UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

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GENERAL PUBLIC UTILITIES CORPORATION, JERSEY CENTRAL POWER & LIGHT COMPANY, METROPOLITAN EDISON COMPANY and PENNSYLVANIA ELECTRIC COMPANY,

Plaintiffs,

v. 80 Civil 1683 (RO)

THE BABCOCK & WILCOX COMPANY and J. RAY McDERMOTT & CO., INC.,

Defendants.

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December 7, 1982

10:15 a.m.

Before:

HON. RICHARD OWEN,

District Judge.

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(Open court)

E D W A R D R U S S E L L F R E D E R I C K resumed.

DIRECT EXAMINATION (Cont'd)

BY MR. SELTZER:

THE COURT: Good morning.

Q. Mr. Frederick, you testified that during the first 10 or 15 minutes of the transient about four or five hundred enunciator alarms in the windows above the panels

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appeared.

On the morning of the accident, what, if anything, did you do regarding all those alarm indications?

A. Well, after they had given us the information I discussed yesterday, groups of alarms came in for the turbine, for the condensate and for the various primary systems. Once that group of information was acquired, they weren't doing much for us but they could be analyzed individually. So we decided not to acknowledge -- not to push the acknowledge button.

Q. What difference does that make, pushing the acknowledge button? How does that effect what you see or hear in the control room?

A. Well, if an alarm comes in, it sounds the enunciator alarm, electronic beeper, and then you look up and you see the card flashing and you push the acknowledge button and it turns off the beeper and it makes the alarm card stop flashing.

When that alarm clears, it sounds the beeper again, it begins to flash again and when you push the acknowledge button, it goes out, that light, if that condition is fixed, cleared.

So in this case where we had all those alarms coming in and going out --

Q. Let me clarify something.

If an alarm condition has appeared in the plant, you've said the card flashes and the beeper comes on. If you push the acknowledge button, what happens to the status of the card?

A. When the alarm is coming in?

Q. Yes.

A. When you push the button, the card remains lighted solid, like you see in there. Then when it is clearing, it flashes dimly, there are two voltages which could be applied to it and it flashes dimly when it is cleared.

Q. What do you mean when it is cleared?

A. Whatever condition is and the condition is --

THE COURT: Being remedied.

THE WITNESS: Is being remedied. That's a good word. If it happens again, you push the button and the light goes out. With all the alarms coming in and going out, we decided not to push the acknowledge button because it would erase some of the acknowledge conditions and we decided to see what it would be. Later on we thought when it settled down, we could go through the individual alarm cards and see if there was any more information we could draw from the alarms.

Q. To resume with the point in the transient where I believe we were yesterday, reactor coolant system

pressure and pressurizer level were falling.

At that point, did you observe what was happening to the temperature in the reactor coolant system?

A. It was trending down with the other -- pressure level and temperature were trending down.

Q. Did you take note of the specific level to which or at which reactor coolant system temperature was at any point when pressure and pressurizer level were coming down?

A. Not that I recall, no. I was just looking at the trending information on the graph.

Q. Did there come a time early in the transient when you checked the temperature and pressure on the reactor coolant drain tank?

A. I really don't recall that, going back there now, but I had testified much earlier just after the accident that I did. So I don't really remember it now though.

Q. Do you mean in one of the times that you were being questioned after the accident you gave testimony about that?

A. Yes. Soon after the accident we were interviewed by a lot of different groups and back in there somewhere I said I went back there. I just don't remember it now.

Q. Were you interviewed by personnel from the NRC's I & E division in April 1979?

A. Yes. They interviewed us for several weeks in, I think, April of 79.

MR. SELTZER: Your Honor, I would like to read from Mr. Frederick's I & E testimony, his recorded recollection under Rule of Evidence 803 sub.5.

MR. FISKE: We have no objection, your Honor.

MR. SELTZER: This is at page 64.

