ORIGINAL

OFFICIAL TRANSCRIPT
PROCEEDINGS BEFORE

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

DKT/CASE NO.	50-289 (Restart)
TITLE	METROPOLITAN EDISON COMPANY, ET AL. (Three Mile Island Nuclear Station, Unit No. 1)
PLACE	Bethesda, Maryland
DATE	March 8, 1983
PAGES	174 - 363

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NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

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In the matter of: :

METROPOLITAN EDISON COMPANY, ET AL. : Docket No. 50-289

(Three Mile Island Nuclear Station, : (Restart)

Unit No. 1) :

- -x

Nuclear Regulatory Commission

Fifth Floor Conference Room

4350 East-West Highway

Bethesda, Maryland

Tuesday, March 8, 1983

BEFORE:

GARY J. EDLES, Chairman

Administrative Judge

DR. JOHN H. BUCK

Administrative Judge

DR. REGINALD L. GOTCHY

Administrative Judge

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PROCEEDINGS

(9:30 a.m.)

JUDGE EDLES: Good morning.

We will begin this morning with the Staff's witnesses. But before we do that, are there any matters of business that we need to take up in advance of that?

MR. WEISS: Mr. Chairman, I just wanted to address the question of when Mr. Ornstein should appear. You asked me yesterday if I wished to call him during the boiler condenser section or this section. I wanted to let you know that, although the bulk of the questions that we have for Mr. Ornstein deal with boiler condenser, there are a few that deal with bleed and feed, and we would like to take them all at once after all of the other testimony is in.

I just want to make it clear so there wouldn't be any objections to asking those few questions.

JUDGE EDLES: Will there be any problem with that with any other counsel?

MR. CUTCHIN: None with the Staff, sir. But I think for clarification I would have read the Board's ruling under the paragraph of the regulations under which it was made to say that the Board was directing that the Staff present as the Staff's witness a Staff person with that knowledge. And of course we will make

him available whenever the Board wants him available.

JUDGE EDLES: Well, I think it was our intent, Mr. Cutchin, to respond simply to UCS' request for subpoena. We issued the subpoena on behalf of UCS. It is my understanding -- correct me if I am wrong -- that when subpoenas are issued on behalf of someone, that person comes as a witness on behalf of the party issuing the subpoena.

Now, he may well be a hostile witness or a witness for which Ms. Weiss is unaware of the testimony he is likely to give or something like that. But as I understood the matter, he would be called as a UCS witness.

MR. CUTCHIN: Well, if I disagree with that and I find that the Staff does, I will get back to the Board. But either way it's not going to be a problem.

JUDGE EDLES: If I'm incorrect on that I would appreciate any regulatory case authority contrary to my understanding.

Then I believe we proceed, Mr. Cutchin, with the Staff's witnesses.

MR. CUTCHIN: We would recall Mr. Jensen and Dr. Sheron to the stand.

JUDGE EDLES: I would again remind the witnesses that you continue to be under oath.

Whereupon,

BRIAN W. SHERON and

WALTON L. JENSEN, JR.,

recalled as witnesses by counsel for the Regulatory Staff, having previously been duly sworn by the Chairman, were examined and testified further as follows:

MR. CUTCHIN: And, their testimony having been placed in the record in full yesterday, they are available now for cross-examination. I would suggest, sir, since there are no other witnesses on either 9, 10 or 11, if it please the Board, perhaps while they are on the stand we could just go through 9, 10 and 11 before we come back to 8, which would be the only remaining issue.

JUDGE EDLES: Okay.

(Counsel for the Intervenor conferring.)

MR. WEISS: Excuse me. We just have our papers a little messed up.

CROSS-EXAMINATION

ON BEHALF OF INTERVENOR

BY MR. POLLARD:

Q Now, Dr. Sheron, first I want to address the changes to your testimony on issues 9 through 11 on page 35 of your testimony, which is figure 11-2.

A (WITNESS SHERON) Excuse me. I don't have a copy of my changes in front of me. I thought I had them.

(Document handed to witness.)

A (WITNESS SHERON) I have it now.

Q I'm sorry, I got a little bit ahead of myself. First on page 34, which is figure 11-1, what was the basis for that change?

A (WITNESS SHERON) We called Idaho National Engineering Lab and asked them to clarify the sequence of events with respect to their calculation, and they advised use that the 1200 seconds should be 1500, and that the statement made in my testimony regarding starting the HPI at 20 minutes was indeed 20 minutes after the initiation of the event, as opposed to the start of the calculation.

If you recall, there were 300 seconds in which they ran for steady state calculation before they initiated the event. So the question was, did the HPI iniiate at 15 minutes or 20 minutes, and they confirmed that they did do it at 20 minutes.

Q The motivation for this call to Idaho, was that as a result of the questions we asked you during your deposition?

A (WITNESS SHERON) That is correct.

Q Just so that we can be a little bit faster in my questioning, is the explanation for the changes on page 35, which is figure 11-2, page 36, 11-3, page 38, figure 11-4, and page 39, figure 11-5, is the explanation for the change on those figures the same as what you've just described for page 34, figure 11-1?

A (WITNESS SHERON) Yes, it is.

Q So that Idaho sent you incorrect information originally; is that correct?

A (WITNESS SHERON) If you want to interpret it as incorrect. It is just a matter of how one reads the curves, I guess. Obviously they were being misread at the time, and this is what they felt was a clearer -- in other words, they put down one HPI train initiated at 1200 seconds. Their interpretation was 1200 seconds from the start of the event, as opposed to the start of the calculation.

Q Among the people who misread those curves was yourself; is that correct?

A (WITNESS SHERON) Correct. I was not sure which was the correct time.

(Counsel for the Intervenor conferring.)

Q Is it correct that all of the figures included in your testimony on issues 9 through 11 are the figures supplied by Idaho and that the only change you made is

to add the page number and to change the figure number from the figures as they were submitted to you by EG&G?

A (WITNESS SHERON) On response to question 11, there are I believe two figures, figure 11-6 and 11-7, which were performed by Los Alamos National Laboratory, not Idaho. But the other remaining figures 00 --

(Panel of witnesses conferring.)

A (WITNESS SHERON) Yes, the figures for response to questions 9 through 11, with the exception of the 11-6 and 11-7, were from Idaho National Engineering Laboratory, and the only thing we did was to attach our own figure numbers and make the indicated correction on the time that the HPI was initiated.

Q If you refer now to page 40, originally the testimony as filed in the middle of the page, the sentence read, "Thus, the liquid flow uncertainty is biased in a conservative direction," and you've now changed that to read, "Thus, the liquid flow uncertainty is mostly biased towards the conservative direction."

Can you please explain to me the basis for that change?

A (WITNESS SHERON) Yes. During the deposition you had asked whether I was referring to it being entirely conservative, and in fact the plus 9 percent could be interpreted as in a nonconservative direction.

I agree that the wording is not clear and this was added just to better clarify the intent that was meant by this sentence.

Q With respect to this testimony on issues 9 through 11, is it correct, Dr. Sheron, that you are the principal author of this testimony, as opposed to Mr. Jensen?

A (WITNESS SHERON) Yes. I did primarily the initial drafting and Dr. Jensen was -- I guess reviewed it, added to it, supplemented it, whatever. But we did both cosponsor it.

Q I'm going to direct my questions to you, Dr. Sheron. If Mr. Jensen wishes to supplement your answer, that's fine.

The Appeal Board's question on issue 9 deals with -- the question is, under what circumstances feed and bleed is necessary at Three Mile Island Unit 1. And about six lines down into your answer on page 22, you say that feed and bleed cooling involves using systems under conditions for which they were not specifically designed.

Could you please tell me which systems are being used under conditions for which they were not specifically designed in the feed and bleed mode?

A (WITNESS SHERON) The safety valve and its

associated relief systems, the quench tank and the like, were not, obviously sized to handle the discharge, the continuous discharge from the safety valve. The safety valves, my understanding is, were not specifically designed to relieve a two-phase or single-phase liquid flow. And although the high pressure injection pumps are believed to be capable, a design condition for them is not specifically to provide continuous flow of coolant to the reactor system at 2500 pounds for an extended period of time.

JUDGE EDLES: Dr. Sheron, could you just move a touch closer to the mike or pull it closer to you.

(Counsel for the Intervenor conferring.)

BY MR. POLLARD: (Resuming)

Q Do the Three Mile Island Unit 1 emergency procedures direct the operator to attempt to use the PORV during feed and bleed?

A (WITNESS SHERON) I don't know the answer to that.

A (WITNESS JENSEN) It is my understanding that the procedures tell the operator to open the PORV in feed and bleed.

Q Dr. Sheron, then if the PORV were being used, is that another one of the components that would be in use under conditions for which it was not specifically

designed?

A (WITNESS SHERON) I believe that is correct.

Q In what respects is the PORV not specifically designed for use in feed and bleed?

A (WITNESS SHERON) That is difficult to say. Again, this is strictly my judgment on it, but it is not again designed like the safety valve capacity, two-phase or liquid flow. And I do not know the status of the control mechanisms on it, whether they are designed to operate in the environment that would be associated with a feed and bleed situation.

Q In your earlier answer, you said the HPI pumps are believed to be capable. What is the basis for that belief?

A (WITNESS SHERON) The basis is that the shutoff head for the pumps is considerably greater than the safety valve set pressure of 2500 pounds.

Q Do you know what the shutoff head pressure is for the TMI-1 HPI pumps?

A (WITNESS SHERON) I'm not sure. I think it is about 2700 pounds.

Q If a pump is designed to have a shutoff head of 2700 pounds, how does that information lead you to believe that the pump is capable of running long-term at a pressure above 2500 pounds?

MR. CUTCHIN: For clarity,, Mr. Chairman, could Mr. Pollard please define what he means by long term?

MR. POLLARD: We will come back to that question.

BY MR. POLLARD: (Resuming)

Q First I will ask the witness to define for me, if we were in the feed and bleed mode at Three Mile Island Unit 1, is it correct that feed and bleed might have to continue for a time longer than it took to empty the borated water storage tank if there were no means of removing heat through the steam generators?

A (WITNESS SHERON) I would guess one could postulate such a scenario.

Q And is it correct that after the borated water storage tank is emptied, that the operator would transfer the suction to the sump and take water from the containment sump with the low pressure injection pumps discharging to the high pressure injection pumps, and that you would continue to feed and bleed in that mode?

A (WITNESS SHERON) I would presume as much. We have not carried out any detailed analysis to determine the capabilities of long-term feed and bleed.

Q Do I understand your last answer to mean you don't know how long the HPI pump would have to run at

2500 pounds?

A (WITNESS SHERON) No, I have no idea.

Q Then what basis do you have for believing that the HPI pump is capable for running until -- what basis do you have for believing that the HPI pump is capable of performing as it would need to in a feed and bleed mode at Three Mile Island Unit 1, if you don't know how long the pump has to run?

A (WITNESS SHERON) The presumption is, is that one has to be able to restore some sort of feedwater within a reasonable period of time.

Q How long?

A (WITNESS SHERON) Again, it is just my judgment. I would presume within a few hours.

Q When you presume that you could restore emergency feedwater within a few hours, you must have made some assumption about the cause of the loss of emergency feedwater; is that correct?

A (WITNESS SHERON) Not necessarily.

Q Well, if we don't have emergency feedwater available and we are in the feed and bleed mode, and then you say that you believe the emergency feedwater can be restored within a few hours, if you don't know what caused the loss of emergency feedwater what basis do you have for presuming that it can be restored in a

few hours?

A (WITNESS SHERON) Well, I would like to go back and just state that, again, we are not requiring feed and bleed for any specific scenario. There is no design base for feed and bleed, and it's very difficult for me to sit and speculate under what conditions it will or won't work and for how long and to design a specific scenario when we don't have one.

Q So then, is it correct that your testimony concluding that the components at Three Mile Island Unit 1 which are necessary for feed and bleed, your testimony is purely speculation, then, as to whether or not the components are capable of accomplishing that function?

A (WITNESS SHERON) Based upon engineering judgment, that is correct.

Q Are you aware of any tests that have been done on the Three Mile Island Unit 1 high pressure injection pumps which would give you any empirical information on which to base your engineering judgment regarding how long the HPI pumps are capable of running at 2500 pounds?

A (WITNESS SHERON) No, I'm not aware of any.

Q Could you explain to me, then, what is the basis for your engineering judgment that the Three Mile Island Unit 1 HPI pumps are capable of performing as

required in the feed and bleed mode?

A (WITNESS SHERON) For a small break loss of coolant accident, the pumps are obviously required to operate to mitigate the event. Small breaks typically can run anywhere within from half an hour to an hour or longer. While these breaks do not have a system pressure of 2500 pounds, they can remain at relatively high pressures, perhaps that of the secondary side relief valves, for extended periods of time, again in the order of tens of minutes, 20 minutes, 30 minutes.

The operation at a pressure of 2500 pounds, as I said, I am not aware of any information which says these pumps cannot operate at 2500 pounds. And based upon my understanding of the design of the pumps, their shutoff head is sufficiently above that.

Q Is it correct, then, that your testimony is you're not aware of any information that the TMI-1 HPI pumps cannot perform as required during feed and bleed cooling, nor are you aware of any information that they can perform as required during feed and bleed cooling?

A (WITNESS SHERON) I think that is a fair statement.

Q With respect to the capability of the TMI-1 safety valves whose performance is required during feed and bleed cooling, do you have any experimental data of

the flow rate through the TMI-1 safety valves as a function of pressure and flow quality?

A (WITNESS SHERON) The only data I'm aware of is what I heard in Mr. Lanese's testimony of yesterday. But I personally have not seen or reviewed any.

MR. CUTCHIN: Mr. Chairman, while there is a lull here, perhaps we could save some time here if we make clear our understanding that the interest of the Board was in whether or not the feed and bleed method of heat removal, if called upon, would have any experimental or analytical verification.

Now, it is a fact that we did not bring witnesses here who are intimately familiar with either the environmental or other qualification of this equipment, that having been decided earlier to be outside the scope of this proceeding. And I just want the record to reflect that the fact that these witnesses do not have that information, there shouldn't be any great conclusions drawn from that.

MR. WEISS: I think that's a nice try, Mr. Chairman. But I don't think we've asked anything beyond the scope of this hearing.

JUDGE EDLES: I agree with Ms. Weiss. I think so far Mr. Pollard has stayed within the ground rules, and it seems to me that as to the reliability of the

witnesses' testimony or what conclusions or inferences we should draw, it seems to me you can make that point on brief.

MR. CUTCHIN: The point I'm making, Mr. Chairman, is if indeed this Board feels that it needs information on that subject, perhaps we should have different witnesses here, and perhaps some of those questions could indeed have been asked of Licensee's witnesses, who would be in a far better position to know.

JUDGE BUCK: Mr. Cutchin, I don't think any questions were on the environment. I think they were on the question of operability and reliability of the pumps involved here.

MR. CUTCHIN: And we have stipulated, Mr. Chairman, that this is not a design basis event. What is there is there, and if we need information on the capability of that equipment these are not the witnesses.

BY MR. POLLARD: (Resuming)

Q Again, Dr. Sheron, I state in the middle of your answer to question 9 on page 22, "Based on analyses performed by B&W and by the Staff, we believe that there is a high probability that the systems will perform successfully."

Do you have any analyses that would indicate if there is a high probability that the systems will perform successfully, even under conditions which are beyond what they were specifically designed for?

A (WITNESS SHERON) What was meant -- and I think we explained this at the deposition -- what was meant by the statement was that we have confidence that when I say the systems will perform -- what did I say, successfully -- in the context of being able to remove decay heat from the primary system; this was not intended to convey any confidence in their operability, their mechanical design, their operability.

It was simply to mean that we have high confidence that, given their performance characteristics, we have high confidence that decay heat will be successfully removed.

Q Is it correct, then, that your testimony is primarily based upon computer analyses and that you are unable to tell me to what extent those computer analyses are applicable to TMI-1, because you don't have any knowledge about the capability of the components at Three Mile Island Unit 1 to behave as your computer predicts they will behave?

A (WITNESS SHERON) If what you mean by your question is that, do we know whether the components will

perform according to the way they are rated to perform under their design base conditions, and then extrapolate it to a beyond-design-base feed and bleed with no data to support the way they operate in that extrapolated mode, the answer is yes.

I don't have any definitive data in the computer codes to not rely on, or do not have any definitive data, okay, which substantiates their performance capabilities beyond the design base.

(Counsel for the Intervenor conferring.)

MS. WEISS: Mr. Chairman, we have to look through the rest of these questions in light of the answers we have gotten this morning for a couple of minutes.

JUDGE EDLES: Dr. Buck has a question or two, if he could be permitted to ask them while you are going through your material.

JUDGE BUCK: Mr. Sheron, on what basis do you rate -- I believe the Board does rate, or the staff, rather, -- rate the HPI pumps as safety grade? Is that not correct?

WITNESS SHERON: Yes, for the design base for those pumps, that they are safety grade.

JUDGE BUCK: All right. What are the pumps designed to do?

WITNESS SHERON: To operate during the design base conditions, including the environment.

JUDGE BUCK: All right. What are the design basis conditions for the high pressure injection pumps?

WITNESS SHERON: They are used for, I think, the steam line break and for small break loss of coolant accidents.

JUDGE BUCK: Is that all they are used for?

WITNESS JENSEN: Well, they are the normal makeup to the system, so they are generally in use all

of the time at the plant.

JUDGE BUCK: All right. How often do they run and for how long a period of makeup do they run?

WITNESS JENSEN: One pump would always be in service.

JUDGE BUCK: Running most of the time?

WITNESS JENSEN: Yes, sir.

JUDGE BUCK: And all of the HPI pumps, no matter how many there are, they are all rated the same way as far as continuing operations are concerned?

WITNESS JENSEN: That same design of pump. And the pumps are located in the auxiliary building. So they would not see loss of coolant environment.

JUDGE BUCK: All right. One of the design bases of these pumps is that they have a shutoff head of some -- what is it -- 2700 pounds, if I remember correctly.

WITNESS JENSEN: Yes.

JUDGE BUCK: And that is one of the specifications; is that correct?

WITNESS JENSEN: There is a design flow as a function of back pressure curve that the pump is designed to.

JUDGE BUCK: Do you know what flow their design is to provide at, say, 2400 pounds of pressure?

WITNESS JENSEN: As I remember, there were some tests of the head flow curve required by the staff. I do not know whether the tests have been performed yet or not, but I believe the staff required --

JUDGE BUCK: Well, I am not talking about the test. I am asking about design specifications.

WITNESS JENSEN: I think I would need the question again.

JUDGE BUCK: I am asking is there a design specification as to what flow must be provided against a head of 2400 pounds, as an example, or 2300 pounds. In that area.

WITNESS JENSEN: Yes, there is.

JUDGE BUCK: Is there a design as to how long the pumps should run against that head or design specification?

WITNESS JENSEN: I do not know what it is above the design pressure of the plant. Of course, the pump is designed to run for an indefinite period at the plant design pressure, which is about 2200 pounds per squire inch.

JUDGE BUCK: And the specification there calls for the pump to run for an indefinite period?

WITNESS JENSEN: Yes.

JUDGE BUCK: And that is the basis upon which

you grant the set of specification as the basis upon which you grant a safety grade qualification to those pumps?

WITNESS JENSEN: The safety grade qualification is based upon many things, and I was not the one that did that review. But, of course, that is based upon a seismic and environmental qualification, emergency power redundancy of pumps, and the NRC determined that the high pressure injection system was, indeed, safety grade.

JUDGE BUCK: All right, thank you.

JUDGE EDLES: Mr. Pollard, if you need a little more time we can wait for a moment or two.

BY MR. POLLARD (Resuming):

Q Mr. Jensen, can you tell me either quantitatively or a ratio what is the flow through the TMI-1 HPI pumps at the normal operating pressure? And then, what is the flow from the TMI-1 HPI pumps at 2500 pounds pressure?

A (WITNESS JENSEN) I can't remember the flow at normal operating pressure. The flow at 2500 is 256 gallons per minute. I don't think the flow is very much different at normal operating pressure.

Q Are you familiar with the TMI-1 piping for the HPI system to the extent that you could confirm that

there are recirculation lines for the high pressure injection pumps?

A (WITNESS JENSEN) I am not sure whether there are recirculation lines or not. I am not sure they would be required because the pump can -- the pumps are normally cooled when they are passing flow. The flow of the water passing through the pump provides the necessary cooling water, and I would presume the pump would not overheat during operation.

Q So then it is the flow of water through the pump which cools the pump?

A (WITNESS JENSEN) I think at least in the case of these pumps, I think it is.

Q When the discharge pressure goes up, the flow through the pump goes down and, therefore, the coolant for the pump would go down. Is that not correct?

A (WITNESS JENSEN) Yes, that is what I understand.

Q So that extrapolation from the fact that the HPI pump is used as the normal makeup pump and has a given amount of flow through it, you cannot really extrapolate that performance to whether or not the pump would perform successfully in the long term or indefinitely at 2500 pounds, can you?

A (WITNESS JENSEN) Well, 250 gallons per minute

is a lot of flow, and I wouldn't expect the pump to put out so much heat that this large amount of flow would cause -- that the pump would overheat with this large amount of flow going through it. I would think that this would look pretty much like the design condition of the pump.

Now, close to a shutoff head, the flow would be much lower, so close to 2700 pounds per square inch the pump might have difficulty.

Q You heard the testimony yesterday as to the tolerance on the nominal setpoint of the safety valves, didn't you?

A (WITNESS JENSEN) Yes, I did.

Q Do you recall what the upper limit of that tolerance was; how far above 2500 pounds?

A (WITNESS JENSEN) I think it was 3 percent. I believe -- I think I got that number.

Q You would agree, though, that as we approach 2700 pounds or whatever the shutoff head of the pump is, there becomes a point at which there would be insufficient cooling through the pump?

A (WITNESS JENSEN) I haven't looked at it, but I would suspect so.

Q Dr. Sheron, in the middle of -- well, we are still on page 22, about the middle of the page. You say

that we encourage the operators to use all means available to maintain cooling of the core, including non-safety grade equipment under emergency conditions. Can you tell me which non-safety grade equipment you encourage the operator to use with respect to feed and bleed?

A (WITNESS SHERON) With respect to feed and bleed we would encourage the operators, as Mr. Jensen said, to open a PORV in accordance with their procedures to help depressurize the plant. We would also, as I said, -- you know, this was a general statement to encourage the operators to use non-safety grade equipment in other areas besides feed and bleed. As I pointed out, putting low pressure sources of water to the steam generators; if it is possible, bringing a fire truck in, pumping water from the river into the steam generator if it is necessary.

In general, an operator should not sit back and say gee, I can't use that piece of equipment; it is not safety grade, if his choice is cooling the core or not cooling the core.

Q Is it correct that in your testimony where you say you encourage the operators, that what that "encouragment" amounts to is you would challenge any licensee's submittal or applicant's submittal which did

not include in the emergency procedures a direction to use the PORV?

