-site
2	measurements?
3	MR. GIBSON: Yes, sir.
4	COMMISSIONER AHEARNE: We he tracking the plume?
5	MR. GIBSON: The helicopter was used to track the
6	plume. I don't know whether it was used concurrently during
7	this time period. Do you know, Tom?
8	VOICE: During this particular time, no, the
9	helicopter was not used. The licensee focused primarily on
10	performing surveys at known locations, known landmarks that
.11	he would relay a result from that point.
12	There was some plume-tracking done, but the major
13	emphasis was on performing surveys at fixed points. A team
14	was dispatched to a fixed point where they predicted where .
15	• the plume was very dense.
16	MR. MOSELEY: Could we have slide 8, please?
, 17	(Slide.)
18	The things covered on this slide are related to
19	overexposures to individuals, the overexposure cases that
20	are discussed in the report.
21	Next slide, slide 9, please.
22	(Slide.)
23	And this is true, also, of Item E at the top and
24	not true of Item F.
25	The things under 14 on this slide are related to the
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1 overexposure cases in terms of the limits themselves. And 2 15 ---3 Next slide, please. (Slide.) 4 15 has to do with providing radiation monitoring 5 to monitor doses in those cases where exposures were obtained 6 7 as in Item A. Item B was not an overexposure. And number 16 is the final one of our potential items of non-compliance 8 for consideration. 9 And that wraps it up, Mr. Chairman, unless someone 10 has guestions. 12 MR. STELLO: Mr. Chairman, let me comment that I know Mr. Moseley has gone through the last several slides 13 very quickly. I think that it is appropriate that we do this 14 because I don't believe we're prepared to discuss the merits. 15

16 As I indicated at the outset, I think considerably 17 more time and thought is required to look at the real 18 situation which you have and whether or not an item of 19 non-compliance is really appropriate in light of the 20 circumstances that they were working with. And I am not 21 prepared in any way to debate the merits of any of these at this time. 22

Some seem, I'm sure, to each of us more obvious 23 24 than others. Clearly, this is an item of non-compliance. 25 But until you really have had some time to think about it, I

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just don't think it's appropriate to argue that point now. Nor do I think it really serves any useful purpose trying to move quickly to get a notice of violation out and take enforcement action with this licensee.

5 Clearly, I think he's well aware that he had an 6 accident.

CHAIRMAN HENDRIE: He has a problem.

8 COMMISSIONER BRADFORD: What is the process that 9 you will go through now on these potential areas of 10 non-compliance?

11 MR. STELLO: I said at the outset -- perhaps you weren't here -- that my intent is not less than 60 days for 12 13 sure, to try to deal with each of the potential items of 14 non-compliance, try to make some kind of a decision. But it 15 isn't clear to me that because of the issues of what were 16 the real issues on safety or the underlying facts relating 17 to the total picture, whether it's appropriate to even wait 18 for some or many of these until some other investigations 19 are over.

But assuming that all that's behind us, the classical process will follow. We'll decide on non-compliance, prepare a notice of violation, if that's appropriate, send it to the licensee. And if civil penalties are appropriate, include those, and then follow up with whatever action we need from that point on.

1 COMMISSIONER BRADFORD: What are the criteria that 2 you use, assuming that you come to a point where you can say 3 fairly clearly, this is not consistent with the tech 4 specs? Then what criteria do you use in determining whether to pursue the matter further? 5 MR. STELLO: It follows the briefing we had the 6 7 last time that you were here on the enforcement policy. A 8 ranking, depending on the issues associated with the item of 9 non-compliance as to its severity. And it will receive a 10 number of points, depending on which it is. .11 COMMISSIONER BRADFORD: Or on up through to a higher 12 citation? 13 MR. STELLO: Yes, to try to reach that decision. 14 COMMISSIONER BRADFORD: The point system may not mean 15 a whole lot. 16 MR. MOSELEY: It's a guide, guiding our judgment. 17 We have not used it as an absolute indicator, in any case. 18 COMMISSIONER BRADFORD: But I gather it works in 19 terms of points per time period and the chances of there being very many more points at a particular time period. 20 21 MR. STELLO: Commissioner Bradford, dealing with 22 the issue involved in an accident is not something for which 23 that system was set up for. And that's, again, why I just 2.4 want more time. This is not a classical enforcement procedure, 25 in my view, and I'll need a little bit more time because the

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whole process wasn't set up to handle this. 1 CHAIRMAN HENDRIE: I had a question on the 2 3 radiological side. Does anybody offhand have an estimate of what the occupational exposure has been to date? 4 5 MR. STELLO: Integrated? MR. GIBSON: What is the man-rem? 6 7 VOICE: The man-rem for the first three days was estimated at 104. That's just for the first three-day 8 9 period. We did not go beyond that point in trying to 10 estimate the cumulative man-rem to date. 11 CHAIRMAN HENDRIE: Okay. 12 MR. STELLO: Do you have any idea if the first three 13 days were clearly typical or things are considerably better since then? 14 VOICE: The man-rem accumulation rate will increase 15 16 as the recovery operations go on. 17 MR. STELLO: With an increased number of people. 18 CHAIRMAN HENDRIE: Yes, I expect it. I was just 19 curious as to whether it's up into the several thousand person-rem level yet, or even above. 20 21 All right, other questions? 22 COMMISSIONER AHEARNE: Vic, you have now a lessons 23 learned effort underway. And I would imagine that this would be a major part of it. Is that correct? 24 25 MR. STELLO: Yes.

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1 COMMISSIONER AHEARNE: So that when the lessons 2 learned will focus not just on what I&E in Bethesda does in 3 this, but also any possible changes in regulations that we 4 might be proposing as a result.

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Is that correct?

6 MR. STELLO: Regulations or orders. There might be 7 suggestions that we choose to send over to Mr. Denton 8 suggesting some additional licensing requirements. That may 9 be prudent, which won't require a change in regulations.

10 Those two.

11 CHAIRMAN HENDRIE: Thank you very much. I commend 12 the audience as well for a long morning in a hot room. Your 13 stamina surprises me.

14 (Whereupon, at 12:45 p.m., the hearing was
15 .adjourned.)

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