Q. Is Mr. Hunter somebody who was interviewing you from I & E?

A. His name was Darwin Hunter, one of the investigators.

Q. Mr. Hunter said to you:

"Okay. Let's spend a couple of minutes on a reactor coolant drain tank. I know that we have been here awhile but I am going to try to get this.

Let me get talk about the reactor coolant drain tank. The initial conversation we talked about the reactor coolant drain tank, we touched on the reactor drain tank and the fact that you went around behind the panel and noted that pressure was zero, high temperature, that the pressure was down, low pressure. You turned the reactor coolant pump off. And you turned the coolant pump off.

"Mr. Frederick: The level was down, the pressure was up and the temperature was up. We have three gauges, level, temperature and pressure."

What did you understand, conceptually, from your prior training and experience could cause reactor coolant drain tank temperature and pressure to be elevated as you described in this prior testimony?

A. Well, the condition, a specific condition would be a blast from one of the relief valves that would cause an exhaust of a lot of steam from the pressurizer and it would go into the drain tank and heat it up. That steam would hit the water and the drain tank heated up and would raise the pressure.

Then it would exhaust for awhile and it would shut. Pressure and temperature would remain high for awhile and then later on it would go back to normal.

Q. Where was the panel on which reactor coolant drain tank information was shown?

A. Panel 8-A is located around the left-hand corner of the rear panels shown here in the control room. It faces the outer wall of the control room.

Q. Did you have any understanding why the reactor coolant drain tank information was on a back panel?

A. Well, we had a number of rear facing panels like that for systems that we don't use very often. And since this was not a panel that we used very often, that's why I would classify it as a back panel.

Q. Could you just very succinctly indicate what

other kinds of information is displayed on back panels?

A. There are -- around this side of the control room, around the right-hand side of the panel --

MR. FISKE: I will object to this as irrelevant, where the panels are. He went and looked at it.

THE COURT: I sustain that objection.

Q. Mr. Frederick, you indicated that it was your understanding that a blast of steam from a relief valve could elevate temperature and pressure.

What did you mean by "a blast"?

A. Well, you had very hot steam and high pressure and the valve springs open and the steam rushes through the steam pipe to the drain tank and the effect is to rush all that energy into the drain tank and I just used the term blast. It opens, blasts the steam out and reshuts and you get an excursion in the drain tank.

Q. On the day of the accident, would it have helped you if the drain tank information had been displayed on a front panel?

MR. FISKE: I will object to that, your Honor.

THE COURT: Yes. I will sustain that.

I don't gather that anybody contends that they didn't look at it or didn't know about it, correct? You don't contend that?

MR. SELTZER: No. This witness says --

THE COURT: Then I'll sustain in that objection.

Q. On March 28, 1979, was elevated temperature and pressure on the reactor coolant drain tank expected or unexpected?

MR. FISKE: Your Honor, I will object to this unless the witness describes how high the temperature was when he saw it, how high the temperature and pressure were.

THE COURT: Well, it seems to me, in addition to that we have got to have some prior act such as pressure reaching a point where a valve would open to make that expected and you haven't laid that foundation at all.

So I will sustain that objection.

Q. Mr. Frederick, you said that you heard Mr. Zewe, the shift supervisor, announce that there had been a reactor trip. You say that after he announced that you checked panel indications.

From your looking at panel indications, were you able to tell what had triggered the reactor trip?

A. Yes. I knew that the reactor trip was due to a turbine trip which resulted in high pressure in the reactor coolant system and high pressure reactor trip.

Q. At what pressure does a high pressure reactor trip get actuated?

A. 2255 pounds. So what I understood had happened, the turbine trip rejected all that energy back into the

reactor coolant system and caused the high pressure condition which caused the PORV to open at 2255, trip at 2355 and then when the pressure started coming back down again, the PORV reset at 2205 and then we go into the reactor trip immediate actions.

(Continued on next page)

Q. How soon after the start of the transient did you understand the pressure moved up to the PORV set point, up to the reactor trip set point and then down through the PORV closing set point, as you just described it?