A (WITNESS SHERON) I think yes, that is right, we would challenge their basis for not providing that guidance in an emergency procedure.

(Counsel for Intervenors conferring.)

Q Dr. Sheron, is it your position that there is no -- and I emphasize no -- design basis event for TMI-1 in which feed and bleed is necessary?

A (WITNESS SHERON) That is correct. I am not aware of any.

(Counsel for Intervenors conferring.)

Q Isn't it correct that in stating your position that there is no design basis event for TMI-1 in which feed and bleed is necessary, isn't it correct that you only consider a small break LOCA and a main feedwater transient, but not including a main feedwater transient caused by an earthquake?

MR. CUTCHIN: Mr. Chairman, I am going to object, and maybe this would be a good time, again, to get back to the subject of yesterday. I believe based upon a Commission order that was issued on the 4th, the taking of any testimony by this Board relative to seismic qualification or no would be clearly outside the scope of the proceeding.

MS. WEISS: The purpose of the question is simply to get the record clear on the limitation of the testimony.

JUDGE EDLES: I think that is a reasonable purpose; I will allow the witness to answer the question.

WITNESS SHERON: Could you repeat the question?

MR. POLLARD: Could you read it back?

REPORTER: "Q: Isn't it correct that in stating your position that there is no design basis event for TMI-1 in which feed and bleed is necessary, isn't it correct that you only consider a small break LOCA and a main feedwater transient, but not including a main feedwate transient caused by an earthquake?"

WITNESS SHERON: That is correct.

(Counsel for Intervenors conferring.)

BY MR. POLLARD (Resuming):

Q Dr. Sheron, I would like you to assume for this question that the emergency feedwater system were not safety grade.

A (WITNESS SHERON) Okay.

Q Under those conditions, is it not correct that feed and bleed would be necessary to be used during small break LOCAs and main feedwater transients?

(WITNESS SHERON) I would say that there would have to be an alternative means for decay heat removal. I

don't want to say that feed and bleed is absolutely required; just that a means, an alternative means, would have to be available.

Q And that alternative means would have to be safety grade, would it not?

A (WITNESS SHERON) Within the context of today's requirements, yes.

(Counsel for Intervenors conferring.)

Q With respect to a follow-up on the last question, with respect to Three Mile Island Unit 1, is it correct that emergency feedwater and feed and bleed are, in your view, the only safety grade systems available to cool Three Mile Island Unit 1 in the event of a small break LOCA or a main feedwater transient?

A (WITNESS SHERON) Within the scope of the hearing, the emergency feedwater system, as I understand it, meets safety grade requirements. I can't say whether a feed and bleed is a safety grade system, a feed and bleed system would meet safety grade requirements. We have never said that, we have never required it.

(Counsel for Intervenors conferring.)

MS. WEISS: We are finished with questions on 9, Mr. Chairman. We will be going on to question 10. Would this be a good time to take 5 minutes?

JUDGE EDLES: I have no objections. Does

anyone object to taking 5 minutes at this point?

(No response.)

I think Dr. Gotchy has one question, and then we will take a five-minute break.

JUDGE GOTCHY: Dr. Sheron, if you had a small break LOCA but maintained off-site power, would the operators normally rely, then, on main feedwater for cooling as opposed to emergency?

WITNESS JENSEN: I believe that following a small break LOCA, the main feedwater pump would be throttled down and the cooling would be by the emergency feedwater system.

JUDGE GOTCHY: Well, subsequently, if you had problems with emergency feedwater, would they then turn on the main feedwater?

WITNESS JENSEN: Yes. There are, -- I believe there is in the procedures that if the main feedwater is not available, then the procedures instruct the operator to try to depressurize the steam generators and to utilize the condensate pumps.

JUDGE GOTCHY: I see, thank you.

BY MR. POLLARD (Resuming):

Q Two questions on that, Mr. Jensen. Is the main feedwater system at TMI-1 a safety-grade system?

A (WITNESS JENSEN) No, it is not.

Q Please tell me specifically which procedures you have reviewed which direct the the operator to use main feedwater and to depressurize the steam generator and use low pressure pumps to inject into the steam generator.

A (WITNESS JENSEN) I believe it is the loss of feedwater procedure.

Q Specifically, which emergency procedures for Three Mile Island Unit 1?

A (WITNESS JENSEN) I don't remember the number of the procedure.

Q You did review Three Mile Island Unit 1 emergency procedures; is that correct?

A (WITNESS JENSEN) I looked at them, but it was some time ago.

Q So that your answer, then, is you don't even know if you reviewed the most current version of the emergency procedures for Three Mile Island Unit 1?

A (WITNESS JENSEN) I haven't looked at the most current version.

Q Do you know if the version that you looked at is the most current version?

A (WITNESS JENSEN) I don't think so.

Q You don't think you know, or you don't think what you looked at is the current version?

A (WITNESS JENSEN) I don't think it is the current version.

Q I know you don't know the numbers, but could you tell me again which are the procedures that you did look at?

A (WITNESS JENSEN) I think it was the loss of feedwater procedure.

(Counsel for Intervenors conferring.)

BY MS. WEISS:

Q I am going to hand you a copy of TMI Nuclear Station Unit 1 Emergency Procedure 1202-26A, loss of steam generator feed to both once-through steam generators, Revision 14.

JUDGE EDLES: Is there a date on that?

MS. WEISS: Yes, June 4th, 1982.

JUDGE EDLES: Do other counsel have copies of that document?

MR. BAXTER: I do.

MR. CUTCHIN: I am sharing one.

JUDGE EDLES: And Mr. Adler?

MR. ADLER: We do not.

JUDGE EDLES: Ms. Weiss, would you have an extra copy for Mr. Adler to look at?

MS. WEISS: All we have is this one; we just got it last week from Mr. Baxter and really didn't

anticipate that it would be used.

MR. ADLER: I have no objection to proceeding.

(Counsel handing document to witnesses.)

MS. WEISS: I would like to have this marked for identification. Should we start the exhibit numbers all over again?

JUDGE EDLES: I think we should probably do this sequentially so as not to have any confusion.

MR. POLLARD: The licensees --

JUDGE BUCK: Are the witnesses supposed to be reading this now?

MS. WEISS: Yes.

JUDGE BUCK: Why don't you have them read it now, if the witnesses could be reading it, we can get the number later.

MS. WEISS: The last exhibit that we have from the Licensing Board record was UCS 44, so this would be UCS 45.

MR. CUTCHIN: And might I ask, Mr. Chairman, while she is providing copies to the reporter, that copies be made available to each of the attorneys as well?

JUDGE EDLES: As well as to the Board.

(The document referred to was marked UCS Exhibit

No. 45 for identification.)

(Pause.)

JUDGE EDLES: Dr. Sheron, are you nearing the end of your perusal of the document

WITNESS SHERON: Yes, sir.

BY MR. POLLARD (Resuming):

Q Mr. Sheron, do you find any -- or, Mr. Jensen, -- do you find any place in that procedure where it says to use main feedwater or depressurize the system, to use low pressure pumps?

A (WITNESS JENSEN) I found the part. I found where it says to use main feedwater. And it says -- of course, it says to try to get main feedwater back. This is a loss of main feedwater, so it says to look and see that the emergency feedwater pumps operate, and then try to get it back; if you lose the emergency pumps to try to get back either main or auxiliary feedwater.

And then it says to turn on the high pressure injection pumps if you can't get any feedwater.

Q And it says use the inadequate core cooling procedure, does it not?

A (WITNESS JENSEN) If neither main nor emergency feedwater can be restored and plant depressurization is required, refer to the inadequate core cooling procedure.

Q So wouldn't it be correct to say, then, that at least based upon this emergency procedure, the way things will work assuming this procedure is followed is if there is a loss of both main and emergency feedwater, the operators are directed, not as you suggested in your testimony or answer to use low pressure pumps, but in fact, to go essentially to feed and bleed?

A (WITNESS JENSEN) Well, I don't remember what the inadequate core cooling procedure says, and it may very well -- of course, the procedure as we have it here has told the operator to operate high pressure injection. And this would -- if feedwater were not established, it would actuate the feed and bleed. And I believe the guidance of the procedure is also telling the operator while the high pressure injection pumps are operating, to continue to try to get feedwater back.

Q But this does not say in this procedure to try and get water back to the steam generator by depressurizing it and using the low pressure pumps, like the condensate pumps. Is that correct?

A (WITNESS JENSEN) Not in this procedure.

MS. WEISS: Could we have a stipulation from counsel that this is the most current revision of the procedure?

MR. BAXTER: Yes. And as to the matters that

were discussed today, that hasn't changed in the Licensing Board proceeding.

MS. WEISS: I will move this into evidence.

JUDGE EDLES: Any objection?

MR. BAXTER: No.

JUDGE EDLES: In the absence of objection, so moved.

(The document previously marked UCS Exhibit No. 45 for identification was received in evidence.)

JUDGE EDLES: Ms. Weiss, have you now finished with question 9?

MS. WEISS: Yes.

JUDGE EDLES: Let's take a 10-minute recess. I'm sorry, let's finish question 9, I am sorry.

CROSS EXAMINATION

BY MR. BAXTER:

Q Mr. Jensen, just to get to the bottom line of Mr. Pollard's questioning about the HPI pump capability, does the use of the HPI pumps for system makeup for extended periods of time during normal operation of the plant give you confidence in the HPI pump capability for feed and bleed conditions?

A (WITNESS JENSEN) Yes, it would. It would show

the pump could operate for a long period of time with flows not so much different from what it would have in feed and bleed operations.

MR. BAXTER: Fine, that is all I have.

JUDGE EDLES: Mr. Adler?

MR. ADLER: The Commonwealth has no questions.

JUDGE EDLES: Any redirect, Mr. Cutchin?

MR. CUTCHIN: A couple of questions, Mr. Chairman.

REDIRECT EXAMINATION

BY MR. CUTCHIN:

Q There has been some discussion as to whether EFW is or is not safety grade. What does the fact that the EFE system may not be fully safety grade by the time of RESTART say to you, if anything, about whether it would be reliable?

A (WITNESS JENSEN) I don't know the relationship between the reliability of the system and whether or not it is safety grade.

Q Do you know that there is any relationship?

A (WITNESS JENSEN) No, I don't.

MR. CUTCHIN: That's all, Mr. Chairman.

JUDGE EDLES: Ms. Weiss?

MS. WEISS: No further questions.

JUDGE EDLES: We will take a 10-minute recess.

(A short recess was taken.)

JUDGE EDLES: Let's go back on the record.

MR. CUTCHIN: Mr. Chairman, before we move to the questions on the next two issues, maybe it would be timely -- I have placed at the stations of the Board and the parties copies of Dr. Graham Wallace's testimony in the GPU/B&W proceeding. It was asked yesterday that we provide transcript references, but it is my understanding that this is the extent of that testimony, and it is at transcript pages 6647 to 6656 on direct, and there are two pieces at transcript 6782 to 6789, and 6813 to 6818 on cross.

JUDGE EDLES: Those are the transcript pages in the Southern District of New York?

MR. CUTCHIN: That is correct, and that is the testimony that was referred to, I am told, in the Board Notification 81-23.

JUDGE EDLES: You mean 83-21?

MR. CUTCHIN: Yes, 83-21. I'm sorry. And I take that to satisfy my obligation.

JUDGE EDLES: Yes, sir.

[Counsel for Intervenors conferring]

CROSS EXAMINATION

BY MR. POLLARD:

Q On page 22 of your testimony you refer at the bottom of page 22 to a report attached to a letter from

P. North of EG&G to Mr. J.E. Solecki, S-o-l-e-c-k-i, entitled "Extension of Analysis of Primary Feed and Bleed Cooling in PWR Systems," PN-08-83, dated January 14, 1983. Is that the document which was sent under cover of letter from your counsel to this Board dated February 17, 1983?

MR. CUTCHIN: I will stipulate that it is, Mr. Chairman.

BY MR. POLLARD: (Resuming)

Q Dr. Sheron, do you have a copy of that in front of you? We will be asking some questions on it.

A (WITNESS SHERON) Yes.

Q Will you please look at page 2 of the EG&G report? I'm sorry. I occasionally get ahead of myself. In the figures attached to your testimony for Issue 10, is it correct that figures 10-6 through 10-8 were not included in this EG&G report and you obtained those separately?

A (WITNESS SHERON) 10-6 through 10-8?

Q Yes, sir.

A (WITNESS SHERON) Yes, those were obtained after this report was issued.

Q From whom?

A (WITNESS SHERON) I believe it was Gary Johnson at EG&G.

Q Okay. On page 2 of the EG&G report, Item No. 4 states, "The pressurizer calculation was changed from thermal non-equilibrium to thermal equilibrium at 1350 seconds because of an excessive time run condition." Do you know what specific changes were made to the RELAP code in order to change from thermal non-equilibrium to thermal equilibrium?

A (WITNESS SHERON) I believe the way one changes the code is with an input designation telling the code whether it should treat a specific volume, I guess, in this case as an equilibrium volume or a non-equilibrium volume, and I would presume that the change that was made was just an instruction to the code to treat this volume as an equilibrium volume beyond 1350 seconds.

Q Is it correct that the reason that they changed the code was because it cost too much to run in the thermal non-equilibrium condition?

A (WITNESS SHERON) Yes, that is stated as Item 4, although I would point out that one does not change a code to do something just because it is a little cheaper without first understanding what the impact is, and I would presume that the EG&G people looked at the calculation and determined that changing from a non-equilibrium to an equilibrium model beyond 1350

seconds would not alter the conclusions.

[Counsel for the Intervenors conferring]

Q Dr. Sheron, do you have any independent knowledge of whether, had they not changed the code and remained in the thermal non-equilibrium, whether it would have had different results than what were actually obtained by the run that they did at EG&G?

A (WITNESS SHERON) If you are saying have I done the calculation independently with retaining a non-equilibrium model, the answer is no. If I examined independently the results, I note that if you see Figure 1, which shows the mass flow out of the PORV with time, and at that time you can see that the PORV flow transition to steam, almost entirely to steam, both the code calculation and the data, and that would indicate to me that non-equilibrium would not have any substantial effect because of the fairly good agreement that is shown in that figure.

Q Do I conclude, then, from your last answer that the flow, the mass flow rate through the PORV after 1350 seconds indicates to you that the steam and the water in the pressurizer at the same temperature?

A (WITNESS SHERON) On an indirect examination, yes. At this point you will note that the transitioning is due to the surge line, all of a sudden the flow

entering the surge line has now become highly voided, mostly steam. This steam is passing up into the surge line through the pressurizer and out the PORV.

I kind of find it difficult to envision steam bubbling up through a subcooled liquid and not producing, not saturating out that liquid such that the steam and water would be at the same temperature under these conditions.

JUDGE BUCK: Mr. Pollard, may I ask a question?

Dr. Sheron, can you tell me exactly what EG&G means by the phrase "excessive run time condition"?

WITNESS SHERON: It is hard to say. Everybody has their own limits on what constitutes excessive run time. It usually depends upon how much money you have. In their case they were under contract to the Staff. Their funding was finite. And I presume that what they were referring to here was that if they proceed with the calculation using the non-equilibrium models, that the computer costs would be excessive with respect to their contract funding.

JUDGE BUCK: On what basis would they cut it off at this point? Why pick 1350? Do you think it has reached equilibrium, or is that their assumption or what? Why did they pick 1350?

WITNESS SHERON: I did not ask them specifically that question, although, as I just pointed out, I believe it is obvious at this point, the flow has transitioned primarily to steam and there is no reason to believe that a non-equilibrium calculation would yield any better results. As you can see, there appears to be at 1350 --

JUDGE BUCK: A smooth transition.

WITNESS SHERON: Yes. There is no big jump.

JUDGE BUCK: All right, thank you.

BY MR. POLLARD: (Resuming)

Q Dr. Sheron, do you know whether the calculation was terminated at the same time that he actual S-SR-2 test was terminated? In other words, do we have calculations for the entire length of the S-SR-2 tests?

A (WITNESS SHERON) No. My knowledge of the calculations or the extent to which the calculations were carried out and the extent to which the test was carried out are just based upon these reports. I did not ask them whether they were carried out further than the 2400 seconds that were indicated here.

Q Let me just clarify that answer. Do you know whether the test ran longer than the calculation ran, or you just don't know?

A (WITNESS SHERON) I have no knowledge of how much beyond 2400 seconds they ran the test.

Q When you were speaking a moment ago with Dr. Buck, you talked about the funding constraints of the contract under which EG&G is operating. Do you know whether prior to this most recent calculation which EG&G has done for you, whether there were other funding constraints with respect to Semiscale tests, S-SR-1 and S-SR-2?

A (WITNESS SHERON) The funding for Semiscale testing and any analyses that are done in support of that test come from the Office of Research. I have no knowledge of whether there are any financial constraints or not.

Q Do you know what a QLR is as used in the sentence which says "publish a normal QLR covering the results of greatest interest and preliminary conclusions"?

A (WITNESS SHERON) QLR I believe refers to a quick look report.

Q The next sentence --

A (WITNESS SHERON) I'm sorry, where are you reading from?

Q Well, you may not have this. I am just trying to understand these definitions first. An EDR as used

in the sentence, "Dispense with the EDR for the present."

A (WITNESS SHERON) Experimental Data Report I believe is what EDR refers to.

Q Have you received yet the EDR for Semiscale test S-SR-2?

A (WITNESS SHERON) I have not seen it.

[Counsel for Intervenors conferring]

Q I'm going to show the witness an unclassified Telex dated July 6, 1982, sent to Mr. Robert E. Tiller, U.S. Department of Energy, Idaho Operations Office, in Idaho Falls, by apparently Ralph Landry from the NRC's Office of Nuclear Regulatory Research.

MR. CUTCHIN: Could copies also be provided to the parties for perusal as well?

MS. WEISS: I can just give it to you now before I give it to the witness.

[Pause]

JUDGE EDLES: Mr. Adler, you must at times feel like the lonesome end who has to get his signals from the sideline.

[Laughter]

MR. ADLER: Perhaps I should put someone at the front of the room to give the signals for me.

[Laughter]

BY MR. POLLARD: (Resuming)

Q Does this, either Dr. Sheron or Mr. Jensen, refresh your views as to any prior funding constraints on the Semiscale tests?

A (WITNESS SHERON) Again, the Semiscale program is totally managed and funded from the Office of Research, unless they specifically come to us and ask us whether there is something they intend to do which they believe would impact an ongoing licensing proceeding or something. This type of report would normally not pass my desk, at least.

Q But you also, is it not correct, have contact with Research in order to ask Research to direct that EG&G either do tests and/or analyses, don't you?

A (WITNESS SHERON) Yes, users of Research, we do that.

Q And specifically in order to answer this Board's questions for this proceeding, you did such, didn't you? You did go and have to ask Research to direct Semiscale to run the RELAP 5 run for the test S-SR-2?

A (WITNESS SHERON) To do the recalculation in this report.

Q Yes, sir.

A (WITNESS SHERON) Yes, that is correct.

Q And it was NRR that requested the second

Semiscale test S-SR-2 to be run, is that not correct?

MR. CUTCHIN: Mr. Chairman, I would like an inquiry into where this line of questioning is going. I understood the purpose of the Board's question to be to have an analysis run of the feed and bleed method of removing decay heat, and we may be able to save a lot of time if we can find out where this is going and what it has to do with that particular matter.

JUDGE EDLES: I think that would be useful for me, Mr. Pollard, if you would just give me a thumbnail sketch.

MR. POLLARD: Perhaps I should have listened to counsel whispering in my ear and ask the final question. The final question I was going to come down to is what is in an engineering design report? How does that information in there help you to evaluate the Semiscale test?

I also am engaging this line of questioning because in the course of preparing for this proceeding, we asked the Staff to provide us any documentation about the request for the Semiscale test, and they said there were no documents, that in fact all of this had been done orally; and I find through a Freedom of Information Act request that there are substantial documents.

MR. CUTCHIN: I would take issue, Mr.

Chairman. I believe that the documents that were provided to the parties were provided at the request of the Board for the underlying references as I referred to in my letter of February 17th, and I had no agreement or do not recollect any discussion asking for any other such documents.

JUDGE EDLES: Well, if you want to ask the question, Mr. Pollard, as to whether there are any other documents that the witnesses are aware of that haven't been served up, I will let you ask the question; but I would prefer also that you stick to the reliability of the code and things of that nature.

MS. WEISS: The purpose, Mr. Chairman, is just because these witnesses come here today to present work that was done by EG&G and not by them. We are just trying to get a handle on whether these are only preliminary results which they received from EG&G and are passing on to us.

JUDGE EDLES: I think that is a legitimate purpose and I will allow you to ask questions along that line.

BY MR. POLLARD: (Resuming)

Q Dr. Sheron, can you tell me what kind of information would be in an engineering -- what did you say -- design report?

A (WITNESS SHERON) Experimental data report.

JUDGE EDLES: Mr. Sheron, sit a little closer to the mike, again.

BY MR. POLLARD: (Resuming)

Q That would not be in the quick look report.

A (WITNESS SHERON) The experimental data report is usually a very comprehensive document which provides all of, I think, what our Office of Research calls qualified data from all of the instruments that are available in the Semiscale facility or whatever facility they happen to be using at the time. It also, I think -- a lot of times I have seen, at least, in like the LOFT reports, it covers different time scales, from, say, zero to perhaps 100 seconds, zero to 1000, and maybe over the entire test presents those in, as I said, under the different scales that one can see detail during short times as well as over the long duration of the test.

A quick look report is what the name implies. They obtain key data, what I would call figure-of-merit-type data. They qualify it, put it into the proper -- transpose it from perhaps voltages or milivolt readings into the proper engineering units and provide this very quickly to the technical community.

The purpose is that one does not want to wait

the many months it usually takes to get an experimental data report, so the quick look report provides some of the key information very early on, and an experimental data report is a follow-up report which provides just reams of instrument readings and the like.

Q As of this point in time, then, is it correct that you have only seen the quick look report for test S-SR-2 and that you have not yet received --

A (WITNESS SHERON) The only reports I have seen for S-SR-2 are this report called Analysis of Primary Feed and Bleed Cooling in PWR Systems, EGG-SEMI-6022, which is dated September '82, and the second letter report which went from Gary Johnson to Jim Solecki at DOE, which was the one you referred to earlier on and that was dated January 14th, the Extension of Analysis of Primary Feed and Bleed Cooling at PWR Systems, PN-08-83.

[Counsel for Intervenors conferring]

Q Okay. On page 8 of the EG&G report of the RELAP 5 calculation for test S-SR-2, there is a footnote which states, "Differences between the measured and calculated HPIS flows (figure 5) are due solely to differences between measured and calculated PCS pressure; HPIS flow as a function of pressure was the same."

In view of that footnote, I would like to compare figure 2 and figure 5. Figure 2 appears on page 4 of the EG&G report and plots pressure as a function of time, and figure 5 appears on page 9 and shows the volumetric flow rate of HPI versus time.