A. That happened in only a few seconds. From the time that I had moved from my original position to panel 6 and was returning to panel 4 to look at the ICS when Mr. Zewe announced the reactor trip, and then I verified the reactor trip, all that had already happened.

Q. With that as foundation, knowing that there had been a high pressure reactor trip and that the plant had moved through the open set point and the close set point for the PORV and had, as you described it, ejected a blast of steam --

THE COURT: Mr. Seltzer, don't sum up. Just put the next question. Give the background.

What did you expect to find in the way of elevated temperature? All right. Let's keep moving forward, please. What did you expect to find, given that?

THE WITNESS: I expected to see the pressure and temperature elevated in the drain tank due to that excursion from the --

THE COURT: And how much?

THE WITNESS: I just knew it would be well above normal. Again, I was just looking for that as a trend

information.

THE COURT: You had no specific figures in expectation, is that what you are telling me?

THE WITNESS: That's right. There is no way to anticipate what those numbers might be.

THE COURT: Because the PORV has only been open for, what, maybe 5 or 10 seconds?

THE WITNESS: Not very long. I don't know how many seconds.

Q. What if any expectation did you have of what level pressure would be in the reactor coolant drain tank?

A. Just that it would be well above normal.

Q. You testified yesterday that in scanning the panel indications shortly after the start of the transient what you observed was normal following a reactor trip and turbine trip.

Let me ask you now, when you got back to panel 4, do you know what the status of the indicator light for the pilot operated relief valve was?

A. It was off.

THE COURT: Do you remember seeing it lit?

THE WITNESS: It was not lit.

THE COURT: No. Do you remember at any time seeing it lit?

THE WITNESS: No. The --

THE COURT: The answer is no?

THE WITNESS: No. I had my back to the panel.

Q. You indicated at what point in time the PORV would have lifted. Where were you at that point in time?

A. I was over here between panel 5 and 6 at the turbine control. I was verifying the turbine trip.

Q. When you got back to the panel 4 position and the PORV light was off, what if any understanding did you have then about whether the PORV light being off would be a normal or an abnormal indication?

A. That would be a normal indication because we have already had the high pressure excursion in the reactor coolant system and we were into the post reactor trip where I am going to have to take manual control of the makeup system now. So we are a few seconds into the transient, the pressure is down below that and the valve should be shut.

Q. The pressure is down below what?

A. The pressure has gone below the reset point.

Q. For --

A. For the PORV, for the relief valve.

Q. You testified yesterday that one of the first actions that you performed after you got back into the area on the lefthand side of the panel was that you started a second makeup pump. On that morning did anything happen as

a result of your starting the second makeup pump and putting whatever additional flow it does into the reactor coolant system?

A. After starting the second makeup pump and increasing the makeup flow I soon saw that the pressurizer level turned and began coming back up.

Q. Did there come a point in time early in the transient when high pressure injection and other emergency safety features automatically actuated?

A. Yes.

Q. When was that?

A. I don't have a time in mind, but it was after this time when the pressurizer level was beginning to rise back up when I had control of pressurizer level.

Q. What systems start on an emergency safety features actuation?

A. The systems that are directly affected by the high pressure signal are the makeup system and the decay heat removal system. These pumps of the makeup system shift automatically so the A and C pump are running and the B pump is off whereas on manual control I had the A and the B pumps running. Then these four injection valves, 16-A, B, C and D, opened to their full injection set points.

The decay heat removal pumps that are controlled from over here start, but they have no function at this

time until the pressure is reduced around 700 pounds. Then they would begin injecting water. They are the low pressure injection pumps.

All the support systems that supply cooling water for the makeup system and for the decay heat removal system are also automatically started and the valves and the coolers for the electrical lineup necessary to support that is indicated back here on panel 13, the white lights. Also the backup electrical power source, these diesel generators, would start to supply standby electrical power in case of some problem with the normal electrical sources here on the front panel.