If I compare the HPI flow beginning about 1900 seconds and I see that the RELAP 5 code is calculating an increase in HPI flow, whereas the test data remained constant, and when I look at figure 2 I see that the test data in the RELAP 5 calculations are generally trending smoothly downward from about 1900 seconds, can you explain to me why, if HPI flow is calculated solely as a function of system pressure, the calculation shows a peak in the HPI flow after 1900 seconds?

A (WITNESS SHERON) Yes, I believe you asked the same question at the deposition. The answer I gave you is still, I believe, correct. I have had one of my staff check this and they have confirmed, if you look at figure 12, page 19 of the same report, you will see a curave called actual test HPIS.

JUDGE BUCK: Mr. Sheron, we don't have the deposition. I don't know what answer you gave. Can you do a repeat on what answer you gave to this particular question?

A (WITNESS SHERON) The answer I am going to

give is essentially a repeat.

JUDGE BUCK: All right, thank you.

WITNESS SHERON: You will note in that figure that at about, it looks like between 7 and 7-1/2 megapascals pressure, that there is a peak in the HPI flow. I have no knowledge of why it is there, but upon questioning EG&G, they informed me that this was the actual HPI versus pressure curve that existed in the test.

You will note that there is a strong sensitivity, I guess, of HPI flow versus pressure right at that point. Now, if you go back and you look on figure 2, you can see that right around, I guess it was 1900 seconds you were pointing at, the pressure is indeed somewhere between 7 and 7-1/2 megapascals at that time, and therefore you can see that as pressure goes down, the HPI flow would go up at that point.

So if one were to plot the HPI flow as a function of the pressure calculated by RELAP 5, one would indeed see the HPI flow increase at that point due to that blip, as I would call it, in the head versus flow curve. And as I pointed out, I asked one of my staff to just confirm that one would indeed see that performance, and she did advise me that that was the cause.

Q Can you give me your understanding of physically what would cause the HPI flow to take a rapid increase at this particular pressure range?

A (WITNESS SHERON) My understanding of Semiscale is that they can preprogram the HPI flow versus pressure curve. In other words, I can ask EG&G to represent the HPI characteristics of, say, a Combustion plant with a low head pump or a Westinghouse plant with an intermediate head pump or a B&W plant with a high head pump, and by this preprogramming they can obtain the approximate characteristics.

I am only speculating right now. As I said, I did not question EG&G on the why-for of this blip. But I would presume it had to do with the way they programmed this characteristic. It is obviously not typical.

Q When you say they programmed it, are you referring now to programming the flow in the test or programming RELAP 5?

A (WITNESS SHERON) Programming the flow in the test.

Q So it is your understanding that on Figure 12, that when EG&G did test S-SR-2, they deliberately inputted to the test a flow characteristic of actual test HPIS as shown on Figure 12?

A (WITNESS SHERON) When you say the word "deliberate," I don't think that they intended to have it be as atypical as it is shown. I think that they did program it in trying to represent as close as possible the HPI characteristics of a Westinghouse 15 x 15 plant after which Semiscale is modeled, and after running the test and going back and looking at the pump performance, this is what they understood the actual performance was.

So I don't think it was deliberate that they put this peak in there. I think it just happened for some reason, and I don't know why.

[Counsel for Intervenors conferring]

JUDGE BUCK: Dr. Sheron, you are saying that the HPI pumps they used have this particular characteristic, this characteristic peak in them?

WITNESS SHERON: No. No, I don't think the pumps themselves have this characteristic peak in them, but I think that the method they use to preprogram or to precontrol or specify the characteristic of the pump may have had some sort of anomaly in it which produced this.

Again, I am saying I don't know exactly why this is here. I do know that if they had to do it over again and knew this was here, it wouldn't be here.

JUDGE BUCK: I don't understand, then, what they mean by actual test HPIS.

WITNESS SHERON: When they run the test and then they go back and look at actually the way the pumps, valves, whatever actually performed during the test, and they went back and they looked, they found out that the HPI flow versus pressure curve did not perform the way they had originally intended it to.

JUDGE BUCK: I had this peak in it?

WITNESS SHERON: It had this peak in it, and this is one of the reasons they went back and did the reanalysis we asked them to do, which was reported here, was because the original RELAP calculations used a flow versus head curve which they originally assumed was used for the test, and in fact what was used in the test was not what they originally assumed and, therefore, we believed accounted for a lot of the anomalies between the original calculation and the test results.

JUDGE BUCK: Go ahead, Mr. Pollard. I will follow up in a minute.

BY MR. POLLARD: (Resuming)

Q What I would like to do now, Dr. Sheron, is summarize your answer to the last series of questions and then ask one more question.

If I understand your explanation, that during

the actual test of S-SR-2, figure 12 illustrates the actual HPIS flow as a function of pressure; is that correct?

A (WITNESS SHERON) Yes.

Q And your explanation of this peak is because of the characteristics which they tried to use during the HPI test. In other words, all I am trying to say is when we went back and did the RELAP 5 calculation, they inputted to the RELAP 5 as an input the actual HPI test characteristics. That is, they would have actually inputted to RELAP 5 the curve labeled "Actual Test, HPIS," that is shown on figure 12.

A (WITNESS SHERON) This would be for the second calculation, I would call it.

Q The second calculation?

A (WITNESS SHERON) Not the original.

Q For the calculation reported in this document?

A (WITNESS SHERON) Yes, they would input that actual curve.

Q Now, could I then direct your attention to Figure 5. I think I now understand why RELAP 5 has a peak, because you told RELAP 5 there would be a peak at that pressure. My question is if your explanation is correct, why is there not a flow peak in the actual data? And I am talking about the data on Figure 5 for test S-SR-2.

A (WITNESS SHERON) I would say if you go back to Figure 2 you will see that at that same time, about 1900 seconds, the pressure is just about at what looks like just slightly above 7 megapascals. And from Figure 12 at that lower pressure, the HPI flow is rather predictable at that point. In other words, it is decreasing as a function of increasing pressure.

I think what I am saying is that if on Figure 5 that you referred to, had the actual pressure in the test been slightly higher, you probably would have seen the same type of behavior. As a matter of fact, I may be jumping here, I am not sure, but I would not be surprised -- and I am just guessing right now -- if that

between 800 and 1200 seconds, some of the spikes you see on the actual volumetric flow data may be due to that peak in the HPI characteristic.

Q One final question. You are postulating these peaks from 800 to 1000 seconds. Is it not correct that the type of information which would be contained in the experimental data report might help us to understand the discrepancy between the data curves in the RELAP 5 calculation shown on Figure 5?

A (WITNESS SHERON) No, I don't think it is clear that is what is in the data report would necessarily explain that.

Q Wouldn't the experimental data report -- I thought you told me it would give us very detailed information about specifically what were all of the instruments measuring throughout this test period.

A (WITNESS SHERON) It usually does that, but it is not obvious to me that that information will resolve, I guess, what you believe is a discrepancy here. In other words, I am not convinced that there are discrepancies on this information here.

Q Would you agree that in analyzing feed and bleed, the HPI flow is an important parameter in analyzing the viability or whether or not feed and bleed will be successful?

A (WITNESS SHERON) Yes, I agree.

Q And would you agree with me that at some points in time, particularly around 1000 seconds, that the difference between the calculated flow and the experimental flow, as shown on Figure 5, is roughly 50 percent?

A (WITNESS SHERON) Yes, I would say one could see a difference of about that.

(Counsel for Intervenors conferring.)

Q Dr. Sheron, on page 24 of your testimony, if you recall, during the deposition we talked about those specific ratios shown on that page.

A (WITNESS SHERON) Correct.

Q Am I correct that that ratio is supposed to represent the deviation between the test data and the calculation divided by the actual test data?

A (WITNESS SHERON) With the correction to the page 24, yes.

Q Is there a correction to page 24? We didn't receive it, which is why I am asking that question.

MR. CUTCHIN: That was not in the package I got. Can we make the correction here, if there is one?

WITNESS SHERON: I apologize. I had it here.

MS. WEISS: Can you enlighten the rest of us as to what the correction is?

WITNESS SHERON: Well, it really doesn't affect any of the conclusions on page 24. Where it says, "Similarly, from Figure 10-7, the uncertainty in the integrated PORV flow is estimated at 2400 seconds to be ..." where it says 115 kilograms; replace that with 103 kilograms. And then replace the 10 percent on the righthand side of the approximate sign to 12 percent.

BY MR. POLLARD (Resuming):

Q On page 23 of your testimony, approximately in the middle of the page, the end of the paragraph says that small uncertainties in the inventory calculation could produce significant uncertainties in the level calculation and, consequently, the degree to which core uncovery would be expected. Is it true that if the actual core level was significantly different than the calculated core level within this range of uncertainty, that you could change from a conclusion that feed and bleed was an adequate method of cooling the core to a conclusion that feed and bleed was not adequate?

A (WITNESS SHERON) I think the answer is yes. Let me just qualify it by saying that if the uncertainty one applied to the results would put you in that region near the top of the core -- in other words, if your minimum inventory results in a minimum vessel level, let's say, that is far away from the top of the core,

even when one applies an uncertainty associated with the code -- then one would not have to draw a conclusion that feed and bleed may or may not work. You could confidently say I am far enough away that it is not a problem.

Q Do you have the deposition in front of you?

A (WITNESS SHERON) No.

Q Well, if it is permissible, I would just like to read you two questions and your answers and then I will show it to you and all I am going to ask is do you have any reason to change now the answers you gave during the deposition.

A (WITNESS SHERON) Okay.

Q "Isn't it true that if the actual core level was significantly different than the calculated core level..." --

MR. CUTCHIN: Could we get a citation? What page, Mr. Chairman?

JUDGE EDLES: I think that is fair.

MR. POLLARD: I'm sorry, it is page 136, line 17, continuing on the rest of that page through page 137, endingat line 4.

JUDGE EDLES: Thank you.

BY MR. POLLARD (Resuming):

Q The question is: "Isn't it true that if the

actual core level was significantly different than the calculated core level within this range of uncertainty, you could change from the bottom line conclusion that feed and bleed was adequate or that feed and bleed was not adequate? Answer (Witness Sheron): Definitely. Question: Would that be true within the range of experimental uncertainties: Answer (Witness Sheron): Yes, I think that is a fair statement."

(Counsel handing document to witness.)

Aside from the additional information which you gave today that it depends where the core level is, I understand that, do you have any reason to change your answers to those questions?

A (WITNESS SHERON) No, I don't.

Q Thank you. Back to the EG&G report, the RELAP 5 calculation of S-SR-2, pages 18 and 20, --

(Counsel for Intervenors conferring.)

Dr. Sheron, I am going to read that paragraph, the last paragraph on page 18 which continues on page 20, and you can read it along to yourself.

"The similarity between the calculated and observed PORV mass flow rates allows a further observation. Figure 12 shows the required PORV average mass flow -- the PORV flow needed to remove the net power delivered to the system, less than the critical

flow to the PORV. The PORV could have been cycled open and shut to reduce the mass flow rate, while still maintaining a favorable energy balance. To have done so would have moved the upper pressure bound to the intersection of the required PORV average mass flow and the HPIS mass flow rate about 7.0 megapascals. This would have prevented a further decrease in PCS inventory, and would have established a steady operating condition. Although Figure 4 shows that the core had already uncovered, further uncovery could be avoided by cycling the PORV."

Do I interpret that paragraph correctly to say that as long as the PORV was left open, that is; when they were uncovering the core during the test and they had to terminate the test, but had they cycled the PORV they would have achieved steady state feed and bleed?

A (WITNESS SHERON) That is what they said.

Q Now, if I compare that situation to the situation which might exist at Three Mile Island Unit 1, if they were using feed and bleed during a small break LOCA is it not possible that the Three Mile Island operator using the PORV to accomplish feed and bleed might wind up in the same or equivalent situation as was observed during this test? Namely, that if he leaves the PORV open he might uncover the core, but if he

cycles the PORV he might be able to successfully feed and bleed.

A (WITNESS SHERON) I don't believe that would be the case for Three Mile Island. My understanding is that with a single PORV, the PORV cannot remove all of the decay heat energy.

Q The situation I was postulating was during a small break LOCA, so I am assuming that some of the decay heat is going out the break, and some of the decay heat would be going out through the PORV.

A (WITNESS JENSEN) The Semiscale was somewhat different from Three Mile because it is designed to model a Westinghouse plant, and a particular plant that does not have high pressure injection. That doesn't have high pressure injection that can force open the safety valves. So what they are doing is trying to hold open the PORV and depressurize the plant to such a low pressure that these low-pressure and high-pressure injection pumps can add sufficient water into the core.

I have seen analyses by Westinghouse where they cycled the PORV and where they left the PORV open, and the PORV open case provided significantly more core cooling than the cycled PORV case.

Q But that was not the case, was it, at Semiscale during test S-SR-2?

A (WITNESS JENSEN) At Semiscale test S-SR-2 I understand they opened the PORV and left it open, but the corrections were not correct for feed and bleed.

Q So then, we can draw the conclusion from test S-SR-2, can we not, that it is not always beneficial to lower system pressure while you are in feed and bleed?

A (WITNESS JENSEN) I don't see how you would possibly draw that conclusion.

JUDGE BUCK: I am sorry, Mr. Jensen, I didn't hear that last answer.

WITNESS JENSEN: I don't see how that conclusion would be drawn from Semiscale because they opened the PORV in Semiscale and left it open. And this test number 2, as opposed to cycling the PORV --

WITNESS SHERON: Let me try and add, I think, to clarify what Mr. Jensen said. It goes back to, I think, what we have originally stated all along and that is that one can look at Semiscale and see that under those particular conditions under which it was run, yes, what they say is if that is their conclusion on that, that latching open the PORV at that point put them into an operating band such that they lost excess inventory and that cycling the PORV would have prevented the loss of that, that is probably correct.

It is not fair to take that situation and

apply it directly to TMI without the benefit of a detailed analysis. Again, what is good for the goose is not necessarily good for the gander, and the like. There is nothing that says that if one latched open a PORV at Three Mile it would lead to the same situation. It may, indeed, lead to a more beneficial situation.

BY MR. POLLARD (Resuming):

Q It may or may not; is that correct?

A (WITNESS SHERON) Yes.

Q Have you constructed for Three Mile Island Unit 1 this so-called operating map?

A (WITNESS SHERON) With -- ?

Q As described in the EG&G reports.

A (WITNESS SHERON) I think as I stated before, for Three Mile Island without taking credit for a PORV and just relying on the safety valve, one cannot really construct such an operating map because there is no what I would call PORV flow versus pressure curve, which one would plot on this map to show the intersection of -- with the HPI. It is a single point, and the rate of energy removal would -- the only effect it would have would be to cycle the safety valve open and closed or the frequency of it.

So there is really no operating map that one can define for Three Mile Island using the safety

valve. As for constructing one including a PORV, the answer is no, we haven't.

Q Your last phrase was --

A (WITNESS SHERON) No, we have not.

Q I understand, Dr. Sheron, that the -- in your analysis of feed and bleed for TMI-1 you did not take credit for the PORV. What my concern is, is the emergency procedures for Three Mile Island direct the operator to use the PORV. And what I am trying to understand is have you done any analyses for Three Mile Island Unit 1 where you might be using feed and bleed with the PORV to cope with a small break LOCA. So that you are able to say that if that operator leaves the PORV open, he will not uncover the core as they did in test S-SR-2, but that if he had some more information about what was actually going on in the system, he might then conclude to cycle the PORV and, therefore, successfully feed and bleed, as indicated in the EG&G report.

So my question is have you done, in your view, sufficient analyses of TMI-1 that you are able to say today as your testimony that under no circumstances of using feed and bleed at TMI-1 for a small break LOCA you can't get into the same situation as described in the paragraph that we read on pages 18 and 20 of the EG&G

report?

A (WITNESS SHERON) I guess I'm a little confused about what you say is sufficient analyses. My response to that would be no, we haven't done what I would call analyses necessary to stand up and unqualifiedly say no, we can never get in trouble anywhere, and I can demostrate it 100 percent.

A (WITNESS JENSEN) I would like to add that it is the staff's judgment that in the Semiscale test, the cover was uncovered because the power in the test was too high relative to the plant that it was supposed to model. And the HPI flow was too low relative to the plant that it was supposed to be modeling. And that is why the core uncovered, and not because the PORV was opened.

And in addition, the PORV, -- the operator at TMI would open the PORV for inadequate core cooling conditions, which would be conditions beyond the plant design basis.

Q Mr. Jensen, though, is it not correct you may have some disagreement as to whether or not test S-SR-2 actually duplicated the plant they were trying to duplicate? That is not my question. It is correct that during test S-SR-2, as it was conducted, if they left the PORV latched open, they uncovered the core, but had

they cycled the PORV they would have achieved steady state feed and bleed.

A (WITNESS JENSEN) Based upon the analysis I have done and the review of the test, I believe that the core would have been uncovered in either case.

Q In other words, then, you disagree with the paragraph in the EG&G report we read; is that correct?

A (WITNESS JENSEN) I haven't evaluated the paragraph in detail, but I think this is -- it is the opinion of the author perhaps, and he may be talking about specific circumstances during the test and not the test as a whole.

Q Do you agree or disagree with the statement in the EG&G report that the PORV could have been cycled open and shut to reduce the mass flow rate while still maintaining a favorable energy balance? This would have prevented a further decrease in PCS inventory and would have established a steady operating condition.

A (WITNESS JENSEN) I think the author is talking about a specific time during the test, and I haven't reviewed the test data to the extent that I could either agree or disagree.

Q Mr. Sheron, did you write any part of the staff's testimony? Excuse me, Mr. Jensen, did you write any part of the staff's testimony on question 10?

A (WITNESS JENSEN) I did not write a major part. I don't remember exactly if I wrote any part of this or not.

Q And you have not reviewed the test data from test S-SR-2? Is that what you just testified?

A (WITNESS JENSEN) I did not review the particular details of what went on in various portions of the test. I have compared the conditions of the test to the conditions of the plant for which it was supposed to model.

MR. CUTCHIN: Mr. Chairman, I once again fail to see where we are headed. As I understood the Board's concern, they wanted to have some evidence that the RELAP test could model S-SR-2, and then they would have more confidence that if the computer code could adequately predict what was going on in an experimental rig, they would have greater confidence that perhaps it could predict what was going on in a reactor core, if the inputs were correct. And I fail to see where all of this is leading us.

JUDGE EDLES: Mr. Pollard, are you getting to the summation of this line of questioning?

(Counsel for Intervenors conferring.)

MR. POLLARD: As to the last question the Chairman asked me, am I getting to the summation of this

point, I suspect I won't put it all in logical order until we make our findings. But in general, what I am trying to establish is that there were phenomena occurring in the Semiscale tests which could very well occur at TMI.

We now learn from this witness that he has not reviewed the test data, but he is at least partially responsible for what I perceive to be the staff's conclusion, that RELAP 5 can predict test S-SR-2, and that RELAP 5 can predict TMI. And perhaps I am asking here some questions which, in our findings, will be more relevant to the codes, to the relationship between the code's calculation for TMI and reality.

It seems to me very significant when EG&G makes the finding, as I interpret this paragraph which we have been focusing on, that leaving the PORV open could lead to core uncovery; whereas, in cycling the PORV you might achieve a steady state condition. I think that illustrates the potential that low pressure is not always better; that just because the pressure is low and the HPI flow is higher and the break flow is lower, mass flow rate does not mean that you are in a better situation. I think that is what test S-SR-2 shows.

I was taken aback by the witness's answer that

he had not reviewed the test data, and -- well, I guess I have tried the best I could to answer a combination of counsel's objection and your question, and if I haven't, perhaps you will have to ask me again.

JUDGE EDLES: Mr. Cutchin.

MR. CUTCHIN: Out of all of that I fail to see how there is anything coming for this that would indicate on this record that the RELAP program has not adequately predicted what occurred in the Semiscale test based upon the reanalysis. Most of this questioning is going to the original analysis that raised the Board's questions to begin with. The reanalysis is what is discussed in detail in Mr. Sheron and Mr. Jenson's testimony, and I fail to see the tie-in.

We are still beating on the analysis that caused the question, but we are not focusing on the reanalysis to test whether indeed there can be drawn a conclusion that the RELAP code does adequately predict what happened once one understands what really happened in the test, which was not the case at the time of the original report, as I understood it.

JUDGE BUCK: Well, I guess I am a little confused now about what test and what conclusions are in the Staff's report. You state in here on page 23, "Comparisons show that the RELAP 5 was capable of predicting the data to within the accuracy of experimental uncertainties."

Now, have you discussed this EG&G report with them, any of the details of it at all?

WITNESS SHERON: Do you mean with EG&G?

JUDGE BUCK: Yes.

WITNESS SHERON: Some I have, yes.

JUDGE BUCK: How about Mr. Jensen?

WITNESS JENSEN: I think I did. Yes, I did.

JUDGE BUCK: Have you discussed your disagreements with some of their conclusions that we were just talking about here, that Mr. Pollard was just talking about?

WITNESS JENSEN: No, I haven't. I suspect again that they are talking about a specific time in the test and not feed and bleed in general.

JUDGE BUCK: Well, if you have got confidence in the report to do certain things and yet you disagree with part of the report, I would have expected that you would have discussed this in detail with them.

WITNESS SHERON: I think that and what I told Mr. Pollard was that we don't disagree with the report from the point of view that I think what he is saying is that if you put a big enough hole in the system, you are going to lose more mass than you can put back in. And even though the system pressure goes down because you put the bigger hole in the system, that doesn't necessarily mean that it is going to allow you to put back in enough mass to make up what you're losing out of

this hole.

The Semiscale test, and what the author was concluding on this page 18, was that for that particular test and that particular set of conditions, which I think is what Mr. Jensen is referring to, when they opened the PORV and left it open, the PORV in that circumstance and for that set of conditions, namely the higher power, the lower HPI flow rate produced -- even though it did produce a depressurization of the primary system, it produced a net mass loss to the primary system which allowed the core to uncover.

JUDGE BUCK: But Mr. Jensen apparently agrees, or disagrees with their conclusion that cycling the PORV would have solved the problem.

WITNESS JENSEN: Only as it would apply to a plant. As I said, the conditions of the test were not typical of a plant in that the power was too high and the HPI flow was too low. And yes, probably that they are correct for those conditions, that opening the PORV would cause more mass to be lost from the system, which could not be made up perhaps by the HPI flow because the flow was too low.

JUDGE BUCK: Okay. What you are saying, that you believe the RELAP code 5 or RELAP 5 here did properly predict the Semiscale experiment that was run

by EG&G, but that the conditions that were put into that thing do not apply to TMI.

WITNESS JENSEN: Yes, that is true. And they don't apply to a reactor plant in general.

JUDGE BUCK: All right. But then you're saying that if the conditions applying to a plant were put into the RELAP, you would have expected it to give the right answers?

WITNESS JENSEN: Yes, because the HPI flow would increase with pressure, and yes, HPI flow would increase as the pressure went down.