Q. Is there any independent indication of when the diesels have started?

A. Yes. For one thing there is a large bell, like a fire alarm bell, on the top of the diesel, each one. There is also a blue and an amber running light for each diesel that comes on.

Q. Is that a soft bell?

A. No, it is a large, like a fire alarm bell.

Q. Did you take any steps to verify whether there had been emergency safety features actuation?

A. Yes. After I realized that we had had the automatic initiation, I began to check each of the components I just outlined and their subsystem to make sure

that everything moved to its automatic initiation status, both on this panel 3, panel 8, and then the individual status on panel 13. Each component has a white light that indicates that it is in its ES status. You have to wait for all those components to move to their white light status.

Q. Once the diesels have been actuated by an emergency safety features signal, how are they shut off?

A. They can't be stopped from the control room as long as the ES signal is still in. You have to send an operator to the diesel, which is a separate building from the control building, and they would have to shut it down manually.

Q. Is that some times called a fuel rack?

A. Well, when you get to the diesel there is a large red button that controls the fuel feed to the diesel generators, and when you disengage or push that button in, it disengages the fuel supply from the diesel and it shuts down.

Q. If the diesels are shut off at the fuel rack, what if any effect does that have on the bell alarm that you said goes off on the diesel panel when there is an automatic safety features actuation?

A. The bell sounds because you have applied a signal to the diesel to start. It will tell you, one, that

the diesel is attempting to start, that it has started or that it has failed to start, whatever -- all these alarms are separate enunciators. Just like these enunciator alarms will give you a beeper, these alarms will give you a bell. Anything that affects the diesel generator will cause the bell to ring.

If you push the start button or give it an automatic signal to start and it doesn't go, then you will get the alarm to tell you why it doesn't start. If it does start, then you will get the alarm that says diesel running.

Q. You described that when the emergency safety features signal came in the A and C pumps started or the A and C pumps were functioning instead of the A and B pumps which you had on manual.

A. I am referring to the makeup pumps, the high pressure injection pumps.

Q. Does the source of water for the HPI mode differ from the source of water for the makeup mode?

A. Yes. The source of water I was using was the makeup tank, the tank that's connected to the suction pumps in the auxiliary building. When HPI is fully initiated, then it takes -- suction is shifted to the borated water storage tank which is a large tank outside on the grounds of the site there. It is outside the building.

Q. When you got the indications on the panel that

high pressure injection had automatically actuated, what if any thoughts did you have about what had caused that automatic initiation of HPI?

A. I saw the ES actuation or I knew that the ES actuation occurred, and I figured it was due to low pressure, the 1600 or 1640 pound low pressure signal on the RCS.

Q. What if any prior experience did you have at the plant or the simulator with initiations of high pressure injection, automatic initiations?

A. Well, I had seen it before and I knew that there had been several ES actuations, so I knew that it could happen. I knew that it was a likelihood.

Q. Did you expect an automatic actuation of high pressure injection on every reactor trip?

A. I wouldn't expect it on after trip because the reaction that the operator takes -- the reactor trip procedure is actually high pressure injection. It is just being done manually. If you do it quick enough and if you do it with enough flow, you will avoid the automatic initiation because you are quick.

Q. Let me ask you, if it is not expected on every reactor trip, what did you think explained the automatic actuation of HPI on this trip?

THE COURT: I thought he told us. He said it

went below 1650, right? That's what you said you believed --

THE WITNESS: That was the actuation signal, yes.

THE COURT: That's what you believed.

Q. What did you think had led the plant on this excursion to drop pressure to the 1640 actuation point?

A. Well, the reason we got it on this trip was because I was somewhat delayed in returning to the makeup system to begin the manual initiation because I was over on panel 6 to begin with, so, a few second delay, I didn't get it in as quickly as I might have if I did it right away.