JUDGE BUCK: So you're saying nothing more now than the fact that you believe that the EG&G experiment showed that the RELAP code was accurate, providing you put the right conditions into it.

WITNESS JENSEN: Yes, sir.

JUDGE BUCK: Okay. Thank you.

JUDGE EDLES: I think, Mr. Cutchin, that bears on the issues that we are at least considering, even though you may want to argue later as to its decisional significance.

Go ahead, Mr. Pollard.

(Counsel for the Intervenors conferring.)

BY MR. POLLARD: (Resuming)

Q Now, Dr. Sheron, back to where I think we were

roughly, with respect to the use I understood that you are not going to take credit for use of the PORV, but my question is framed in the context of our knowledge that the operators are directed to use the PORV for feed and bleed.

Have you constructed for Three Mile Island Unit 1 a map, as EG&G refers to it, from which you could decide what is the lower and upper pressure bound of feed and bleed for Three Mile Island Unit 1?

A (WITNESS SHERON) No, we haven't.

Q Would you look, please, at the EG&G report on the bottom of -- excuse me -- on page 20. There is a paragraph there at the bottom of page 20 which reads, "The extreme sensitivity to measurement uncertainties makes an analysis based upon mass and energy balance as more meaningful than a side-by-side comparison of RELAP 5 calculations and data."

Do you agree with that sentence?

A (WITNESS SHERON) No, I do not.

Q Can you explain to me why you don't agree with that?

A (WITNESS SHERON) These operating maps which EG&G has devised to portray the feasibility of feed and bleed are useful if one is trying to demonstrate whether a feed and bleed operation is theoretically possible.

But in order to demonstrate that one can obtain this or get to this end point, one needs to run the detailed calculation.

One needs to know how far out in time -- in other words, these curves, if you will look at them, assume one point in time because the decay heat is a solid line, which means that the energy going into the system is representative of only one point in time. You need to know what that point in time is in order to determine whether you have a viable feed and bleed. The only way you can get that point in time is to determine how long it takes for the system to discharge sufficient fluid in order to uncover the surge line and allow steam generated in the core to enter the surge line, because that is the break point when feed and bleed becomes effective.

What I am saying is that in feed and bleed you have a net mass loss from the system. While you are discharging liquid from the PORV, the HPI is not going to compensate for that usually. You have to wait until the system inventory drains down such that you can pass steam generated in the core out of the safety valve, which means steam has to be able to enter the surge line. In order to do that, the level in the vessel or the primary system must drop into the hot legs so that

steam generated in the core can pass into the hot leg and out the surge line.

In order to find out what the decay heat is at that time, one has to do a detailed calculation. I will be quite honest. We pointed this out to EG&G as one of the shortcomings of these, drawing conclusions from these operating maps. One needs to know the decay heat at that time, and one cannot obtain that unless one does the detailed calculation.

Q Is it correct, Dr. Sheron, the TMI-1 PORV can't relieve all of the decay heat and that, therefore, if we were in feed and bleed, even if the PORV were open, you could not achieve any sort of a balanced state for feed and bleed with just the PORV, that you would also have to rely upon the safety valves?

A (WITNESS SHERON) It is my understanding that is correct, except way out in time when the decay heat levels had dropped so that the PORV was sufficient to remove that, all of the decay heat.

(Counsel for Intervenors conferring.)

Q Is it correct that as of today you received no more information from EG&G other than what we have now been provided?

A (WITNESS SHERON) That is correct. We did speak with them since the deposition, but it was

primarily to get clarification on some of the items brought up at the deposition; and they are reflected in the corrected graphs and texts.

MR. POLLARD: We have no further questions at this time on issue 10.

JUDGE EDLES: Mr. Baxter.

MR. BAXTER: I will have a couple of questions, Mr. Chairman. If we are close to the luncheon recess, I could use that time to consult with m technical colleagues.

JUDGE EDLES: We can do that. You would prefer that to continuing and getting finished with Question 10 before the lunch break?

MR. BAXTER: Well, there are some questions I can ask and others I need to discuss with them.

JUDGE EDLES: Well, let me ask a question of Ms. Weiss and Mr. Pollard.

How long do you anticipate you will take on cross examination on Question 11?

MS. WEISS: I would say up to a couple of more hours.

JUDGE EDLES: Okay. Why don't we take an hour and a half for lunch at this point? And let's come back at -- well, a little less than an hour and a half. Let's come back at a quarter of 2:00.

(Whereupon, at 12:20 p.m., the hearing was recessed for lunch, to be reconvened at 1:45 p.m., the same day.)

AFTERNOON SESSION

(1:45 p.m.)

JUDGE EDLES: One little order of business on which I need some advice from counsel. The EG&G report is not physically incorporated into the record, and I would like some vehicle for getting it in there. I realize there is no one here from EG&G to sponsor it.

Mr. Cutchin, do you have an idea?

MR. CUTCHIN: Well, it was my understanding that UCS might offer that as an exhibit, and I don't plan to object.

MS. WEISS: We talked to the Staff about this, Mr. Chairman, and we have the copies which were provided to us by the Staff, and we'll be happy to offer it into evidence as a UCS exhibit.

JUDGE EDLES: That will be fine.

MS. WEISS: Do you want me to do that now?

JUDGE EDLES: We can do that now. That would be fine.

MS. WEISS: I have taken the Emergency Procedure 1202-26 to be copied, and I'll pick that up before the end of the day. If that is 45, this would be UCS 46.

(The document referred to was marked as UCS

Exhibit No. 46 for identification.)

JUDGE EDLES: We will receive UCS 46 into evidence.

(The document previously marked UCS Exhibit No. 46 for identification was received in evidence.)

Whereupon,

BRIAN W. SHERON

AND

WALTON L. JENSEN, JR.

resumed the stand and were further examined and testified as follows:

CROSS EXAMINATION

BY MR. BAXTER:

Q Mr. Jensen, this morning Mr. Pollard was questioning you on the imposition of HPI system flow characteristics from the test itself on the model calculation. Isn't it necessary to impose test boundary conditions such as HPI flow as a function of pressure in order to assess the predictive capability of the model?

A (WITNESS JENSEN) One should input the proper HPI flow curve into the model to get the correct results.

Q Mr. Sheron, I'm going to ask you a question now from your affidavit that was filed with the Appeal Board on November 22, 1982 in conjunction with the Staff's comments on the Appeal Board's memorandum and order of November 5, 1982.

I'm sorry I don't have copies for everyone. This was served on all of the parties. I will provide one for the Reporter to follow.

Mr. Pollard was questioning drawing the process or suggesting the possibility of drawing conclusions from the Semiscale test phenomena about what actually might happen at TMI-1 during feed and bleed operations; and I believe you have discussed in paragraphs 4, 5 and 6 of this affidavit the use of experimental test data in the licensing process and as the Staff employs it. And if you have now any reason to change the statements in your affidavit, I would like you to simply read those into the record.

A (WITNESS SHERON) "Use of experimental test data in the licensing process. No test facility, whether it be Semiscale, LOFT, FLECHT, et cetera, exactly reproduces the behavior of a large PWR. Some aspect of the power plant facility is scaled in the test facility. For example, if the volume of the test facility is less than the volume of a large PWR, then

the primary coolant system surface area will not scale in the same proportion as the volume.

"Similarly, if elevations in the scaled facility are not preserved, then gravity-dominated hydraulic behavior can be distorted. The scaling of the Semiscale facility has been selected as an optimization among such competing factors, including costs, in general and with some compromises among the competing scaling interests. Semiscale simulates most of the important phenomena associated with PWR behavior. However, the Staff has never taken Semiscale results (or for that matter, any other test results, including LOFT) and applied them directly to a large PWR.

"We have always maintained that the results from Semiscale and other test facilities are primarily for code verification purposes. Our confidence in understanding large PWR behavior, including feed and bleed operation, is predicated on confidence in the computer codes which calculate the behavior. The main objectives of the scaled tests are to look for new or unique thermal hydraulic phenomena associated with transient and accident scenarios, and to assure that the computer codes are capable of predicting the observed behavior.

"By demonstrating that the computer codes can

properly calculate and predict the behavior of scaled facilities, such as Semiscale and LOFT, under conditions similar to those that could occur in large PWRs, we believe that there is reasonable assurance that these same computer codes can be used to directly predict the behavior of the large PWRs."

Q And paragraph 6, please?

A (WITNESS SHERON) In summary, data from any test facility such as from Semiscale or LOFT cannot be directly applied to a large PWR. Rather, it is used to demonstrate the ability of a computer code to predict the relevant thermal hydraulic phenomena so that sufficient confidence can be gained that the code can be applied to predict the behavior of a large PWR.

Q Do you have any disagreement today with the statements you made in your affidavit of last November and have read today?

A (WITNESS SHERON) No, I don't.

MR. BAXTER: Those are all my questions. Thank you.

JUDGE EDLES: Mr. Adler.

MR. ADLER: No questions.

JUDGE EDLES: Dr. Gotchy.

BOARD EXAMINATION

BY JUDGE GOTCHY:

Q In the testimony you spoke of, when you're giving liquid levels, that you used the collapsed liquid level. I think the first place it is referred to is on page 23 at the bottom of the page. And I was wondering if you used -- if RELAP 5 calculates both the two-phase froth level as well as the collapsed liquid level?

A (WITNESS JENSEN) It calculates the two-phase level internally in the code, and it can be programmed -- not programmed but by the input. Input can be put into the code that would cause it to calculate the collapsed liquid level also.

Q I was just curious. I didn't know how the RELAP code worked. But certainly with the heat transfer calculations, steam generation rates and that sort of thing would be different, I would think, for liquid as opposed to two froth. And I just wanted to be sure that the code really was a more realistic calculation than using the collapsed level.

On page 24 where you talk about the uncertainties, what is the technical basis for referring to -- really what you have here is the difference between observed and predicted values divided by the observed values, I guess. And what is the basis for calling that the uncertainty statistically?

A (WITNESS SHERON) I don't believe I ever

referred to them as statistical uncertainties.

Q I'm aware of that, but that is normally the way I've seen uncertainties referred to.

A (WITNESS SHERON) I apologize if you inferred them to be statistical. I agree one hundred percent that they certainly are not a random uncertainty from the standpoint that if you ran the code a second time, you would get a different number. You would get the same difference all the time.

Q I would understand it was some indication toward the uncertainties.

A (WITNESS SHERON) It is a measure of accuracy of the computer code.

Q On page 27, Figure 10-3, again Mr. Pollard got to the questions there dealing with the overestimate of volumetric flow rate using RELAP 5, but yet I notice that after, well, going back if we used Figure 10-1 which gives the pressure, it is obvious that RELAP slightly overestimates the system pressure pretty well across the range of the calculated -- of the time calculated for the calculations, and yet, after 400 seconds it seems to me that RELAP tends to -- well, from 400 seconds to 1700 seconds it tends to greatly underestimate the HPI flow rate. And I recognize that is a conservative assumption, but I was wondering if

there is a reason that there was that large a difference there given the relatively small difference in the pressure over that time.

(Pause.)

Maybe that's just a function of scale on these figures, but it looks like quite large disparities.

A (WITNESS SHERON) It may be clearer if you turn to Figure 12 in the document entitled "Extension of Analysis, Primary Feed and Bleed Cooling at PWR Systems," the EG&G report.

If you will note that about beyond 400 seconds the pressure is -- the RELAP calculation is slightly above 8 megapascals. The data is slightly below. On Figure 12 you can -- and also, you will note that the difference, for example, at about it looks like maybe 600 seconds, one could say that the RELAP calculation, the volumetric flow rate was .01 liters per second. The data showed it was upwards of it looks like .018.

Now, if you go to Figure 12, you can see that when the pressure is slightly above 8 megapascals, the mass flow rate is down at about -- this would be, let's see, that's 10^{-3}, so that would be .01. And so if it is slightly below point -- I'm sorry -- 8 megapascals, you can see it is up close to about .18.

So I think the curves are consistent. I think

what you are seeing is that in the pressure range of around 8 megapascals on either side of it the HPI flow is an extremely sensitive function, and slight differences in pressure will show up as very large differences in the HPI flow.

JUDGE GOTCHY: Thank you. That's all I have.

JUDGE EDLES: Mr. Cutchin, do you have any redirect?

MR. CUTCHIN: None, Mr. Chairman.

JUDGE EDLES: Any further questions with respect to Question 10?

MS. WEISS: Yes.

(Counsel for Intervenors conferring.)

RECROSS EXAMINATION

BY MR. POLLARD:

Q Dr. Sheron, I want to read to you some short portions from NUREG-0963, which is entitled "Review and Evaluation of Nuclear Regulatory Commission Safety Research Program for Fiscal Years 1984 and 1985, A Report to the Congress from the Advisory Committee on Reactor Safeguards."

The report itself is not dated, but there is a letter dated February 18th, 1983 from Jeremiah J. Ray, Chairman of the Advisory Committee on Reactor Safeguards to the Honorable George Bush, the President of the

Senate and the Honorable Thomas P. O'Neill, Jr., the Speaker of the House.

Section 3 of the report deals with thermal hydraulic transients, and Section 3.3 deals with Semiscale and Babcock and Wilcox simulation. I am reading now from page 34 of this NUREG.

"We have commented in past reports that a facility with typical B&W plant geometry is needed in a timely manner to provide an acceptable level of confidence in the analytical models that have been developed to predict the phenomena associated with LOCA-related transients and accidents. We note that funding for upgrading the GERDA facility has been included in the fiscal year 1984 and 1985 budgets. The NRC Staff has concluded this approach will provide an adequate experimental base and will be more cost effective than a Semiscale Mod 5. We accept this conclusion, but believe that special attention will be needed to provide appropriate analytical support for the experimental program."

That is the entire paragraph. Were you aware that that was the ACRS' position?

A (WITNESS SHERON) Indirectly. I did not read -- I did not read those words in that report, but I am aware that that was their position.

(Counsel for Intervenors conferring.)

Q Do you agree or disagree with at least what I have read to you? And I can let you look at the report, if you wish.

A (WITNESS SHERON) I think in general I would say I agree.

Q There is one other paragraph I would like to read. Chapter 6 of this report is entitled "Accident Evaluation and Mitigation." Section 6.8.2 is their summary of the ACRS's specific recommendations.

I am going to read a paragraph labeled little a on page 50: "Less emphasis should be given to the development of codes which, because of their elaborateness and complexity, may give the appearance of validity but which may produce results that are either of little use or misleading. More emphasis should be placed on efforts to identify accident initiators and sequences not yet encountered in operating reactors."

Were you aware that that was the ACRS's position?

MR. BAXTER: Mr. Chairman, I am going to object to any further questioning from a document that has not provided to the witnesses or to counsel. There is no way we can follow along or determine whether there is any need for further cross-examination on our part.

JUDGE EDLES: Is there an opportunity to

provide a copy for counsel and the witness, Mr. Pollard?

MR. POLLARD: All I can do today is let them borrow mine.

JUDGE EDLES: How much more do you plan to read?

MR. POLLARD: That is all.

JUDGE EDLES: Why don't you show that now to counsel so they can take a look at it, and then please show it to the witness.

(Counsel and witnesses shown document.)

WITNESS JENSEN: Could you identify the paragraph?

MR. POLLARD: I think it was page 34.

JUDGE EDLES: Mr. Pollard, when you find it again, why don't you read the paragraph for the reporter in case anybody reading this wants to go back and look at it again.

MR. POLLARD: I think I read it the first time. It is just that my memory is not the best, apparently. I read the top paragraph on page 34 and a paragraph labeled little a on page 50 in section 6.8.2.

JUDGE EDLES: Thank you.

(Pause.)

JUDGE EDLES: Have you completed looking at the document, Mr. Jensen and Dr. Sheron?

WITNESS JENSEN: Yes.

WITNESS SHERON: Yes.

JUDGE EDLES: Mr. Pollard, do you want to repeat the question, or was it simply do you agree with what was in the document?

MR. POLLARD: I think we got through page 34 and we got the objection on page 50.

BY MR. POLLARD: (Resuming)

Q Were you aware that that was the ACRS's position with respect to computer code analyses being potentially misleading or that that paragraph on --

A (WITNESS SHERON) No, I wasn't. But I was wondering if you might clarify for me what you mean by "misleading."

Q Well, I didn't write it, so we would have to ask the ACRS, I suppose, what they meant by "misleading."

MR. CUTCHIN: If that be the case, Mr. Chairman, and we are asking for an interpretation of what the ACRS meant, then I am going to object because as this Board well knows, ACRS documents can only be admitted for the evidence of their existence and not for the truth of the matters asserted therein.

JUDGE EDLES: That is correct. I think that Mr. Pollard is driving at what the witnesses' views are with respect to that matter. They are not being

submitted for the purpose of offering the ACRS's testimony. So I guess I will have the witness just draw your own conclusion from what you believe the document says and then offer your opinion in response to Mr. Pollard's question.

MR. CUTCHIN: Mr. Chairman, I am going to object to his having to interpret what "misleading" means because then that leaves the record fuzzy as to what the ACRS may have meant in making that statement. Now, if Mr. Pollard wants to frame a question as to what the witness believes about whether or not computer programs may be misleading, I would have no objection. But to have him interpret the ACRS words I think is going one step too far.

MR. POLLARD: Well, perhaps we can settle the matter in the paragraph, what I read, which is a summary of their specific recommendations, and it references section 6.3 of that report. So perhaps if they would read section 6.3, they will have a better understanding of what the ACRS meant by "misleading."

WITNESS SHERON: Reading section 6.3 at the bottom of page 47, I think the ACRS is referring to the fact that one cannot specify an accident scenario with any great degree of detail and specificity. And therefore, by developing a computer code that can handle

specific phenomena associated with a specific scenario may not be in their mind as beneficial as looking at all of the possible initiating scenarios.

In other words, one should not develop a compute code for a specific class or a specific type of event when in fact that one event in and of itself may have a low probability when compared with the entire spectrum of possibilities of events.

JUDGE EDLES: Now, Mr. Pollard, do you want to ask him for his own assessment?

BY MR. POLLARD: (Resuming)

Q Do you agree with that view of the ACRS as you understand it?

A (WITNESS SHERON) Not in total, no.

Q Can you explain why, please?

A (WITNESS SHERON) Well, I agree that one should look carefully at all initiating scenarios and not just a very limited set or a classical set, if you would call it. But I also think one has to devote the resources necessary to assure that the computer codes are giving reasonably good predictions. And if there is any identified or known deficiencies, the resources should be expended to correct those as necessary.

Q I have one question on your affidavit, at least that portion that you read into the record. You

say on page -- I am sorry, there are no page numbers. It is paragraph 5, continuing on the next page, three lines down.

JUDGE EDLES: This is the affidavit in response to our November 5th order?

MR. POLLARD: Yes, sir.

JUDGE BUCK: I thought you were still talking about the ACRS report.

MR. POLLARD: No, sir.

BY MR. POLLARD: (Resuming)

Q The sentence reads, "The main objective of these scale tests are to look for new or unique thermal hydraulic phenomena associated with transient and accident scenarios and to assure that the computer codes are capable of predicting the observed behavior."

Am I correct that the purpose of such tests is that the test may show some pheneomena occurring which the computer codes do not predict?

A (WITNESS SHERON) Yes, that is always a possibility.

MS. WEISS: We don't have any more questions on Issue Number 10.

JUDGE EDLES: Any further questions, Mr. Cutchin?

MR. CUTCHIN: None, Mr. Chairman.

JUDGE EDLES: I guess then we can move -- Mr. Baxter, do you have any questions?

RECROSS EXAMINATION

BY MR. BAXTER:

Q Dr. Sheron, in your opinion, did the Semiscale tests that we're discussing here reveal any phenomena that would prevent feed-and-bleed cooling for working at TMI-1?

A (WITNESS SHERON) No, I am not aware of any.

MR. BAXTER: Thank you. That's all I have.

JUDGE EDLES: Okay. Mr. Pollard, Ms. Weiss, you may proceed with Question 11.

CROSS EXAMINATION

BY MR. POLLARD:

Q Mr. Sheron, on Question Number 11, the Appeal Board asked for the results of a RELAP-5 type analysis to determine whether feed-and-bleed will successfully provide core cooling at TMI-1. What inputs to that calculation are necessary? And I am talking about inputs like HPI pump characteristics, safety valve flow characteristics. Could you name, please, for me all of the inputs to such a calculation?

A (WITNESS SHERON) If I named all of the inputs to such a calculation, we would probably be here for a week.

Q Those inputs which are plant-dependent.

A (WITNESS SHERON) Again, I could just answer that question in a general sense and probably not name all of them in detail.

Q Let's try that first.

A (WITNESS SHERON) Okay. One needs to input the number of volumes and flow junctions or whatever that you are going to use to represent the plant. You would need to include the actual volumes of those, the actual numbers for those volumes based on the plant dimensions. You would have to input the physics constants for the probably the decay power if one is going to use realistic fuel parameters, fuel dimensions, flow areas in the core.

Q Perhaps I could summarize up this part. Is the physical geometry of the plant has to be adequately modeled?

A (WITNESS SHERON) Yes.

Q You also have to input the HPI pump flow versus pressure characteristics?

A (WITNESS SHERON) That's true.

Q Would you have to input the safety valve flow characteristics as a function of both pressure and flow quality?

A (WITNESS SHERON) No, you would input an

effective flow area.

Q An effective flow area?

A (WITNESS SHERON) For the valve.

Q Would that effective flow area vary as a function of flow quality?

A (WITNESS SHERON) No. The area would be fixed.

JUDGE EDLES: Dr. Sheron, would you again pull your mike just a little closer, please?

BY MR. POLLARD: (Resuming)

Q Okay. Now, in the calculation which you asked EG&G to do in order to answer Question 11, is it correct that you still have the written report for that calculation?

A (WITNESS SHERON) No. They have not documented that calculation yet.

Q In doing the calculation, did they use the pressure versus flow characteristics of the TMI-1 high-pressure injection pumps?

A (WITNESS JENSEN) Yes, they did.

Q Where did they obtain that data from?

A (WITNESS JENSEN) They got them from GPU, I understand.

Q What data did GPU supply? Was it from the FSAR? Was it from a test?

A (WITNESS JENSEN) I am not real sure of the

design flow versus pressure curve, and I am not really sure where GPU got the data.

Q So you are not sure what data GPU supplied to EG&G?

A (WITNESS JENSEN) Except that as to the design flow for the high-pressure injection pump.

Q And you know that because EG&G told you that?

A (WITNESS JENSEN) Yes, that is what I understand.

Q In the same calculation we're talking about that EG&G did for Three Mile Island Unit 1 to respond to Question 11, did they model the specific pressurizer for Three Mile Island Unit 1 in terms of its geometry?

(Witnesses conferred.)

A (WITNESS JENSEN) Yes, I think they did. It was the pressurizers for all of the B&W plants similar -- in fact, they have the same volume. So, yes, I think they did. I have not specifically examined their RELAP input.

Q Did I understand you to say that all pressurizers for all B&W plants are exactly the same in terms of physical dimensions?

A (WITNESS JENSEN) I believe all of the lowered-loop B&W plants have the same pressurizer volume.

Q Even though those plants have different power

levels?

A (WITNESS JENSEN) Yes.

Q In the calculation did EG&G use the flow characteristics of the TMI-1 safety valves?

A (WITNESS SHERON) The safety valve flow used by EG&G was based on the rated relieving capacity of the valve from which they obtained an effective area for flow. Once they derived the effective area for flow, then the code would calculate the discharge as a function of pressure.

Q Okay. Dr. Sheron, I would direct your attention to page 36 of your testimony. The first sentence under safety valve flow characteristics says that EG&G-Idaho reported that safety valves relief capacity, which is the relief capacity used in these analyses, is about 15 percent below the tested relief capacity for the Dresser-type safety valves used at TMI-1 for steam flow.

When they say "the Dresser-type safety valves used at TMI-1," was it identical to the valves used at TMI-1?

A (WITNESS SHERON) I don't know. This was again reported by EG&G.

Q When they say that the rated safety valve relief capacity is about 15 percent below the tested

relief capacity, which tests are they referring to?

A (WITNESS SHERON) Again, I am not sure which tests. I presume they are referring to the EPRI tests.

Q The next sentence in your testimony that says the uncertainty in relief capacity is estimated at plus-or-minus 15 percent of the rated capacity for steam flow, what is the basis for that estimate?

A (WITNESS SHERON) This is what EG&G provided to us as their estimate. We questioned them on what they felt the uncertainties were in the values they were using in their calculations. So the information here was provided by EG&G.

Q What I want to know is what is the basis for EG&G's estimate that the uncertainty is plus-or-minus 15 percent of rated capacity?

A (WITNESS SHERON) I can't answer that. I am presuming it is from the data.

Q Okay. On page 40, the second paragraph, your testimony is now talking about EG&G's examination of the liquid relieving capacity of the safety valve. When you state that they reported that the safety valve liquid flow calculated by RELAP-5 is an average of 9 percent above the measured flow, where was the flow measured?

A (WITNESS SHERON) I really don't know. As I said, these tests were not done by the Staff. They were

reported by EG&G.

Q What is the basis for the statement that the uncertainty on this value is plus-or-minus 15 percent?

A (WITNESS SHERON) Again, what EG&G reported to the Staff.

Q Earlier when we were discussing the inputs to the code, you said that after looking at the valve they inputted to the code an equivalent flow -- orifice, did you say?

A (WITNESS SHERON) That is an area.

Q Area. Excuse me. What was the equivalent area inputted to this calculation for the TMI-1 safety valves?

A (WITNESS SHERON) I don't know the exact number that they used. I would have to back-calculate it.

Q On page 40 a sentence in the same paragraph reads, "However, the flow discharge area" --

JUDGE BUCK: I am sorry. What page are you talking about?

MR. POLLARD: Page 40 of the testimony of Mr. Sheron, the second paragraph, about the middle.

JUDGE BUCK: All right. Your words all ran together. When you start speeding up, your words run together and I don't know what page you are talking

about.

MR. POLLARD: I am sorry. I will go slower.

BY MR. POLLARD: (Resuming)

Q "However, the flow discharge area was sized to 15 percent smaller in the analyses." My question is: If you had directed EG&G to do a feed-and-bleed calculation for TMI-1, why did they use a flow discharge area sized to 15 percent smaller in that analysis?

A (WITNESS SHERON) When they were setting up the input deck, they tried to retain the input data as close to the design values as they can. The information that one provides on a valve in an FSAR or wherever is typically the rated flow at the rated pressure. From that rated flow at a rated pressure one can, as I said, back-calculate an effective area using an appropriate critical flow model that would give you that same rated flow.

Now, that is the area which one would input into the computer code. The fact is that when one rates a safety valve, if you go through the ASME code for how to size the safety valve, you will find out that they require the imposition of a number of conservativisms. So that when you are through with your sizing calculation, the rated relief capacity will usually be less by some percentage than the actual relief

capacity. And since they used the rated capacity in their sizing, it obviously came out less than what one would actually expect it to be.

Q This paragraph that we are talking about now, am I correct, talks about liquid relieving capacity of the valve? Does the TMI-1 safety valve have a design rating for liquid flow or was in fact the calculations here based upon a measured liquid flow?

A (WITNESS SHERON) I don't know, because the old ASME code in the early '70s did not address liquid discharge, it was a steam discharge. I presume that at the time the plant was built the valves were sized to the code. It did not address liquid discharge.

Q But if there is no rated discharge for this valve for liquid discharge, your explanation before as to why they used a discharge area sized 15 percent smaller all related, as I understood it, to compensating for the rated capacity of the valve. But how could that be right if there never was a rated capacity for this valve for liquid discharge?

A (WITNESS SHERON) Well, it is rated for steam, and our experience is that once you come up with an effective area for critical flow, then you can calculate the discharge, be it liquid, subcooled liquid, saturated liquid, two-phase or steam, using that area and the

appropriate critical flow correlation.

Q Is the reverse true, that if you knew or had measured flow, you could then back-calculate to find out the discharge area?

A (WITNESS SHERON) You could back-calculate an effective discharge area.

Q Okay. An effective discharge area. All right. I direct your attention again to the same paragraph where you say that they reported a safety valve flow calculated was an average of 9 percent above the measured flow. To me that means -- and correct me if I am wrong -- that EG&G knew what the liquid flow was through the TMI-1 valve because it had been measured. Is that correct or incorrect?

A (WITNESS SHERON) I think the way they reported it, it would appear that they had knowledge of the liquid flow.

Q If they had knowledge of the liquid flow, why did they size the orifice for the effective flow area 15 percent smaller?

A (WITNESS SHERON) Because it was sized to steam, to a steam discharge, and not a liquid discharge.

(Counsel for Intervenors conferred.)

Q Do I understand you correctly that if you knew what the measured flow was through the valve with steam

and that if you back-calculated to find the equivalent flow area and that if you also knew the liquid flow through the valve and you back-calculated to get the equivalent flow area, you would get two different numbers?

A (WITNESS SHERON) Probably, yes.

Q But physically, the valve of course doesn't change size?

A (WITNESS SHERON) No, the valve doesn't. But what it is is the critical flow characteristics through the valve, the modeling of the critical flow through the valve is an approximation.

Q Okay. Thank you. Would also the critical flow through the valve, could it also be affected by the inlet piping to the valve?

A (WITNESS SHERON) Probably.

Q And how about for the backpressure on the valve?

A (WITNESS SHERON) That depends. The critical flow correlations, the whole concept of critical flow is that the flow is independent of the downstream pressure. So therefore, the backpressure would not be of significance unless it was high enough to be able to affect the upstream flow.

Q With respect then to the inlet piping, do you

know whether in this calculation EG&G has taken account of the fact that the inlet piping to the safety valves has been changed at TMI-1?

(Witnesses conferred.)

A (WITNESS JENSEN) I don't know, but the shorter the inlet piping would be the greater the flow would be because there would be less loss in the pipe between the pressurizer and the valve. And I understand that the valve has been moved closer to the pressurizer in the plant. But I don't know what EG&G used.

(Counsel for Intervenors conferred.)

Q Mr. Jensen, earlier in answer to a question by Mr. Baxter, I believe you said something along these lines, and correct me if you said something different: that one should input the proper HPI curve into the model to get the proper results. Do you recall that?

A (WITNESS JENSEN) Yes. I agree with that.

Q And is it correct that you don't know for the EG&G calculation for TMI-1 feed-and-bleed whether or or not they have inputted the proper HPI curve to the model?

A (WITNESS JENSEN) I don't know the degree of the curve. I know it came from GPU.

Q But you agree it is the proper curve?

A (WITNESS JENSEN) I haven't verified it. I haven't done tests on the pump myself.

Q Am I correct then that you cannot verify whether the results of the calculations are in fact the proper results for TMI Unit 1?

A (WITNESS JENSEN) These are results by EG&G. I rely upon EG&G to provide the proper results.

(Counsel for Intervenors conferred.)

Q And EG&G relies upon, as far as you know, GPU to get the proper inputs?

A (WITNESS JENSEN) Yes, I believe in this case they got the inputs for this particular value from EG&G.

JUDGE BUCK: I am sorry, Mr. Jensen, I didn't get the last part of your sentence.

WITNESS JENSEN: From GPU, they got the HPI flow curve from GPU.

JUDGE BUCK: Thank you.

BY MR. POLLARD: (Resuming)

Q Is it correct that the Staff has not been provided with that HPI curve that was used by EG&G in this calculation?

A (WITNESS JENSEN) I have the HPI curve, and it was also given to LANL, and it appears in a letter report that LANL sent to us. And I believe we provide that, a reference that was provided to all of the parties.

JUDGE EDLES: What is LANL, Mr. Jensen?

WITNESS JENSEN: The Los Alamos National Laboratory.

JUDGE EDLES: Thank you.

BY MR. POLLARD: (Resuming)

Q Can you please tell me specifically where the parties have this curve that EG&G used?

A (WITNESS JENSEN) It appears in Table 1 of a letter from Los Alamos to Dr. Robert T. Curtis of the NRC.

MR. CUTCHIN: Mr. Chairman, that was the second attachment to my letter of February 17.

JUDGE BUCK: That is the February 17th letter?

MR. CUTCHIN: Yes.

JUDGE EDLES: That was moved into evidence earlier this afternoon.

MR. CUTCHIN: Only the first attachment has yet been moved into evidence. That is the EG&G report.

BY MR. POLLARD: (Resuming)

Q Is Table 1 of this document that you have identified, is that the curve that you are referring to?

A (WITNESS JENSEN) Yes, it is.

Q And you know of your own personal knowledge that this is the same input that EG&G used?

A (WITNESS JENSEN) I was told so by EG&G. I have not personally inspected the input to the computer

code.

Q Now, on this page of this LANL report, which is Table 1, model descriptions and assumptions for TMI-1 feedwater transients, I notice they are talking about the Oconee TRACK PF-1 model down at the bottom of the page. They talk about the Oconee steam relief system used. And in your direct testimony, yours and Mr. Jensen's, on page 43, you say that the Los Alamos National Laboratory performed a feed-and-bleed analysis for an Oconee reactor.

Now, my question is: Which is it; is it a curve for the TMI-1 pumps or is it a curve for the Oconee pumps?

A (WITNESS JENSEN) You will note that the note above the curve says "HPI train available. Data supplied by GPU," which I believe is at the TMI-1 pump rather than the Oconee pump.

Q In other words, you are inferring from that that GPU supplied the TMI pump data and not the Oconee pump data?

A (WITNESS JENSEN) The LANL calculation was done with an existing input deck for Oconee, which is virtually identical to TMI-1, I believe. We know there is a very slight difference in power level. And it was modified with the HPI flow curve from GPU.

Q Looking at again this Table 1 in the Los Alamos report, it shows that at 2,500 psig the flow is 254 gallons per minute. If I recall the testimony earlier today, the shutoff head of the TMI-1 pump is approximately, did you say, 2,700 pounds?

A (WITNESS JENSEN) Yes, I believe it is.

Q Could I infer from that then that the flow between 2,500 and 2,700 pounds is going to rapidly decrease as a function of increasing pressure to zero when we reach 2,700 pounds?

A (WITNESS JENSEN) Well, it will certainly decrease, and it will be zero at the shutoff head. I don't think it rapidly decreases. It follows a smooth curve. As you might get from extrapolating the difference between the 2,400 psi value and the 2,500 psi value. And I believe that for that 100 psi change in pressure, the flow rate decreases by, it looks like, about 10 percent.

Q Yes. But if I extrapolated that -- in other words, you see between 2,400 and 2,500 pounds, the flow has only gone down by 25 gallons per minute. And if I extrapolated that, that would tell me that at 2,700 pounds I would still have 200 gallons per minute. So I certainly can't extrapolate it, can I?

A (WITNESS JENSEN) At first you can. It would

be fairly accurate. But, yes, it would decrease. But we don't have the curve in front of us, but I think it would. It would not be an inflection point at 2,500, it would be a smooth function.

Q Mr. Jensen, have you ever seen the entire flow versus pressure curve for the Three Mile Island Unit 1 HPI pumps?

A (WITNESS JENSEN) Yes, I have.

Q Where have you seen that?

A (WITNESS JENSEN) In the FSAR, I believe.

Q Is that the curve that EG&G and Los Alamos used?

A (WITNESS JENSEN) The curve they used is this curve here.

Q But you don't know if this is the same curve as the one that's in the FSAR, is that correct?

A (WITNESS JENSEN) No, I don't.

Q Now, Dr. Sheron, during the EG&G calculation of the Three Mile Island Unit 1 feed-and-bleed -- I am sorry, I have to stop.

MS. WEISS: I think it is probably appropriate for me to mark and move this into evidence, since we have asked so many questions about it.

JUDGE EDLES: Is there any objection?

MR. CUTCHIN: None from the Staff.

JUDGE EDLES: In the absence of objection, so moved.

MS. WEISS: For purposes of the record, this is a document from Los Alamos National Laboratory, which begins with a cover letter to Dr. Robert T. Curtis, subject: "Feed-and-bleed Calculations and Support of TAPA-45," date February 8, 1983.

JUDGE BUCK: Should we identify that as being a second enclosure from a letter from the Staff, since that is the way it was sent out?

MR. CUTCHIN: Perhaps better for the record would be by UCS exhibit number. You could tie the two together that way as well.

JUDGE EDLES: Let the record simply reveal that it was provided to counsel by the Staff on -- what was the date?

MR. CUTCHIN: February 7, 1983.

MS. WEISS: And this would be UCS Exhibit 47.

(The document referred to was marked UCS Exhibit No. 47 for identification and received in evidence.)

BY MR. POLLARD: (Resuming)

Q Dr. Sheron, do you know in the EG&G calculation of the TMI-1 feed-and-bleed analysis what

did they assume in terms of the pressure at which the safety valve would reclose?

A (WITNESS SHERON) I believe it was at 2,500.

Q I am sorry. Is it 2,500 it would open, isn't it?

A (WITNESS SHERON) Yes, I believe they would also would assume it reclosed at about 2,500.

Q Okay. Thank you. Can you tell me in the EG&G calculation of feed-and-bleed, did the calculation show that the capacity of both safety valves was needed or would be utilized?

A (WITNESS SHERON) I don't know the answer to that.

A (WITNESS JENSEN) THey did utilize both safety valves. But whether or not they were both necessary, we don't know.

JUDGE EDLES: Mr. Jensen, just as a help to me, when you answer could you pull the mike closer so I could hear you, please?

WITNESS JENSEN: Yes, sir.

BY MR. POLLARD: (Resuming)

Q Now, Dr. Jensen, I now direct your attention to page 41 of your testimony -- excuse me. Dr. Sheron, toward the bottom of the page, about eight lines from the bottom, the sentence begins, "One question that does

INSERT #1

February 16, 1983

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of	)	
	)	
METROPOLITAN EDISON COMPANY	)	Docket No. 50-289
	)	(Restart)
(Three Mile Island Nuclear Station, Unit No. 1)	)	
	)	

LICENSEE'S TESTIMONY OF

GARY R. CAPODANNO AND RICHARD J. CHISHOLM

IN RESPONSE TO ALAB-708 ISSUE NO. 8

(SAFETY-GRADE STATUS OF EMERGENCY FEEDWATER SYSTEM)

SUMMARY

This testimony addresses the Appeal Board's request for clarification of the safety-grade classification of the emergency feedwater system components generally, and of the new manual control stations in particular. The testimony reports that there have been no changes in the status of the safety-grade classification of the EFW system from that previously submitted to the Licensing Board and the Appeal Board. The testimony also provides a detailed description of the new EFW manual control stations and concludes that, while this modification is highly reliable, it cannot be considered safety-grade.

INTRODUCTION

This testimony by Gary R. Capodanno, Fluid Systems Director, GPU Nuclear Corporation, and Richard J. Chisholm, Manager of Electric Power and Instrumentation, GPU Nuclear Corporation, is addressed to Issue No. 8 of the Appeal Board's Memorandum and Order of December 29, 1982 (ALAB-708), which seeks:

> 8. Clarification of the apparent inconsistencies and confusion concerning the safety-grade status of components in the EFW system (from the licensee and the staff).

Mr. Capodanno was a witness earlier in these proceedings on the EFW system. He sponsored Licensee's Exhibit 15 which describes the EFW system at the time TMI-1 last operated, the modifications being made to the system prior to restart, and long-term modifications planned for the future. The status of modifications to the EFW system to be completed prior to restart was also addressed by Licensee in submittals of August 12, 1982, and November 22, 1982, in response to Appeal Board requests for information of July 14 and November 5, 1982, respectively.

BY WITNESSES CAPODANNO AND CHISHOLM:

We have reviewed Licensee's Exhibit 15 as well as pages 9 through 13 of Licensee's August 12, 1982 response to the Appeal Board, and pages 9 through 15 of Licensee's November 22, 1982 response to the Appeal Board. That review has been conducted to determine whether there are any inconsistencies or confusing

statements regarding the safety-grade status of equipment prior to restart which should be corrected for the Appeal Board and to determine whether there are any items projected to be safety-grade prior to restart which may not actually be so, or items not intended to be safety-grade by restart that may be so. The review has considered the capability of equipment to respond to either a loss of main feedwater or a small break loss of coolant accident (SBLOCA).

Our review confirms that statements by Licensee regarding the safety-grade status of equipment in the EFW system and modifications to that system at the time of restart are consistent and appear to be clear. At the time of restart, the EFW system will be safety-grade for purposes of responding to either a loss of main feedwater or SBLOCA. The present status of EFW modifications to be completed prior to restart has not been altered. Those items anticipated to be safety-grade prior to restart will be safety-grade for the accidents under consideration; those items expected not to be safety-grade will not be so qualified prior to restart.

The review has also considered any known inconsistencies or apparent inconsistencies between Licensee's and the Staff's descriptions of the safety-grade status of equipment in the EFW system. We are aware of only one such inconsistency -- the one pointed out by the Appeal Board in ALAB-708 related to the manual control stations.

BY WITNESS CHISHOLM:

An alternate manual control capability for the EFW flow valves has been installed which is independent of the ICS. It consists of manual control (loader) stations, one for each steam generator, in the control room which the operator can activate by means of selector switches to manually provide control signals to the emergency feedwater control valves. Operation of the selector switches also transfers the power supplies for the remote voltage/pressure transducers from an ICS derived power supply to an independent power supply. The new manual control circuits are supplied from a battery-backed, 115 volt 60 hertz power supply. The power comes from an inverter which is normally fed from the Red train 1E AC power system and backed up by the Red battery. If voltage from the inverter is lost, an automatic transfer switch will switch to a regulated voltage source which is derived from the Green 1E AC power system. The manual control circuits utilize highly reliable industrial grade components and the design is such that no single failure in the control circuits will result in a loss of system function. This manual control feature by itself is highly reliable but not "safety-grade" as we have applied that term throughout our review.

BY WITNESSES CAPODANNO AND CHISHOLM:

The functional objective of the EFW system for SBLOCA or loss of main feedwater events is to provide adequate flow to either of the steam generators. The function can be termed safety-grade if it has the following attributes:

1. Capable of performing in the accident or transient environment.

2 Capable of performing its function following a loss of off-site power.

3. Satisfies the necessary provisions of the approved QA program.

4. Can perform its function following the worst single failure in active mechanical or active or passive electrical components.

5. Adequate time is available for manual control functions.

The components of the EFW system can collectively meet these criteria.

The manual control station is highly reliable but can fail as a result of certain single power supply distribution component failures. A single failure in one of these components will not disable the system function, however, since the operator dispatched to the vicinity of the EFW control valves in the intermediate building on each EFW demand can manually manipulate the valves with the local hand wheel. Since there is adequate time for this operator action, system function is

achieved. Thus there are no single failures which can prevent the accomplishment of the safety function.

GARY R. CAPODANNO

Business Address: GPU Nuclear Corporation
100 Interpace Parkway
Parsippany, New Jersey 07054

Education: B.S., Mechanical Engineering, Fairleigh Dickinson University, 1967.

M.S., Mechanical Engineering, Newark College of Engineering, 1974.

Experience: Fluid Systems Director, GPU Nuclear Corporation, 1982 to present. Responsible for technical and administrative direction of the mechanical and radwaste engineering sections of the Engineering and Design Department with responsibility for secondary plant, reactor plant and radwaste systems and components within GPU Nuclear plants. Directs, through the Mechanical Systems, Mechanical Components, and Radwaste Systems section managers, the engineering for fluid system designs, modification of existing plant systems, operations and maintenance review and troubleshooting for plant systems, and preparation and review of responses to inquiries of regulatory agencies. Directs the reviews and approvals of work done by outside engineering firms to assure conformance to GPU Nuclear criteria and standards. Directs the review of engineering standards and procedures, plant operating and emergency procedures and technical support to the plants during plant outages.

Manager of Mechanical Systems Engineering, GPU Service Corporation/GPU Nuclear Corporation, 1978 to 1982. Responsible for technical and administrative direction of the activities of company mechanical and nuclear engineers in the design of new power plants and major modifications to existing power plants for the three operating companies that comprise the GPU Sytem. Also responsible for directing these engineers in the review of work being done for GPU and the operating companies by architect-engineering firms.

Lead Systems Engineer, Ebasco Services, Inc., April 1978 to July, 1978. Work on the Synthesis Gas Demonstration Plant Program for W. R. Grace Company and the United States Department of Energy. Responsible for plant arrangements and system design work. Directed mechanical engineers in the design of steam, cooling water and materials handling systems for a plant that was to use coal as a feedstock for the preparation of anhydrous ammonia and the production of elemental sulfur or sulfuric acid as a by-product.

Mechanical Group Supervisor, Burns and Roe, Inc., 1974 to 1978. Engineering supervisor responsible for the technical and administrative direction of project engineers in the development of: plant general arrangements, system flow diagrams, engineering calculations, equipment specifications, bid evaluations, construction liaison, and licensing activities for nuclear power plants.

Mechanical Engineer, Burns and Roe, Inc., 1971 to 1974. Responsible for design engineering of nuclear and conventional mechanical equipment and systems for nuclear power stations. This included preparation of specifications and system flow diagrams, evaluation of equipment proposals, performance of design calculations, construction liaison activities and activities related to governmental licensing of nuclear power plants.

Design Engineer, Foster Wheeler Corporation, 1969 to 1971. Responsible for design and development engineering of fossil fuel firing equipment and systems for electric generating plant steam generators, preparation of engineering standards, evaluation of vendor equipment, and engineering assistance to company project site personnel.

Mechanical Engineer, Consolidated Edison Company, 1967 to 1969. Responsible for design and applications engineering of mechanical equipment and systems for nuclear and conventional electric generating stations.

Professional Affiliations: Licensed Professional Engineer -- New York, New Jersey and Pennsylvania

Member -- American Nuclear Society

Member -- National Society of Professional Engineers

Publications: "New Approach to Optimization of the Multistage Flash Desalination Process", Summer Simulation Conference, San Diego, 1972.