Q. What if any effect does the level of load at which the plant is operating have on the amount of cooldown?

A. Well, in relation to how it affects the saturation, if you start at a very high power level in a transient like this, you are likely to have a very severe cooldown. If you are at a lower level, the cooldown would be less severe because it is just a smaller transient. The other trips that we had had that initiated ES were all from lower power levels, 30's and -- 20, 30, 40 percent, in that range. This was from nearly a hundred percent, and I expected it to be a bigger transient.

Q. Before March 28 had you been trained to use high pressure injection actuation as a diagnostic tool to figure out what casualty occurred?

A. No. You really can't use it to diagnose what

the problem is. You know why it started, it is the automatic initiation signal, but it doesn't help you diagnose what the initiating problem was or identify the name of the transient that you are going through. Diagnostically it really doesn't help you very much.

Q. Had you had any training or experience before March 28 which informed you how much of a temperature drop would be needed in order to decrease reactor coolant system pressure sufficiently to actuate high pressure injection?

A. I don't think I had a specific range of temperatures in mind. I expected that it could occur on any large transient like this. It just depended on, not how quickly the pressure dropped, but just the fact that it was going to because you had a trip. It is all a matter of quick response in a manual response to the reactor trip.

Q. You said that you observed that pressurizer level had started to recover. What if any thoughts did you have as you watched pressurizer level beginning to recover?

A. Once I had control and was raising pressurizer level, then I knew that the reactor trip transient was just about over, we could start wrapping up the excess makeup that I had applied and that we could return to normal makeup lineup in a few minutes after I got the level a little higher.

Q. Did you have any understanding why pressurizer

level was increasing?

A. Because I was -- this is after the automatic initiation or before?

Q. After.

A. It was a combination of my manual makeup and the automatic initiation dumping in a thousand to 1200 gallons per minute, you are going to get a large increase in the volume in the system. So that's indicated by the pressurizer level going up.

Q. Did there come a time when the shift foreman, Mr. Scheimann, entered the control room?

A. Yes. He had been in the turbine building and he came into the control room.

Q. Do you know whether Fred Scheimann was back at the control room by the time the automatic safety features actuation came in?

A. He was in right around that time. That's when he arrived.

Q. What if anything did you observe Mr. Scheimann doing shortly after he arrived?

A. Initially he was looking through procedures and then he came to the corner between panel 3 and 4 where I was, I was at the makeup station, and he began to observe the primary parameters while I manipulated the equipment on panel 3.

Q. At about the time that the emergency safety features actuated, what was Craig Faust doing?

A. He was still over at the secondary station between panels 4 and 5. He was monitoring the -- establishing steam generator level at the post trip set points.

Q. What is the level at which the steam generator normally maintains water when the plant is generating power?

A. It is in the operating range 80 or 100 percent, something like that. About 250 to 300 inches.

Q. What is the level which you understood it was appropriate to adjust steam generator water level once there has been a trip of the turbine?

A. Thirty inches.

Q. Based on your experience before March 28 how long did you expect it would take for Mr. Faust to bring steam generator water level down from its pretrip level to the 30-inch level?

A. A couple of minutes, two or three minutes.

Q. Did you know from the start of this transient that main feedwater was unavailable?

A. No, I did not.

Q. Based on your prior training and experience, if main feedwater were unavailable, was there a particular level in the steam generators where auxiliary feedwater or

emergency feedwater would be actuated?

A. At the same level. It would try to maintain the same post trip condition, 30 inches.

Q. How many minutes after the start of a transient such as the one you had would emergency feedwater or auxiliary feedwater, as it is alternately called, come on?

MR. FISKE: You mean assuming there was no main feedwater?

MR. SELTZER: Exactly.

A. It would come on the same way the main feedwater would have come on, a couple of minutes into the transient. When the level boiled down to 30 inches, it would start to maintain the 30-inch level, to at or around 30 inches, just before you got there.