RICHARD J. CHISHOLM

Business Address: GPU Nuclear Corporation
100 Interpace Parkway
Parsippany, New Jersey 07054

Education: B.E.E., Manhattan College, 1948

M.B.A., Fairleigh Dickinson University, 1971.

Post-graduate courses in Electrical Engineering, New York University and New Jersey Institute of Technology.

Experience: Manager, Electrical Power and Instrumentation, GPU Nuclear Corporation/GPU Service Corporation, 1980 to present. Manager of engineering section responsible for design activities for plant systems related to electrical power and instrumentation.

Senior Electrical Engineer, GPU Service Corporation, 1971 to 1980. Lead engineer for all instrumentation and control design activities for nuclear and fossil plants.

Manager of Electrical Design, Curtus-Wright Corporation, Electronics Division, 1966 to 1971. Responsible for engineering group involved in design of instrumentation and control equipment for Navy nuclear program.

Chief Engineer of a small company engaged in the manufacturing of I&C equipment for industrial and shipboard applications. 1958 to 1966.

Project Engineer with manufacturer of control equipment. 1951 to 1958.

Consolidated Edison Company. Design of instrumentation and control systems for power plants and substations. 1948 to 1951.

MR. BAXTER: The witnesses are available for cross-examination.

JUDGE EDLES: UCS?

CROSS-EXAMINATION ON

BEHALF OF INTERVENORS

BY MR. POLLARD:

Q Am I correct that in order to prepare this testimony you re-reviewed Licensee Exhibit 15 to determine whether all of the information in that exhibit is correct?

A (WITNESS CHISHOLM) Yes, that is true.

Q And your conclusion was that all of the information that is in Licensee Exhibit 15 remains correct today?

A (WITNESS CHISHOLM) Yes, that is true.

Q I'd like to direct your attention, please, to Licensee Exhibit 15. Do you have a copy?

A (WITNESS DEMPSEY) Yes.

Q In Table 1 of Licensee Exhibit 15, in the remarks section, responding to general design criterion 2 there is a sentence which reads: "The EFW piping system is, however, designed and qualified to the seismic class one requirements."

Is that sentence true today?

MR. BAXTER: Objection, Mr. Chairman. What

the testimony says is that the witnesses reviewed this material, including Licensee's Exhibit 15, in the context, as it says on page 2 beginning at line 5, to consider the capability of the equipment to respond to either a loss of main feedwater or a small break loss of coolant accident.

The testimony clearly does not state that they reviewed this material to determine the seismic qualification of the emergency feedwater system, and indeed the testimony does not purport and does not present the results of any such review, which we continue to believe is outside the scope of this proceeding.

MR. WEISS: The witness just said in response to Mr. Pollard's question that he had reviewed Licensee Exhibit 15 and that every statement in there was correct. Now, if that is not true I think we're entitled to know that it is not true.

MR. BAXTER: It is true within the context of the testimony that has been presented, which is it within is the capability of the system to respond to a small break loss of coolant accident and a loss of main feedwater, and that is the scope of the testimony.

MR. WEISS: The question is, have you reviewed every statement and is every statement true. Just a yes

or no answer.

JUDGE EDLES: I think the witness should be entitled to explain. He can offer a yes or no answer if he likes, but I would give him an opportunity to explain if he would like to do that.

WITNESS DEMPSEY: I guess I would like to answer this question with an explanation.

MR. WEISS: I think Mr. Chisholm gave the answer, didn't he, gave the previous answer? Could I hear his explanation?

WITNESS CHISHOLM: I should point out that we reviewed it from different points of view, that Mr. Dempsey would have reviewed it from the mechanical systems aspect of the design and I would have reviewed it from the electrical instrumentation and control aspects.

In my review I can state that I did not considder the seismic qualification of the system.

BY MS. WEISS: (Resuming)

Q So then the statements in Exhibit 15, all the statements that reference seismic qualification, may or may not be true today?

MR. BAXTER: Objection, Mr. Chairman.

JUDGE EDLES: I think the witness has explained pretty much what he means by his

interpretation, and I think we will let it stand at that.

BY MS. WEISS: (Resuming)

Q Is your conclusion about whether the emergency feedwater system is safety grade or not affected in any way by its seismic qualification?

A (WITNESS CHISHOLM) I'm sorry?

Q Is it true that your conclusions about whether the emergency feedwater system and the components thereof are safety grade does not include any consideration of the seismic qualification?

A (WITNESS CHISHOLM) That is true.

BY MR. POLLARD: (Resuming)

Q The sentence on page 2 of your testimony, beginning at line 5 where you say, the review has considered the capability of equipment to respond to either a loss of main feedwater or a small break loss of coolant accident, am I to understand that the bounds of that statement is that you did not consider a loss of main feedwater accident caused by an earthquake?

A (WITNESS CHISHOLM) That is true.

Q I direct you now to page 4 of your testimony, at line 20. "A single failure in one of these components will not disable the system function, however, since the operator dispatched to the vicinity

of the EFW control valves in the intermediate building on each EFW demand can manually manipulate the valves with the local hand wheel."

Focus on the part of that sentence that says that the operator will be dispatched to the vicinity of the valves on each EFW demand. What is your basis for saying that the operator will be dispatched on each EFW demand?

A (WITNESS CHISHOLM) It is part of the loss of feedwater procedure.

Q Can you tell me specifically which procedure?

A (WITNESS DEMPSEY) It is covered in procedures 1202-26A, 1202-26B, and I believe also in procedure 1106-6, which covers the emergency feed system.

Q Would it also be covered in 1202-6B?

A (WITNESS DEMPSEY) I'm not sure what that procedure is.

Q Do you have a copy with you of Appeal Board Decision ALAB-708?

A (WITNESS DEMPSEY) No.

(Document handed to witness.)

Q If you would look at page 13 of ALAB-708, please. Four lines from the top of that page there is a sentence which reads: "The Licensee referred us to plant procedures that require the control room operator

to dispatch an auxiliary operator to the flow control valves for any EFW pump autostart condition." And the Appeal Board cites Licensee Exhibit 49 at 2 and 6 and Licensee Exhibit 48 at 10 and 3.

And the first question I have for you, is that sentence as it appears in ALAB-708 correct to the best of your knowledge?

A (WITNESS DEMPSEY) Yes.

Q Okay. Licensee Exhibit 8 -- or 48, excuse me, which the Appeal Board cites, is in fact emergency procedure 1202-6B. I guess that's not a question. I'm just informing you.

So that in preparing your testimony, though, you looked at procedures 1202-26A, 1202-26B, and 1106-6; is that correct?

A (WITNESS DEMPSEY) Those are the three procedures I have looked at as of today, yes.

Q Can you please tell me which revision of 1202-26A you reviewed to prepare your testimony?

A (WITNESS DEMPSEY) The revision of 1202-26A that I have is Revision 14. It is dated June 4th, '82.

MR. POLLARD: For the record, that is UCS Exhibit 45.

BY MR. POLLARD: (Resuming)

Q Please tell me specifically, find for me where

in that procedure the operator is directed to go to the flow control valves for any EFW pump autostart condition?

A (WITNESS DEMPSEY) In this particular procedure, this procedure covers loss of steam generator feed to both OTSG's, and on page 2 of the procedure there is a step that says, "Send an operator to the emergency feedwater valves EF-P-30-A and B and establish communications."

Q Did you say page 2?

A (WITNESS DEMPSEY) Page 2 of 1202-26A.

Q What is the statement number?

A (WITNESS DEMPSEY) It is step number 3.

Q Would you turn now in that procedure to page 6, please. On page 6 of 1202-26A, item C-5, is this simply a repetition of the step you showed me on page 2?

A (WITNESS DEMPSEY) Well, as I understand it this is the step that basically follows up page 2 and has the operator take control.

Q I would like to turn now to also on page 5, step A-4 directs that, "Have an auxiliary operator check locally that EF-P-1 overspeed trip is reset and that the manual operator for MS-V-6 is in the open position." Is that an additional action that the same operator is

going to have to take?

A (WITNESS DEMPSEY) I would assume it would be the same operator. And I should point out that this is a casualty procedure for failure of the turbine-driven emergency feed pump to start.

Q So would in fact, in your view, would this procedure offer any support for the statement that you dispatch an operator to the flow control valves for any EFW pump autostart condition other than loss of main feedwater?

A (WITNESS DEMPSEY) This procedure does cover dispatching the operator only for this specific case of loss of feed to both OTSG's.

(Counsel for the Intervenor conferring.)

MR. POLLARD: Mr. Chairman, I have only one copy with me of emergency procedure 1202-6B, which -- at least Revision 7 of which was Licensee Exhibit 48. The version I have is Revision 15. That is all I have with me, and I would like to read portions of this into the record, and then I wish to give it to the witnesses and ask them where in this procedure it directs the operator -- or directs sending an auxiliary operator to the EFW flow control valves for any EFW pump autostart condition.

And I would also like to use this procedure to

demonstrate that there are more actions to be done by this auxiliary operator.

MR. BAXTER: Mr. Chairman, I'm going to object at this point. The witnesses in this portion of their testimony are merely repeating the finding this Board has already made in ALAB-708. Having examined the procedures that are in evidence, the Board found that the provisions for sending the operator to the control station are adequate and cover the possible failure of ICS control of the flow control valves.

We are now answering a question about the particular circuitry of that manual control station, and while the witnesses have repeated this conclusion, the Board has already reached it. And unless the Board has questions about this procedure, I don't see why we are going into it in this reopened proceeding.

JUDGE EDLES: Well, to some degree the conclusions that we reached were tentative and those are not final conclusions. Let me just check with my colleagues first.

(Board conferring.)

JUDGE EDLES: I'm not so concerned with the fact that you're challenging something that we may have spelled out in an earlier order, because if we were wrong I'm willing to make corrections in our final

decision. I think I will let you proceed along the lines -- if what you are trying to demonstrate is that there is too much for a single operator to do, I will let you proceed along those lines.

Counsel, do you want copies of the document or do you have them?

MR. BAXTER: No, I have copies of the documents.

I just would make clear for the record that we have produced an electrical engineer and a mechanical engineer, and not someone from the plant operations staff. But they can answer whatever questionos they can.

JUDGE BUCK: Well, also, I am concerned about your reading from various procedures here and whether they're talking about the same operator.

MR. WEISS: The procedure that we are using now is the procedure cited by the Appeal Board.

JUDGE BUCK: But we have already covered two procedures and you're going into a third one.

MR. WEISS: No. This is the second one. This is Exhibit 48 that you cite, the Appeal Board cites, on page 13 of ALAB-708 as support for the proposition that the control room operator -- that auxiliary operators can operate the flow control valves for any autostart

conditions.

JUDGE BUCK: And what you're trying to show is he has too much to do?

MR. WEISS: Well, A, that he has too much to do; B, that he is not necessarily dispatched for every EFW pump autostart condition.

JUDGE BUCK: Well, let's go ahead for a moment and see where we go.

MR. POLLARD: I might also add, the other point I was trying to build upon was, in ALAB-708 you say you find this acceptable provided, later on on the same page, provided that they -- and I assume these procedures -- are retained for use by the TMI-1 operators.

Now, one of the difficulties I have had throughout this proceeding is the emergency procedure on the record is not necessarily the emergency procedure that the operators at Three Mile Island Unit 1 are going to use.

JUDGE BUCK: We are conditioning our order on this thing on that basis. That is basically what we have said here. That is a condition.

MR. BAXTER: I'm not going to apologize for the fact that the operating procedures get revised over time and can't stay in place because of an adjudicatory

procedure.

MR. POLLARD: Do the witnesses have another copy of this, Mr. Baxter, or do I have to loan them mine?

MR. BAXTER: Of which?

MR. POLLARD: 1202-6B, Revision 15.

MR. CUTCHIN: Does that presently have an exhibit number?

MR. POLLARD: No.

JUDGE BUCK: How many pages are you going to read?

MR. CUTCHIN: Mr. Chairman, while he is deciding, I would point out that the Board did make a point of directing parties to identify and provide copies of exhibits that they plan to use in this proceeding. And we have been very lenient in not making this complaint, but I think if it continues I'm going to register a load complaint.

JUDGE BUCK: From how many pages are you asking?

MR. POLLARD: Perhaps I won't ask the questions at all, if I understood what the Appeal Board ruling just is, that if the current procedures do not require dispatching an auxiliary operator to the EFW pump flow control valves for any autostart condition,

you are going to require that if that is your method of resolving your concerns on EFW; is that correct?

JUDGE EDLES: Well, to some degree we are locked into what it is that is in the record. Now, to the extent that procedures have been changing and those are outside the scope of what we have before us, we are not going to be able to rely on that information. I'm not sure that is responsive to your question.

MR. BAXTER: We would be happy to have the Staff check and certify those procedures as part of their certification process to the Commission.

JUDGE EDLES: Mr. Pollard, I think your construction is a fair one, that if we ultimately go in that direction that we would ensure to some degree -- ensure, not to some degree, that the plant procedures are such that the operator is dispatched.

MR. POLLARD: Okay.

BY MR. POLLARD: (Resuming)

Q I have one other question, then, on your testimony. In deciding whether there was, as you put it, adequate time for this operator action, did you review all of the emergency procedures which might be brought into play during either a small break LOCA or a main feedwater transient, in order to determine all of the actions that this auxiliary operator might have to

take other than controlling the EFW flow control valves?

A (WITNESS DEMPSEY) I personally have not done such a review.

Q Mr. Chisholm?

A (WITNESS CHISHOLM) No. We would normally not make a judgment as to whether an operator had time or how many operators were available. That kind of review would be done by the plant staff and we would take their word for that.

Q Well, can you tell me, then -- in your testimony you say, since there is adequate time for this operator action, system function is achieved. On what basis do you say that there is adequate time?

A (WITNESS DEMPSEY) I think the basis behind that statement is time to perform that one individual function.

Q In other words, you assume that this man has nothing else to do other than this one action? That is your basis for saying there is adequate time?

A (WITNESS DEMPSEY) That assumption would apply to this statement.

MR. POLLARD: Thank you.

JUDGE EDLES: Can I just follow up for just a moment.

Are you assuming that is enough time for him or that it might be an additional operator available to do other things if necessary?

WITNESS DEMPSEY: I'm not prepared to comment as to additional operators for additional things. Again, that question would be answered by the plant staff. But the assumption used in making the statement is that 20 minutes is sufficient time to take manual action of the emergency feedwater control valves.

MR. BAXTER: Mr. Chairman, when you get to the management phase I think you will find that a typical shift has a number of licensed control room operators and a number of auxiliary operators.

MR. POLLARD: We have no further questions on this testimony at this time.

JUDGE EDLES: Mr. Cutchin?

MR. CUTCHIN: No questions, Mr. Chairman.

JUDGE EDLES: Mr. Adler?

MR. ADLER: No questions.

(Board conferring.)

JUDGE EDLES: Okay. We have no questions. I think the witnesses can be dismissed. Thank you very much.

(Witnesses excused.)

JUDGE EDLES: Mr. Cutchin?

MR. CUTCHIN: Mr. Chairman, I will call Jared S. Wermiel to the stand.

JUDGE EDLES: Would the witness please state his name.

MR. WERMIEL: My name is Jared S. Wermiel.

Whereupon,

JARED S. WERMIEL,

called as a witness by counsel for the Regulatory Staff, having first been duly sworn by the Chairman, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. CUTCHIN:

Q Mr. Wermiel, do you have before you a copy of NRC Staff testimony of Jared S. Wermiel in response to Appeal Board question number 8, bearing the caption of this proceeding and consisting of three numbered pages?

A (WITNESS WERMIEL) Yes, I do.

Q Was this testimony prepared by you?

A (WITNESS WERMIEL) Yes, it was.

Q Are there any corrections or modifications that you wish to make?

A (WITNESS WERMIEL) No.

Q Do you adopt it as your testimony in this proceeding?

A (WITNESS WERMIEL) Yes.

MR. CUTCHIN: Mr. Chairman, I move that Mr. Wermiel's testimony be received into evidence as if read and bound into the transcript at this point.

JUDGE EDLES: Any objection?

MR. WEISS: None.

(The document referred to, the prepared testimony of Mr. Wermiel, received in evidence, follows:)

INSERT #2

This testimony of Jared S. Wermiel presents the NRC Staff's response to the Appeal Board's Question 8. (ALAB-708 at 43).

The purpose of this testimony is to clarify the safety-grade status of the EFW system functions and components that are necessary to cope with design basis events at TMI-1.

Summary

The flow control valve function and the condensate storage tank level indication function are not presently safety-grade for all design basis events. In addition, portions of the EFW system piping and controls have not been shown to be capable of withstanding a safe shutdown earthquake. Actions necessary to upgrade all EFW system functions and components to safety-grade status are expected to be completed by startup following the first refueling after restart.

Of the EFW system functions that are not safety grade for all design basis events the flow control valve function is the only one necessary to cope with a loss of main feedwater and a small break LOCA. Manual action can be taken to restore EFW flow in the event of a failure of the ICS that leaves both flow control valves closed.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOAPD

In the Matter of)	
)	
METROPOLITAN EDISON COMPANY, ET AL.)	Docket No. 50-289
)	(Restart - Design Issues)
(Three Mile Island Nuclear Station,)	
Unit No. 1)	

NRC STAFF TESTIMONY OF JARED S. WERMIEL
IN RESPONSE TO APPEAL BOARD QUESTION 8

Q.1 State your name and position with the NRC.

A. My name is Jared S. Wermiel. My position is Senior Mechanical Engineer (Auxiliary Systems) in the Auxiliary Systems Branch, Division of Systems Integration, Office of Nuclear Reactor Regulation. A statement of my professional qualifications appears in the transcript of the Restart Hearing following page 6035.

Q.2 What is the purpose of your testimony?

A. The purpose of this testimony is to address Appeal Board Question 8 (Memorandum and Order dated December 29, 1982) which reads as follows:

> "8. Clarification of the apparent inconsistencies and confusion concerning the safety grade status of components in the EFW system."

Q.3 Of the emergency feedwater (EFW) system functions necessary to cope with design basis events for which EFW system function is required, which will not be fully safety grade at the time of restart?

A. 1. The flow control valve function is not fully safety grade because:

a. Each EFW supply line contains a single flow control valve, and therefore does not satisfy the single failure criterion for high energy (main steam and main feedwater) line breaks in the intermediate building.

b. A postulated failure of the integrated control system (ICS) could leave both flow control valves closed thus requiring either local or remote manual operator action to reopen at least one valve.

2. The condensate storage tank level indication function is not safety grade as it is not seismic Category I, does not satisfy the single failure criterion and is not Class 1E.

3. EFW system function following a safe shutdown earthquake has not been demonstrated as portions of the system piping and controls are not seismic Category I.

Q.4 What additional actions will be necessary to upgrade the EFW functions that are not safety grade at the time of restart to fully safety grade?

A. The following response corresponds to the items identified in Q.3 above.

1. The flow control valve function will be fully safety grade when the following modifications are made:

   a. Installation of redundant safety grade flow control valves.

   b. Installation of safety grade automatic EFW flow control valve circuitry.

2. The condensate storage tank level indication function will be safety grade with the installation of safety grade level instrumentation.

3. EFW system function following a safe shutdown earthquake will be assured following modification of certain seismic Category I piping and controls as necessary.

Q.5 When will the above additional necessary actions be completed?

A. The licensee has committed to complete the necessary actions by startup from the first refueling outage after restart.

Q.6 Of the EFW functions that are necessary to cope with design basis events for which EFW system function is required and that will not be safety grade at the time of restart, which are necessary to cope with loss of main feedwater (LOMF) and small break loss of coolant accidents (SBLOCA)?

A. The flow control valve function is required for SBLOCAs and LOMF and may be adversely affected by failure of ICS (Item 1.b under Q.3 above). Therefore, manual action to open a flow control valve would be necessary to restore EFW flow in the event of a failure of ICS that leaves both control valves closed. Sufficient instrumentation (indication of loss of EFW flow) and time (20 mirutes) is available for the operator to take manual action either remotely from the control room or locally at the valves.

MR. CUTCHIN: Mr. Chairman, I would also point out that yesterday in the rush of putting in the testimony the Board may have noticed that Mr. Wermiel's testimony, plus the service list, were attached to the layin. I would suggest that we tear that out of the copy since it is not referred to and we have it in the transcript at the appropriate place here.

Before I make Mr. Wermiel available for cross-examination --

BY MR. CUTCHIN: (Resuming)

Q Mr. Wermiel, I understand that to correct an error in the Staff's comments in response to Appeal Board memorandum and order of November 5th, 1982, which was noted by the Appeal Board on page 12 of ALAB-708, that you would like to correct a statement there concerning whether or not there is safety grade manual control capability available at TMI-1.

Will there be safety grade manual control capability available for the EFW system at the time of restart, and would you explain?

MR. WEISS: Could you just wait a second until we catch up to where this incorrect statement is.

MR. CUTCHIN: The Appeal Board noted it on page 12 of ALAB-708.

MR. WEISS: Do you mean the sentence that

says, "The Staff asserted that a safety grade manual control capability exists at TMI-1"?

MR. CUTCHIN: That is correct.

MR. WEISS: You're saying that is in error?

MR. CUTCHIN: That is my understanding, and I want Mr. Wermiel to explain why that statement is or is not in error.

WITNESS WERMIEL: The Staff incorrectly stated that the new manual emergency feedwater flow control valve stations in the control room are safety grade. While they are fully independent of ICS and are powered from the redundant Class 1E sources, portions of the power supply arrangement consist of single components and therefore do not meet the single failure criterion, and also are not seismic category 1, and therefore we cannot call it safety grade.

MR. CUTCHIN: I think the Board recognized that, but I wanted to clear up that point of confusion.

Mr. Wermiel is now available for cross.

CROSS-EXAMINATION ON BEHALF OF INTERVENOR

BY MS. WEISS:

Q Mr. Wermiel, when did you learn that this statement was incorrect that you had made previously?

A (WITNESS WERMIEL) I did not make the

statement previously. I learned about the incorrectness of it some months ago.

Q From the Licensee's testimony?

A (WITNESS WERMIEL) Partially from the Licensee and partially from my own staff people.

Q So your understanding has changed from what it was at the time you testified before?

A (WITNESS WERMIEL) No. My understanding was that the manual backup capability from the control room was not necessararily safety grade. I was not aware that there had been anything put into the record to the effect that it was.

Q I see, there was just a misunderstanding?

A (WITNESS WERMIEL) Yes.

Q Just a clarification. On page 2 of your testimony, the question that you are answering is: "Of the emergency feedwater system functions necessary to cope with design basis events for which EFW system function is required, which will not be fully safety grade at the time of restart?"

The first thing you deal with is flow control valve function. You say it is not fully safety grade because each EFW supply line contains a single flow control valve, therefore it doesn't satisfy the single failure criterion.

Isn't it also true that it is -- the single flow control valve is not safety grade? In other words, the circuitry is not?

A (WITNESS WERMIEL) For the flow control valve presently, yes, that is true.

Q Item number 3 in response to that same question, and I'm still on page 2, you say, "EFW system function following a safe shutdown earthquake has not been demonstrated, as portions of the system, piping and controls are not seismic category one."

Does that mean that you have concluded that the emergency feedwater system is not safety grade because it is not seismic category one?

A (WITNESS WERMIEL) That is correct.

Q Can you identify for us which portions of the piping and controls are not seismic category one?

A (WITNESS WERMIEL) I can recall some of it. I will have to look back to other references to find the details of that.

MR. CUTCHIN: Mr. Chairman, I am going to interpose an objection now, and if I might explain. It was my understanding that the Appeal Board was interested in ascertaining what portions may not be fully safety grade. Since the Staff does include in its definition of safety grade whether or not a system is

seismic category one, to give the Board a complete answer to its question we provided this information.

Now, I would point out that I think, if we are going too far into seismic qualification or no, then I believe the Commission's order CLI-83-5 yesterday would prohibit the taking of testimony to any great extent on this. I am willing to let it go as far as the Board feels it wants to go, but I want to point out that objection to the questions along this line.

JUDGE EDLES: Well, Ms. Weiss, were you once again attempting to establish the parameters of the witnesses' testimony?

MR. WEISS: As the Chairman no doubt has discovered by this point, we are in a quandary. The only way in which your question can be honestly answered, which I think Mr. Cutchin has just said and certainly this witness has said, is by acknowledging that the emergency feedwater system is not safety grade because it is not seismically qualified, as the witness just answered.

I would just intend for him to describe very generally for me what the extent of that nonqualification is, and I don't intend to go into any details at all.

JUDGE EDLES: Okay, I will let the witness

answeer that question and monitor it as we go along.

WITNESS WERMIEL: I can give you what I recall. There are interconnections between the suction supply piping to the pumps from the condensate storage tank to the non-seismic category one piping to the condenser. That interface, because it is a non-seismic interface, is being evaluated.

I can also recall that portions of the pump recirculation piping to the condensate storage tank are also not seismically qualified. That is the extent of my recollection at this time without further looking.

BY MS. WEISS: (Resuming)

Q The controls for the turbine-driven pump?

A (WITNESS WERMIEL) As I recall the controls, there is a question on their seismic capability, yes.

Q And the de-ice line going into the condensate storage tank?

A (WITNESS WERMIEL) I think the de-ice line is a portion of the recirculation piping that I just referred to.

Q And some cabling?

A (WITNESS WERMIEL) Cabling to certain valves that I just talked about at the interfaces is in question.

Q You state in response to question 4 -- well,

let me read. The question 4 on page 2 of your testimony is: "What additional actions will be necessary to upgrade the EFW functions that are not safety grade at the time of restart to fully safety grade?"

When you say -- and I'm trying to understand the meaning of the word "necessary" in that question -- in your response, do you mean necessary for safety?

A (WITNESS WERMIEL) Yes.

Q And your response on number 3 is: "EFW system function following a safe shutdown earthquake will be assured following modification of certain seismic category one piping and controls as necessary.

Now, is it your understanding that that will be done prior to restart?

A (WITNESS WERMIEL) No, that is not my understanding.

Q You say on page 3 -- the question 5 is: "When will the above additional necessary actions be completed?" Your answer to that is that: "The Licensee has committed to complete the necessary actions by startup from the first refueling outage after restart."

I take it that you do not know at this point what the necessary actions are?

A (WITNESS WERMIEL) That is correct. We haven't identified all of the seismic upgrades.

Q And when you say the Licensee has committed, you've received no written commitment?

A (WITNESS WERMIEL) I have not seen one. I've been told that there is a written commitment to this effect.

Q That has changed since we took the deposition. You learned since we talked at the deposition that some written commitment exists?

A (WITNESS WERMIEL) That is my understanding, yes.

Q But you haven't seen it?

A (WITNESS WERMIEL) I have not seen it, no.

Q You based the statement in your testimony, if I remember correctly, solely on an oral remark made by Mr. Clark, Vice President of GPU, at an open Commission meeting on December 17th, 1982; is that correct?

A (WITNESS WERMIEL) That is correct.

Q And if I remember correctly, what Mr. Clark said was generally that they would make the necessary changes, unspecified changes, if feasible by the first outage after restart. Do you recollect the statement in that way?

A (WITNESS WERMIEL) No, I don't.

(Counsel for the Intervenor conferring.)

Q I'm going to show you the transcript of that

Commission meeting and ask you to look on page 20, lines 19 through 21, and see if that refreshes your recollection.

MR. CUTCHIN: Mr. Chairman, I am going to put in another objection at this point in time. I think we know that that Commission meeting was for the purpose of inquiring into the seismic qualification, and now she is trying to bring it into this proceeding and I think it's improper.

JUDGE EDLES: I appreciate your quandary, Ms. Weiss, but tell me where you're going with this line of questioning.

MR. WEISS: Well, the witness has testified one of the bases for his testimony that the actions necessary for safety will be taken. the sole basis, he said, there is a statement of Mr. Clark at a Commission meeting. And Mr. Clark said at the Commission meeting that they would take these actions if feasible.

And I am just using the Commission transcript to refresh his recollection.

JUDGE EDLES: Are you referring to things other than seismic qualification?

MR. WEISS: No, sir.

JUDGE EDLES: Well, in that case I think I will sustain the objection.

MR. WEISS: In that case, Mr. Chairman, I would like to make an offer of proof and simply read.

MR. CUTCHIN: I would object to that as well, Mr. Chairman. You may not use Commission transcripts for evidence in a proceeding. I can find you the citation if need be.

JUDGE EDLES: Well, I'm not certain that an offer of proof is really necessary in order to protect your rights, Ms. Weiss. I think you have made your point adequately for the purposes of appeal if you care to take them.

BY MS. WEISS: (Resuming)

Q Why are these changes not necessary prior to restart?

A (WITNESS WERMIEL) The Staff as far as I know has made a determination and established a schedule for review of seismic upgrades in all operating plants, and is treating TMI-1 consistent with that schedule, and that established task.

Q Is your answer, Mr. Wermiel, that it is not necessary for safety prior to restart because it is a generic problem?

MR. CUTCHIN: Mr. Chairman, I'm going to object again on the grounds that I think now we are both going outside the scope of his testimony. We are not

here -- again, the purpose of this testimony was to respond to Appeal Board questions on status. It was not to say what the purpose of any of this equipment was or whether it was necessary or unnecessary. It was strictly in response to a question on the status, the safety grade status, period.

JUDGE EDLES: Ms. Weiss, any comment?

MR. WEISS: Well, the whole bottom line of the witness' testimony during the hearing and the two times that he appeared and today is to support the proposition that it is safe enough to operate TMI-1 with the current configuration of decay heat removal systems. And I'm simply inquiring into whether, on the basis of what he now knows about the safety grade status of the emergency feedwater system, which is the question that the Board asked, whether his conclusions remain the same.

MR. CUTCHIN: I will withdraw the objection to the extent of the answer to that question.

WITNESS WERMIEL: I believe my testimony in the hearing was as to the reliability of the emergency feedwater system in small break LOCA's and loss of feedwater transients, and I don't believe that any of the seismic questions changes the testimony on reliability of the system.

BY MS. WEISS: (Resuming)

Q I'm going to direct you just to one paragraph in your testimony in the previous hearing sessions. That is transcript page 16,759, and if you don't have that I will share my copy with you.

A (WITNESS WERMIEL) I don't think I do. I have my testimony, but it is not by transcript page number.

(Document handed to witness.)

Q Do you remember this exchange?

A (WITNESS WERMIEL) Yes, I recall it.

Q If I can just share your microphone, if you're going to share my transcript. You were being asked a series of questions about how seismic qualification or lack thereof might affect your reliability analysis for TMI-1 decay heat removal systems.

MR. CUTCHIN: Mr. Chairman, I'm going to object to any questions going to seismic qualifications. He has been asked the question if any of this would change his opinion as to the reliability, and now we are reopening this portion of the hearing for litigation, and I object.

MR. WEISS: That is precisely the question that is being asked now, and I'm going to direct him to this conclusion exactly and ask him. That door has certainly been opened for that.

JUDGE EDLES: I guess I don't understand the

line of argument you're making, counsel.

MR. WEISS: Which may be because you don't have a copy of the transcript.

JUDGE BUCK: He has the transcript now.

MR. WEISS: On page 16,769 we were discussing generally, as I say, the effect of seismic qualification or lack thereof on reliability of decay heat removal, and Mr. Wermiel says in an answer beginning on line 19, that the reliability studies they have performed aren't affected by seismic qualification because the probability of seismic occurrences is lower generally than so many other potential system failures, and therefore in establishing a point of reliability for the system is not very important. It just does not enter into many of the fault trees.

JUDGE EDLES: What, that the seismic qualification doesn't enter into it?

MR. WEISS: Because the seismic event is a low probability event. And I would like to ask him -- I would like to establish that that conclusion is not true if the seismic event in issue is an operating basis earthquake.

MR. CUTCHIN: I'm going to object to any questions going to seismic qualification, Mr. Chairman.

JUDGE EDLES: I think that is a valid

objection on the basis upon which counsel makes it. I thought you were going to ask him whether or not he has a change in his view on the reliability studies.

MR. WEISS: Well, I'm shortcutting it. I jumped a step.

MR. CUTCHIN: And I thought he just answered that question.

MR. WEISS: He didn't answer anything yet. You've answered so far, Mr. Cutchin.

This answer is based upon the assumption that the earthquake which causes the failure of emergency feedwater is a safe shutdown earthquake. The operating basis earthquake to caused that failure, the probability of an operating basis earthquake is on the order of an anticipated occurrence, according to the NRC rules, which is a probability much higher than many of the transients which do have an important effect on the fault trees.

MR. BAXTER: But if we're not going to take evidence on seismic qualification, the hypothetical would be absolutely meaningless.

MR. WEISS: It's curious to me how the restraints on the jurisdiction of this Board always preclude it from hearing the bad news and allow it to hear the good news.

MR. CUTCHIN: I would object.

JUDGE EDLES: Well, Ms. Weiss, you've got to help me out and explain it to me a little better. And perhaps it is my difficulties. I will sustain objections which go to the basic question of seismic qualification.

Now, what I thought originally it was, you were trying to get around to his discussion of the reliability studies insofar as he testified earlier that they were not affected by the seismic qualifications.

MR. WEISS: Let me just ask that question and see if we can get an answer to it.

JUDGE EDLES: All right.

BY MS. WEISS: (Resuming)

Q Is your conclusion, your answer on page 16,769 beginning on line 19, affected at all by the change in circumstances with respect to seismic qualification for the emergency feedwater system?

A (WITNESS WERMIEL) No, I don't believe so.

Q And why not?

MR. CUTCHIN: I'm going to object to the "why", Mr. Chairman.

JUDGE BUCK: That immediately becomes a seismic question, Ms. Weiss, the way you explored that question. You said you are limiting it only to the

seismic situation.

MR. WEISS: Dr. Buck, you cannot -- this Board seems to think it can separate seismic from safety grade from reliability. You can't do that.

JUDGE EDLES: I don't think the question is whether or not you can separate it. I think the question is the forum in which you will have the opportunity to make the argument.

MR. WEISS: I don't see that I have a forum. This Board, simply because a Board notification was sent, not to the Commission but to this Board -- that is what started this whole cavalcade of events. The Commission got hot and bothered about, why didn't we get that Board notification on seismic qualification. They ordered the Staff before them to make a presentation. That is the only thing that has happened, and how one can construe from the fact that they called a meeting to discuss the Board notification that was sent to this Board that the Commission has accepted sole jurisdiction over over theissue is beyond me.

MR. BAXTER: I would say the order is very clear they issued yesterday.

JUDGE EDLES: Do you have any further questions, Ms. Weiss?

MR. WEISS: No, Mr. Chairman.

JUDGE EDLES: Mr. Baxter?

MR. BAXTER: Mr. Chairman, it was Licensee's position that seismic qualification is not within the scope of the proceeding, but given the cross-examination that has taken place, I have just a couple of questions for Mr. Wermiel.

CROSS-EXAMINATION ON
BEHALF OF LICENSEE

BY MR. BAXTER:

Q Is the investigation of the seismic qualification of emergency feedwater at operating plants a generic program being undertaken within NRC?

MR. WEISS: Objection.

JUDGE EDLES: I believe that question was asked and the objection was sustained earlier. On the same basis I will sustain Ms. Weiss' objection.

BY MR. BAXTER: (Resuming)

Q Has the Staff completed its review of the seismic qualification of the TMI-1 EFW system?

MR. WEISS: Objection.

JUDGE EDLES: Do you want to address the objection, Mr. Baxter?

MR. BAXTER: Yes. We have had several questions asked and answered by counsel and reported in this testimony about the seismic qualification of the

system and the review they have undertaken, and I'm just trying to find out whether they are finished. That goes to the weight of the evidence that has been heard. I'm willing to have all of the testimony on seismic stricken if that is preferable.

JUDGE EDLES: Well, I think you can be satisfied that the Board will not extend beyond its own jurisdiction, if that is your concern. And as I understand what you are saying, I think I will sustain Ms. Weiss' objections.

MR. BAXTER: I don't argue with the Board's ruling. I'm ready to move on.

JUDGE EDLES: Okay. Mr. Adler?

MR. ADLER: We have no questions.

JUDGE EDLES: Any redirect, Mr. Cutchin?

MR. CUTCHIN: None, Mr. Chairman.

BOARD EXAMINATION

BY JUDGE BUCK:

Q Mr. Wermiel, can you tell me whether or not the EFW system is safety grade with respect to all other conditions, eliminating the seismic considerations altogether? Do you know of anything in the EFW that is non-safety-grade?

A (WITNESS WERMIEL) With respect to feedwater transients and small break LOCA's, assuming manual

capability to operate the flow control valves should RCS fail and those valves remain closed, I know of no other condition within the emergency feedwater system that would affect its safety grade status.

JUDGE BUCK: Thank you.

BY JUDGE GOTCHY:

Q I just have a couple of quick questions here. I guess it's just one.

On page 3, the last sentence, you say, "Sufficient instrumentation is available." Is that instrumentation safety grade?

A (WITNESS WERMIEL) Yes, there are safety grade flow indicators in the emergency feedwater system.

JUDGE GOTCHY: Thank you.

JUDGE EDLES: Mr. Cutchin, any further redirect?

MR. CUTCHIN: None, Mr. Chairman.

JUDGE EDLES: Any further questions?

MR. WEISS: I have one question that doesn't have anything to do with seismic qualification.

FOLLOW-UP ON BOARD EXAMINATION

BY MS. WEISS:

Q Dr. Buck asked you was it safety grade, was the emergency feedwater system safety grade excluding seismic considerations and excluding this question of

the flow control valve, and your answer was yes. That reminded me of a question your counsel asked your colleague Mr. Jensen earlier in the day. Mr. Jensen said he didn't see any relationship between reliability and safety grade status.

Do you see such a relationship?

A (WITNESS WERMIEL) No, I don't. Reliability is treated differently from the deterministic criteria that constitute safety grade.

Q And you can't make any general statement about whether a system that is safety grade is more reliable than a system that isn't safety grade?

A (WITNESS WERMIEL) I can only make one parallel. A safety grade system is a single failure-proof system, and that would tend to improve its reliability. That is the only parallel that I can safely draw between the two.

Q What about environmental qualification and all of the other requirements of a safety grade system? Don't those add to reliability?

A (WITNESS WERMIEL) For those events, I would say yes. In our treatment of reliability, environmental qualification isn't particularly important because we are talking feedwater transients and environment is not affected by feedwater transients.

Q I meant to be speaking generally, not just with respect to the feedwater.

A (WITNESS WERMIEL) In dealing with those types of conditions which might cause a harsh environment, then certainly qualification for that environment is important.

Q Is it really true that the whole accumulation of requirements that attaches to the phrase, to the characterization of a system or component as safety grade, are requirements that are at least intended to make that system highly reliable? Isn't that correct?

A (WITNESS WERMIEL) Yes, it is intended to make that system available and reliable for those types of events, yes.

MR. WEISS: Thank you very much.

JUDGE EDLES: Is there anything further?

MR. CUTCHIN: No, Mr. Chairman.

JUDGE EDLES: If not, the witness is dismissed.

(Witness excused.)

JUDGE EDLES: We will reconvene on the morning of Wednesday, March the 16th. Would there be any objection from counsel or others, Mr. Pollard, Mr. Dornsife, if we began at 9:00 o'clock instead of 9:30?

MR. BAXTER: We would prefer that, in an

effort to get done that week.

JUDGE EDLES: If that is the case, we will reconvene on Wednesday morning in this room, March the 16th at 9:00 a.m.

I would again remind the Staff that it is to submit to us no later than close of business this Friday its report with respect to Board Notification 83-21, and that report shall include any necessary analyses of the Licensee's submittal of March the 3rd.

If there is nothing else, we will stand adjourned.)

(Whereupon, at 4:55 p.m., the hearing in the above-entitled matter was adjourned, to reconvene at 9:00 a.m. on Wednesday, March 16, 1983.)

* * *

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

in the matter of: METROPOLITAN EDISON COMPANY, ET AL., (Three Mile Island Nuclear Station, Unit 1)

Date of Proceeding: March 8, 1983

Docket Number: - 50-289 (Restart)

Place of Proceeding: Bethesda, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

Ray Heer

Official Reporter (Typed)

Ray Heer

Official Reporter (Signature)

arise is that although steam from the core now has a direct path to the surge line, the pressurizer can have a significant quantity of liquid remaining in it unable to drain due to countercurrent flow limits. It is conceivable that the steam entering the surge line could entrain this residual liquid in the pressurizer as it rises to the safety valve entrance and still result in a two-phase discharge for a limited period of time until after hot leg uncovery. All of the liquid in the pressurizer was finally entrained and discharged."

Then you say, "We have examined the Semiscale test S-SR-2 data and conclude that this is not the case. The Semiscale data shows that once steam was able to enter the pressurizer surge line, the relief valve discharge quickly transitioned to steam flow with very little entrainment of the residual liquid."

My question is: Isn't it correct that in the earlier EG&G report on S-SR-2 they pointed out that this phemonena was very dependent upon plant-specific geometry? Isn't that correct?

A (WITNESS SHERON) I would have to go back and check the report. I don't know for certain.

Q Assuming that they said this.

A (WITNESS SHERON) Okay.

Q And if the geometry of Semiscale is not like

the geometry of TMI-1 -- that is, with respect to the ratio of diameter to height of the pressurizer, the diameter of the surge line, its connection into the loop -- then you would not be able to dismiss this phenomenon on the basis of the S-SR-2 data, would you?

A (WITNESS SHERON) No. No, you would not.

Q Do you know of any other explanation other than plant geometry that would affect this phenomenon?

A (WITNESS SHERON) The phenomena being whether or not the water is retained or swept out of the pressurizer?

Q Yes, sir.

A (WITNESS SHERON) Not offhand. But then again, this is not really a critical factor in whether feed-and-bleed works or not.

Q Isn't it true that in evaluating the effectiveness of feed-and-bleed, it is an important factor, what the mass flow rate is out of the system?

A (WITNESS SHERON) Only the mass flow rate when the discharge transitions to steam or, I should say, when the -- when the surge line would tend to uncover. The mass flow during the period of liquid discharge or two-phased discharge is not in my mind that critical to whether or not one can successfully feed-and-bleed since one does not achieve the mass balance between MPI and

safety valve discharge while the safety valve discharge is two-phase or liquid.

Q But in your testimony, the part that we have read particularly on the bottom of page 41, it is precisely at this point that you are discussing -- yes, page 41 -- that we're talking about the time in the transient when steam is in fact entering the surge line?

A (WITNESS SHERON) Yes. Well, this was in the testimony because of what Semiscale tests showed, which was that the code was not doing a reasonable job, in my mind, of calculating the inventory in the pressurizer once the surge line had uncovered and begun to pass steam.

Q That is correct. So is it not possible that it would affect the TMI-1 results if in fact at TMI-1 when the surge line becomes uncovered that that steam could entrain the residual liquid in the pressurizer as it rises towards the safety valve entrance and still result in a two-phase discharge of fluid for a limited time beyond what the RELAP-5 calculation shows?

A (WITNESS SHERON) From the standpoint of how it affects the mass and energy balance of the system at that point, one has to look at first the mass balance that is occurring when the hot leg uncovers to the surge line and now steam that is being generated in the core

can pass directly out the hot leg into the surge line.

If one could draw some sort of what I call a control volume around the entire primary system such that it passed through the surge line, then the mass leaving the system through this theoretical cut in the surge line is the net mass loss from the system, the HPI being the net mass gain in the system.

Looking at it from that perspective, you see that what is leaving the system through the surge line is steam, what is entering the system from the HPI is liquid, and these two parameters when added together would determine the net mass balance on the system whether it's increasing or decreasing.

So even if the pressurizer had water in it and the steam was entraining the liquid and carrying it out the valve from a mass balance standpoint on the primary system the only mass that you are continuing to lose from the system is the water that was entrained that was in the pressurizer in the first place.

That water does not contribute to the primary system inventory from the standpoint of aiding poor cooling. That water is lost to the primary system for all intents and purposes. It's going to stay in the pressurizer. It's eventually going to get swept out.

From an energy balance standpoint, the

two-phase discharge, if it cannot remove all of the decay heat, would tend to pressurize the system.

Q Dr. Sheron, I will let you finish answering the question. I don't want counsel to object to me interrupting you, so I will let you finish is you want to. But you are not yet getting around to answering my question. You are explaining to me why you don't think it is important.

My question to you simply was: Isn't it possible, because RELAP-5 doesn't do a good job of calculating this liquid steam separation in the pressurizer, that we could be discharging a two-phase flow through the safety valve for a longer period of time than the RELAP-5 calculation shows for TMI-1? That is a yes or a no is all I am after.

A (WITNESS SHERON) Yes.

JUDGE EDLES: Dr. Sheron, do you want to explain your yes, or do you feel comfortable with just giving me a yes or no?

WITNESS SHERON: Well, I was trying to explain that from the standpoint of liquid inventory in the primary system, it doesn't matter one bit whether that comes out as two-phase.

JUDGE EDLES: I just wanted to make sure that you haven't been cut off from giving your full answer.

BY MR. POLLARD: (Resuming)

Q Okay. At the bottom of page 42 of your testimony where you are talking about the code uncertainty, you say, "To account for code uncertainty we examined the effect of assuming a 25 percent uncertainty in the calculated vessel inventory at the time of minimum inventory." What do you mean by "we"? Do you mean the Staff or did you ask EG&G to do that?

A (WITNESS SHERON) "We" meant the Staff requested our contractor to provide an assessment of a 25 percent decrease in the vessel inventory at the time of minimum inventory.

Q So the Staff selected the 25 percent but EG&G examined the effect of that assumption?

A (WITNESS SHERON) That is correct.

Q Please tell me how you chose the 25 percent?