Q. You say that would be about 2 minutes into the transient.

A. Yes.

Q. At 2 minutes into the transient on March 28, 1979 had the pressure already risen to the actuation point for the pilot operated relief valve?

A. Yes, the pilot operated relief valve had already cycled within the first few seconds of the transient.

THE COURT: Can I stop you a moment? I have been following with this GPU chronology and I just was curious because there they indicate you get to the

emergency feedwater actuation at 35 seconds. He just said it was 2 minutes. I wonder whether there was some discrepancy there.

THE WITNESS: May I explain?

THE COURT: Sure.

THE WITNESS: The actuation of the emergency feedwater system is the actual turning on of the pumps. Steam driven and motor driven pumps get a signal to start as soon as the main feed pump tripped, which was I guess 35 seconds. When the pumps come on they go into a recirculation mode until the level of the control valve on the discharge of the pumps gets a signal to maintain steam generator level.

So the pumps actually started but were not discharging to the steam generators until the level approached down near 30 inches. That's when the automatic valve would have opened and began to maintain the level in the steam generator.

THE COURT: That's what I read here happened at 35 seconds. "Steam generator B level reached the integrated control system set point of 30 inches at which the emergency feedwater valve opens. Feedwater was not admitted into the steam generator B because emergency feedwater block valve was shut. EF-V 128 is normally open."

THE WITNESS: That should be 12-B.

THE COURT: 12-B, excuse me, you are right.

THE WITNESS: The boildown of the steam generators was extremely fast in this condition. That's not what I expect. He is asking me --

THE COURT: You said it was 2 minutes and I read here 35 seconds. Are you just a little bit off? Is it 35 seconds or is it 2 minutes?

THE WITNESS: No. What we are seeing here is because it was a hundred percent trip, it happened much faster than I thought.

THE COURT: So it is 35 seconds?

THE WITNESS: It must be. They probably got that off --

THE COURT: Off the computer?

THE WITNESS: Off the B & W reactimeter downstairs.

THE COURT: Go ahead, Mr. Seltzer.

BY MR. SELTZER:

Q. Based on your understanding of how systems were actuated, did the point at which auxiliary feedwater pumps were actuated have any effect or could it have had any effect on whether the pressure rose to the PORV set point?

A. That pressure excursion was independent of the feedwater transient. It was due to the turbine trip. All these things going on at the auxiliary feedwater happened

after the fact that the PORV cycled. It opened and shut because the turbine stopped demanding steam from the system and rejected all that energy into the RCS, reactor coolant system. At that point the PORV cycled, the reactor tripped, and then these feedwater things were happening later.

Q. Let me put this question, because I think it ties directly into something that came up yesterday.

If the 12 valves which we will come to in a minute had not been shut, if they had been open so that the auxiliary feedwater could come on at the earliest time that it was called upon to come in and inject water into the steam generators, what if any effect would that have had on the primary system, the PORV actuation and reactor trip?

A. It wouldn't have had any effect because all those things had already occurred. As a result of the turbine trip, you get the pressure excursion in the reactor coolant system which actuates the PORV and causes the reactor trip, and the establishing of steam generator level through main or auxiliary feed is a subsequent action, it happens later on.

Q. So would the PORV have opened or not if the 12 valves had not been shut?

A. Yes, it would have. They would have opened and shut.

Q. Would there have been a reactor trip if the 12

valves had been open instead of shut?

A. Yes, the reactor trip was a direct result of the turbine trip and not affected by the status of the feedwater systems.

(Continued on next page.)

MR. SELTZER: Your Honor, you'll note in the GPU chronology it indicates that at 15 seconds the electromagnetic relief valve should have shut at this time.

THE COURT: I saw that. It was open for 11 seconds and it should have shut at 15 seconds.

MR. SELTZER: That precedes by a discreet amount as to when the emergency feedwater should have come on.

THE COURT: Given what we are now focusing on I wonder how much of this testimony is necessary?

MR. SELTZER: What I was bringing it out for, your Honor, was to clarify something that came up in colloquy.