A (WITNESS SHERON) The 25 percent was an engineering judgment. It was chosen to bound the uncertainty on mass inventory, which was reported in Question 10, if I can find it here.

On page 24 of the testimony, the third equation there says -- it says in Figure 10-8, measure to predict that net system mass is compared. This can be seen at 2,400 seconds, the uncertainty is estimated to be approximately 20 percent. We selected, I selected

25 percent as just a nice round number which was greater than 20 percent.

Q Am I correct, though, that these figures on page 24 are your uncertainty estimates of RELAP's ability to predict test S-SR-2?

A (WITNESS SHERON) That is correct.

Q Whereas in Question 11 we are using RELAP to predict TMI-1, is that correct?

A (WITNESS SHERON) That is correct.

Q How do you know that the input data used for the TMI-1 calculation is no different, is no further different from reality than 25 percent?

A (WITNESS SHERON) We are relying, as I think Mr. Jensen said, on the analyses performed by our contractor. We are therefore relying on their ability to input correctly the correct data.

Q Yes. But we have already gone through, we don't even know what data went in. We only know that GPU gave them some curve for the HPI pump. We don't know, am I correct that the Staff does not know, how different the curve used in the calculation is from the flow you might get if you did a test at Three Mile Island Unit 1 of their HPI pump flow versus pressure?

A (WITNESS SHERON) That is correct. We have not done a test at TMI.

Q So therefore you don't know how far away from reality are the inputs to the RELAP-5 calculation of feed-and-bleed for TMI?

A (WITNESS SHERON) We did not verify any numbers in the EG&GB calculation from core power to the dimensions of the primary system.

Q Now, in analyzing -- excuse me. In responding to Board Question 11, whether or not we can successfully feed-and-bleed at TMI-1, the Board is asking you to do a RELAP-5 type analysis. My question to you is: Have you done RELAP-5 type analysis to find out for Three Mile Island Unit 1 whether a long-term use of feed-and-bleed cooling at Three Mile Island Unit 1 would cause you to encounter conditions which might result in pressurized thermal shock to the TMI-1 reactor vessel?

MR. CUTCHIN: Objection. Mr. Chairman, that has nothing whatsoever to do with the issues within this proceeding.

JUDGE EDLES: Ms. Weiss?

MS. WEISS: One of the questions that this proceeding is taking up is the viability of feed-and-bleed as a cooling mode for TMI Unit 1, and if one of the by-products of the use of feed-and-bleed is that one threatens pressurized thermal shock of the reactor vessel, I think that is extremely relevant.

MR. CUTCHIN: I understood the viability to include whether or not the mechanism of feed-and-bleed would adequately cool the core, not whether it would lead to other problems.

(The Board conferred.)

JUDGE EDLES: Ms. Weiss, I will sustain the objection. I think that we are going to limit the matters to the viability of feed-and-bleed and not the by-products.

MS. WEISS: Well, let me just suggest then, Mr. Chairman, that the issue is a result of an analysis to determine whether feed-and-bleed will successfully provide core cooling at TMI-1 in our view is that if the answer is that we might shock the reactor vessel, then we haven't successfully provide core cooling.

(The Board conferred.)

JUDGE BUCK: Ms. Weiss, are you contending that if the feed-and-bleed worked successfully and thereby succeeded in cooling the vessel, the core, that this would cause some tremendous damage somewhere?

MS. WEISS: I am suggesting that if the process of feed-and-bleed over a long period of time exceeds pressure and temperature limits on the reactor vessel, we may have water going in and out of the vessel but we haven't provided successful core cooling if we

crack the vessel in the process.

JUDGE BUCK: Well, if you haven't succeeded in cooling the -- succeeded in getting core cooling and in cooling the reactor vessel down, how do you get thermal shock?

MS. WEISS: Well, if we crack the vessel.

JUDGE BUCK: How would you crack the vessel, ma'am? I am sorry, I don't see this has anything to do with the viability of feed-and-bleed in this case. Absolutely none.

MR. POLLARD: I will try and answer your question, Dr. Buck. If feed-and-bleed cooling were successful for a period of time, we would wind up with Three Mile Island Unit 1 at 2,500 pounds approximately with presumably a cold temperature in the reactor vessel. If that combination of high pressure and low temperature cracked the reactor vessel, we then have to examine the question of whether following that point with a cracked reactor vessel, we could continue to successfully cool the core.

MR. CUTCHIN: And, Mr. Chairman, I take that to be an unproven hypothesis. And it is a what-if. And I think it is well outside the scope and the Board has ruled.

JUDGE BUCK: I am sorry, I see no

justification for it.

JUDGE EDLES: I will sustain the objection, Mr. Pollard. Why don't you move on to another area, please?

MS. WEISS: May I just ask whether you see no justification technically or you think it is outside the scope of this hearing?

JUDGE BUCK: Both.

MS. WEISS: Thank you, Dr. Buck.

MR. POLLARD: I have no further questions at this time on Issue Number 11.

JUDGE EDLES: Mr. Baxter.

MR. BAXTER: I have no questions.

JUDGE EDLES: Mr. Adler? Mr. Dornsife?

CROSS EXAMINATION

BY MR. DORNSIFE:

Q I just have two short lines of questioning. One, I want to create a scenario for you, if I may. And I would like to have you give me some answers on the scenario.

The scenario I am presuming is you have a small-break LOCA with a break area of .01 square feet, and you have -- you assume you have no emergency feedwater being initiated; so therefore, the operators recognizing it may be outside the design basis but the

operators would then presumably go to feed-and-bleed; and because of the procedures as you stated -- I am not sure -- but because of their selection, selective mode of feed-and-bleed, they may use the PORV and the PORV sticks open.

Are you aware of any analysis either by yourself or the licensee that runs basically through that scenario?

(Witnesses conferred.)

A (WITNESS SHERON) We are trying to recall. We don't think there is a specific analysis of this scenario. But we think that there is a calculation that was performed by B&W in the May 7, 1979, Bluebook which would bound your scenario. I think it would be a .02 square foot break with no emergency feedwater, and I believe they demonstrated that if the EFW was reinitiated or the HPI was reinitiated within 20 minutes, they could adequately recover.

The .01 square foot break combined with the PORV which has, as we understand it, an effective area of .007 square foot would be less, slightly less than the .02 square foot break. It would also be at a better location in the primary system because it is high.

Q If I could, I would like to refer you to the licensee's exhibit, the licensee's testimony.

MR. ADLER: This is a copy of a piece of testimony given in the hearing before the Licening Board. It is "Licensee's Testimony of Robert C. Jones, Jr. and T. Gary Broughton in Response to UCS Contention Number 8 and EC&P Contention Number 1E, Additional LOCA Analysis." It appeared in the transcript following page 5038.

JUDGE EDLES: Why don't you give counsel just one moment to locate it.

MR. ADLER: We are also providing a copy for the witnesses.

(Witnesses handed document.)

JUDGE BUCK: Mr. Dornsife, what page of the testimony was that?

MR. DORNSIFE: It is table 3, sir, on the Licensee's testimony.

WITNESS JENSEN: I believe I must have forgotten about this particular analysis. Now that I see it, I do recognize it.

BY MR. DORNSIFE: (Resuming)

Q Do you agree, the Staff reviewed and agreed with these results?

A (WITNESS JENSEN) I believe the Staff reviewed that and, yes, in fact the Staff requested this analysis be done, and I believe this shows very little difference. That the PORV opened, it had very little effect on the course of the event and the core remained covered, as it did in the base case for which the PORV did not stay open.

Q Is it true that this analysis assumed, however, that both HPI pumps needed to function to keep -- to provide adequate core cooling?

A (WITNESS JENSEN) Yes, both HPI pumps were used in this case, as were in the blue book. I would note this was done for a plant with a power level somewhat higher than that of TMI-1. It was 2772 megawatts, and a 20 percent uncertainty was added to the

ANF decay heat curve.

Q But these particular results would not be consistent with Appendix K assumptions?

A (WITNESS JENSEN) Yes, the results would be. The 20 percent was required by Appendix K. However, it would not be required that the power level be 2772 instead of the TMI-1 power level.

MR. CUTCHIN: Which is? Could you say for the record?

WITNESS JENSEN: It is 2535 megawatts.

BY MR. DORNSIFE: (Resuming)

Q Recognizing there probably is no analysis for this particular scenario, but assuming that emergency feedwater does initially function and for some reason the boiler condenser mode of heat removal, when the system drains down, the boiler condenser mode of heat removal is not effective, do you think the conclusions of this particular calculation would change?

A (WITNESS JENSEN) I think the scenario you postulate would be better for the plant, because there would be some heat transfer before natural circulation was lost in the single phased mode.

Q But there is still the possibility you may need two HPI pumps to provide adequate core cooling?

A (WITNESS JENSEN) Yes, it is possible. I

don't know the answer.

Q Would that change your conclusion, any of your conclusions, if that particular scenario did need two HPI pumps, concerning adequacy of feed and bleed as a backup possibly to emergency feedwater?

A (WITNESS JENSEN) We have relied on the boiler condenser mode of natural circulation. We're going to talk about that next week. If boiler condenser were not effective at all in any form, I think we would have a different opinion.

Q But haven't you done analyses to show that feed and bleed could provide adequate backup in case it didn't work?

A (WITNESS JENSEN) Feed and bleed, we have done analyses of feed and bleed for TMI-1 based on a best estimate decay heat value and without a break, and these conditions are more severe than the ones we have analyzed, which is a break in the cold leg which allows some of the HPI water to be lost directly due to the break without cooling the core.

And also, the power level was higher and the 20 percent uncertainty in the ANF decay heat curve is used.

Q Dr. Sheron, based upon your understanding of the analysis the Staff has done to show that feed and

bleed is an adequate backup, assuming the results of your -- you did this calculation, and then you needed two HPI pumps. Would that change your conclusions at all?

A (WITNESS SHERON) If the conclusions were that two HPI pumps were required, no, I don't see how it would, whether it's one or two.

Q Are you aware of any recent LOFT tests that have been done to verify feed and bleed?

A (WITNESS SHERON) Yes.

Q What was the date of the test?

A (WITNESS SHERON) I don't know the exact date it was run. I think about two weeks ago, in that time frame, by the LOFT, the international consortium.

Q Do you have any preliminary -- does the Staff have any preliminary results of the test?

A (WITNESS SHERON) The only thing I know about it is, one of our representatives at EG&G called me on the phone and just told me that it was a success. I know nothing more. I have seen no data. Nothing has been issued.

Q Would you think that the conclusions of that test, once they are in and analyzed, would shed significant -- could change any of the assumptions, any of the conclusions, or shed significant light on this

particular case?

A (WITNESS SHERON) I really don't know. The test was run to simulate the CE type of plant with a low head HPI pump. So again, it was, what we were looking for in that test was to determine if the system could depressurize with the PORV's to below the shutoff head of the safety injection pumps characteristic of the Combustion Engineering design.

Q Could the LOFT test be adjusted to simulate a high head injection pump like TMI?

A (WITNESS SHERON) I don't know if the pumps are physically capable. My understanding is the pumps can be adjusted. Whether they can go up to the shutoff head of a B&W plant, I don't know.

Q So you're not aware of any tests that could better simulate TMI scheduled for LOFT?

A (WITNESS SHERON) No. I think, though, that what you said, that somewhere down the road when we do see the data, it will be used to help support various aspects of the model verification on feed and bleed. Again, for example, the overall process of injecting water in the cold legs, removing energy and mass through the PORV's, will give us some benchmarks on our codes to determine how well we can predict the relieving capacity, mass removal capacity rate of these valves.

Q When would you expect results of that test?

A (WITNESS SHERON) I really don't know. That whole program now is under the auspices of an international management group headed up by the Department of Energy. It is really to some extent out of the control of NRC in terms of when things are issued and the like.

JUDGE BUCK: The data is made available, though, is it not?

WITNESS SHERON: The data is made available. But when, I don't know.

MR. DORNSIFE: I have no further questions. Thank you.

MR. BAXTER: I had one comment, just to amplify the reference Mr. Dornsife gave to the Jones and Broughton testimony, where the results were set forth in the case of a very small break with no feedwater and a stuck-open PORV. That analysis is documented and reported in a more complete fashion in Licensee's Exhibit 13.

JUDGE EDLES: Thank you very much.

BOARD EXAMINATION

BY JUDGE GOTCHY:

Q I just have a couple of questions. One is by way of clarification. If I understood you, Dr. Sheron,

in response to a question from Mr. Pollard -- he asked you, as I understood it, when the safety valve opens and closes, and I think you said it opens about 2500 and closes about 2500.

A (WITNESS SHERON) I was presuming. I don't know exactly what they assumed as a closure set point.

Q The reason I am asking is because the LANL report shows about, I think it is, about a 400 psi variation. It looks like it opens at 2500 and it closes at 2100. Do you see this wide variation in figure 7?

A (WITNESS SHERON) My understanding is LANL did two calculations. One was with the lower closure set point, the 2100, I believe, and the other calculation was with the existing set point.

MR. CUTCHIN: Dr. Gotchy, at the bottom of table 2 in the LANL report they purport to give the opening and closing pressures.

JUDGE BUCK: That's 2500 and 2450 in the case of one and 2500 and 2500 on number two.

BY JUDGE GOTCHY: (Resuming)

Q I gather from your discussion this morning that the Staff is not really prepared to answer questions about mechanical failures of the Dresser type valves; is that right?

A (WITNESS SHERON) That is correct.

Q On the bottom of page 40, the last sentence, there is a discussion beginning in that paragraph which goes on to page 41, and where you say, "When the safety valve flow transitions to liquid discharge." At that time, are there other voids in the primary system or is the system temporarily water-solid until the core boiling you describe in the next couple of sentences later on begins?

A (WITNESS SHERON) The initial one, when the system initially transitions to liquid discharge, there is no voids in the system other than the steam in the pressurizer which is being expelled.

Q We are talking in this paragraph about expelling steam from the pressurizer steam space, and then it says, once the steam is expelled. That is from the pressurizer?

A (WITNESS SHERON) Yes.

Q The safety valve transitions to liquid discharge. My question was, at that time is there any other voids in the primary system or is it water-solid?

A (WITNESS SHERON) At that point it would be water-solid.

Q And then I guess it is a very short period of time after that that you would start to get boiling in the core?

A (WITNESS SHERON) Yes. What you do is, as you heat up the system you are expanding the primary coolant. It is this expansion that is pushing, that is pressurizing the system, pushing the steam in the pressurizer out. Once it pushes all of the steam out, then water starts to discharge.

But this is still due to just expansion and the fact that the primary system cannot hold all of the water during this expansion period. It continues. The expansion is due to the heatup, but the safety valve holds the pressure at 2500 pounds, so the system will continue to heat up until it reaches the saturation temperature associated with 2500 pounds.

Then you start getting boiling in the system.

Q On page 42, the first full paragraph on that page where you say, starting with the conclusion, you conclude here that for successful feed and bleed the safety valve discharge must be steam. Given the fact that you testified that you're going to have what appears to by cyclic flow through the relief valves of liquid, two-phase and steam, it is obvious that there is going to be more than steam discharged in the safety valves.

And the question I have is, how much confidence can we have that the majority of the

discharge is going to be with steam and not some other mixture. Well, I will get to that question later.

A (WITNESS SHERON) I don't really think that there is a problem with whether it's -- how much of it is steam and how much of it is liquid, in other words.

Q There is in terms of core cooling, though. I mean, if you have all liquid discharge you get into a problem where you're going to lose more inventory than you can recover.

A (WITNESS SHERON) Well, up to a point. You have to look at -- it depends upon the elevations of the system. You have to look at the whole primary system. What is happening is that once you start this, once you expand the primary coolant and you start the bulk boiling process, voids that are being formed in the core due to boiling are going to accumulate in the high points of the system -- the top of the vessel, the top of the hot leg, U-bends.

As they accumulate there, that is they displace water and that just pushes more water out of the safety valve. In accumulating in these high points, they are creating a level which is slowly dropping down. The more steam you produce, the more liquid gets pushed out.

Once the levels drop down to where the surge

line on the hot leg, and that comes in on the side of the vertical section on the hot leg, once that is uncovered steam that is being produced in the core can now pass directly into that surge line. Liquid is no longer in contact with that surge line entrance. Therefore, no more liquid can escape the primary system. It only escapes as steam.

Q Is there any problem, then, with continued HPI injection of recovering the primary to the point where it covers the surge line again?

A (WITNESS SHERON) Well, this is where you get into what EG&G refers to as this operating band. If you cover the surge line so that you are now back in a situation where you have to push liquid, which is what you will do, steam generated in the core will tend to pressurize the system and push liquid into the surge line and out the pressurizer.

You will move on this operating band back to a condition where you're expelling more than you're putting into the system. The level will drop down and then you will go back to a steam discharge, so you will tend to cycle at that point. And the whole premise is that as long as that point is above the top of the core, the core is being adequately cooled.

Q I see. There is no way, if you went through a

number of these cycles, there would not be a time in which if you maintained the HPI flow that you could eventually go liquid-solid in the primary system and discharge water through the safety valves?

A (WITNESS SHERON) In time you could eventually go back to a water solid condition.

Q Couldn't that result in essentially a stable feed and bleed mode with the liquid discharge, if the HPI and leak rate were matched?

A (WITNESS SHERON) Yes.

JUDGE GOTCHY: That's all I have. Thank you.

JUDGE EDLES: Mr. Cutchin, do you have any redirect?

MR. CUTCHIN: None, Mr. Chairman.

JUDGE EDLES: Are there any other questions? Mr. Pollard?

FOLLOW-UP ON BOARD EXAMINATION

ON BEHALF OF INTERVENOR

BY MR. POLLARD:

Q Dr. Sheron, your testimony in response to Board question 11 where you were looking at feed and bleed, is it correct that that question deals solely with loss of feedwater, that that calculation did not include small break LOCA?

A (WITNESS SHERON) That is correct.

MR. POLLARD: Thank you.

JUDGE EDLES: Ms. Weiss, let me ask you how much time you think you will need for cross-examination on question 8.

MR. WEISS: I would say an hour.

JUDGE EDLES: Why don't we take a 15-minute break.

MR. WEISS: I had one more question of these witnesses.

JUDGE EDLES: I'm sorry, I thought you had concluded. Go ahead.

BY MS. WEISS:

Q Mr. Sheron, I'm showing you a memorandum that you wrote dated March 31, 1981, to Carl Kniel, K-n-i-e-l, Generic Issues Branch, DST, entitled "Status of Feed and Bleed for Emergency Decay Heat Removal." Is that in fact a document that you wrote?

A (WITNESS SHERON) Yes, it is.

Q I would just like to read to you from page 7 --

MR. CUTCHIN: Mr. Chairman, I would like some clarification as to how this is follow-on cross from the questions that came up, please.

MR. WEISS: I would like to ask the witness if he still agrees with the statement in here that high

pressure feed and bleed is not recommended due to vessel structural consideration. That is not strictly follow-up.

MR. CUTCHIN: Mr. Chairman, you ruled on that, I believe.

MR. WEISS: It is not strictly follow-up. I wanted to respond to Dr. Buck's comment that he could not understand how operation of feed and bleed might involve threats to the pressure vessel.

MR. CUTCHIN: I renew my objection, Mr. Chairman.

(Board conferring.)

JUDGE EDLES: I will sustain counsel's objection, Ms. Weiss.

MR. WEISS: I would like to simply read that sentence for an offer of proof.

JUDGE EDLES: Go ahead.

MR. WEISS: The memorandum contains the statement by this witness, Dr. Sheron: "High pressure feed and bleed is not recommended due to vessel structural consideration. Feed and bleed should be performed at lower pressures."

JUDGE EDLES: Thank you.

We will take a 15-minute recess and when we reconvene we will take up with the Licensee's witnesses

on question 8. And I would like to finish by the end of the day today.

(Whereupon, the hearing in the above-entitled matter was recessed, to reconvene the same day.)

JUDGE EDLES: Let's go back on the record.

Every time I come back I find something else on my desk.

MR. WEISS: Mr. Chairman, that is UCS Exhibit No. 45. It is the latest revision of emergency procedure 1202-26A, and I have had the appropriate number of copies made for the reporter and parties.

MR. BAXTER: One more wrapup matter, Mr. Chairman. I am informed that the HPI performance data that my client provided EG&G is reported in Licensee Exhibit 1. That is the restart report in evidence here, supplement one, part three, question one. And it is the same as the data that Mr. Jensen referred to.

JUDGE EDLES: Thank you.

MR. BAXTER: Would you swear Mr. Chisholm, please.

JUDGE EDLES: Give us your name, please, first.

MR. CHISHOLM: Richard J. Chisholm.

Whereupon,

THOMAS M. DEMPSEY,

recalled as a witness by counsel for Licensee, having previously been duly sworn by the Chairman, was examined and testified as follows:

Whereupon,

RICHARD J. CHISHOLM,

called as a witness by counsel for Licensee, having first been duly sworn by the Chairman, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BAXTER:

Q Would you each state your name and give me your title and the name of your employer?

A (WITNESS CHISHOLM) My name is Richard J. Chisholm. I am the Manager of Electrical Power Instrumentation in the Engineering and Design Department of General Public Utilities, Nuclear, GPU Nuclear.

A (WITNESS DEMPSEY) My name is Thomas M. Dempsey. I am Manager of Secondary Plant Engineering, Mechanical Systems Section of the Engineering and Design Department of GPU Nuclear.

Q Gentlemen, I call your attention to a document that bears the caption of the proceeding dated February 16, 1983, and it is entitled "Licensee's Testimony of Gary R. Capodanno and Richard J. Chisholm in Response to ALAB-708, Issue No. 8 (Safety Grade Status of Emergency Feedwater System)".

And as we established yesterday in the record, Mr. Capodanno was taken ill and will not be able to attend the hearing. Mr. Dempsey, who is substituting

for Mr. Capodanno, we established yesterday works for him.

JUDGE EDLES: Mr. Dempsey, the Board wishes to express its appreciation for your filling in for him on that kind of short notice. It helps us advance the process a little bit and I thank you for that.

BY MR. BAXTER: (Resuming)

Q Mr. Dempsey, have you reviewed the testimony that is indicated to be sponsored by Mr. Capodanno?

A (WITNESS DEMPSEY) Yes, I have.

Q And do you adopt it as your testimony in this proceeding?

A (WITNESS DEMPSEY) Yes, I do.

Q Is it true and accurate to the best of your knowledge and belief?

A (WITNESS DEMPSEY) Yes, it is.

Q Mr. Chisholm, does the testimony associated with your name in this document represent material prepared by you or under your supervision for this proceeding?

A (WITNESS CHISHOLM) Yes, it does.

Q And is it true and accurate to the best of your knowledge and belief?

A (WITNESS CHISHOLM) Yes, it is.

MR. BAXTER: I move that the testimony be

received into evidence and physically incorporated into the transcript as if read.

MR. WEISS: No objection.

JUDGE EDLES: So moved.

(The document referred to, the Licensee's testimony on Issue 8, follows:)