THE COURT: What I am getting at is your asking this gentleman, who is there in an emergency situation, to give us times about things and sequences about things from his recollection now three years old at a time when there was obviously a certain amount of emergency in the air and he's not a clock and we, in fact, have the clock.

I just wonder how much we need to do this with this witness in terms of establishing times because he's obviously not the best source of that definitive information.

MR. SELTZER: No question about it. In fact, Mr. Frederick has testified to the compression of time, the expansion of time, the difficulty of keeping track of time.

THE COURT: I understand. I observe that to you in terms of --

MR. SELTZER: The only point of the last few questions was to establish sequence and the fact that the PORV opens and shuts before auxiliary feedwater would have even been called upon.

THE COURT: I have gone through this chronology and observed that prior to your asking the question. Because, as I remember, in the Davis-Besse incident we had the PORV open for, what, a matter of perhaps 10 seconds on the flutter -- there was a flutter on the chart and then it came straight down.

MR. SELTZER: The pressure came down.

THE COURT: But the flutter was the PORV opened and then apparently it stuck, but it was only open because of the pressure for, what, 8 or 10 or 12 seconds at Davis-Besse.

MR. SELTZER: I think it would have stayed open for about 10 seconds.

THE COURT: Here was 11.

MR. KLINGSBERG: We wanted to clarify, your Honor, because yesterday at 3265 your Honor seemed to be under the impression that the reason why the PORV opened was because the emergency feedwater valves were closed and it happened in a different time sequence.

THE COURT: I see what you are saying. I understand. The PORV opened because the water stopped going through the secondary side for whatever reason, mainly because the condensate polisher valve stuck, right?

Q. Mr. Frederick, why don't you state -- was the reactor tripping and the PORV opening related to the feedwater interruption?

A. No.

Q. What is your understanding as the operator at the panel what event caused the PORV opening and closing in the reactor trip?

A. The event that caused the eventual opening of the PORV was independent of the feedwater, loss of feedwater, condensate polisher isolation. All that happened was that the turbine steam valves closed, stopped demanding steam from the steam generator. The reactor is still producing 100 percent power, so many BTUs of energy per second and there is no place for it to go. And this is an instantaneous reaction.

THE COURT: Could I hear the question back?

THE WITNESS: I am trying to say it is completely independent of the feedwater condensate isolation.

THE COURT: It was the closing of the condensate polisher valves that turned off the circulation on the

secondary side, right?

It stopped the circulation on the secondary side?

THE WITNESS: Yes, sir.

THE COURT: Now, that termination on the secondary side meant that there was no water on the secondary side to take the heat out of the water on the primary side?

THE WITNESS: But there was. There was nearly 300 inches of water in the steam generator, which still could remove heat from the primary side.

THE COURT: But not enough?

THE WITNESS: It could remove it for the next minute or two.

THE COURT: Well, then, I don't follow you. I really don't follow you.

MR. SELTZER: Maybe, your Honor, if I could help.

THE COURT: No. Let the witness tell me, please. All right.

What are you saying caused this reactor trip?

THE WITNESS: The reactor tripped following the turbine trip.

THE COURT: Forget the turbine trip. What caused the reactor trip?

THE WITNESS: High pressure in the reactor coolant system.

THE COURT: Why was their pressure in the reactor coolant system?

THE WITNESS: Because of the sudden energy storage in the reactor coolant system.

THE COURT: And what caused that?

THE WITNESS: Steam valves on the secondary side closing.

THE COURT: Aren't we back to where we were before? The secondary side wasn't taking the heat out of the primary side?

THE WITNESS: Only for the time it takes for the steam pressure to rise to where the steam safety valves open. All this happened in like three seconds.

THE COURT: That's what I understand.

THE WITNESS: But it is not because we lost feedwater. There is no water going into the steam generators because there is no steam leaving.

THE COURT: But the system is no longer circulating, that's what the problem is, right?

THE WITNESS: Yes.

We could easily have caused the same transient just by pushing the turbine trip button and let the feedwater keep running, the same transient would have occurred. Even if you still had feed pumps and loss of condensate and dumping lots of water in the steam generator,

the same transient would have occurred.

THE COURT: Because you are not taking the heat out of the secondary side?

THE WITNESS: Right. You don't take heat out by putting water in as much as you do by taking the steam out.

THE COURT: Since you are not drawing it out, what you and I are talking about, Mr. Frederick, as I understand it, as the secondary side water is going up through here, the primary side water is going down through there?

THE WITNESS: Yes.

THE COURT: You are saying to me that the secondary side water going up through here and turning to steam is not happening at that point because it has no where to go?

THE WITNESS: That's right.

What you are doing is accumulating a lot of steam in here.

THE COURT: And it has no where to go and nothing new coming in to continue to take out heat and, therefore, this comes in with the expectation of getting rid of its heat and it doesn't do it.

THE WITNESS: It doesn't do it.

THE COURT: We're on the same wavelength. It is just a question of how you describe it.

THE WITNESS: All right.

THE COURT: You say that can happen in a matter of just several seconds?

THE WITNESS: Yes.

Q. If you had a full load turbine trip without a feedwater trip, what was your understanding what that would do to the primary side?

A. The same transient would occur. Reactor trip due to high pressure.

Q. Did Mr. Faust who was over monitoring the secondary side inform you what the status was of the secondary side indications?

A. Yes, he did. He said the steam generator ovens were decreasing and he was unsure that feedwater was replacing -- was now going to start controlling the level. He couldn't tell from the instrumentation whether water was actually being admitted to the steam generators.

Q. Did Mr. Faust tell you what, if anything, he was doing to try to control the secondary side?

A. He had taken manual control of the ICS stations for emergency feedwater and was increasing the manual signal to try to see a response in the steam generator level to either hold it up or make it increase slightly so he could be sure he was inserting water. He was having some difficulty with that.

He was beginning to realize that the indication he was looking for wasn't showing up and he couldn't verify that he had flow and so he began to investigate what could cause the loss of flow through the emergency feedwater system. And a few seconds later he discovered that the block valves for the emergency feed system was shut.

Q. Prior to his -- withdrawn.

Was there some way that you knew when he had discovered that the block valves for the emergency feedwater system were shut?

A. Is there some way?

Q. How were you informed, if you were?

A. He shouted that he had found them shut.

Q. Before he announced that, what was happening to the pressurizer level which was on the panel in front of you?

A. As I said before, pressurizer level was coming quickly because of the high pressure injection, so I cut it back.

We were at about -- we were up in the 300 range, 300 inches or more, and I still had a steady increase in pressurizer level so I decided to make a drastic cut in the HPI flow. I cut it back, I think, to about half and initiated some letdown and I saw -- then I gained control of the pressurizer as it dipped over. As the increase

stopped, I started to see the decrease.

Q. You say that you cut back the HPI flow into the reactor coolant system by about half.

What was the level in the pressurizer at about the time when you did that?

A. It was 360, 380, in that range.

Q. Were you cutting back the HPI flow pursuant to any specific procedures or guidelines that you had been trained on?

A. Yes.

I was trying to avoid the high level limit in the pressurizer of 385 to ultimately the 400 in limit which says you can't exceed 400 inches at any time. I didn't want to go solid.

Q. 400-inch limit is what we reviewed yesterday?

A. Yes.

Q. When you were at the simulator for training in Lynchburg, were you working from your plant procedures and tech specs which had limitations on going solid?

A. Yes. We had all those limits imposed in both places.

MR. FISKE: I think he said it was during the one week in 1977.

THE WITNESS: That's incorrect.

MR. FISKE: In 1976 he said he was using the B &

W simulator procedures.

THE WITNESS: We were using the TMI-2 tech specs.

Q. So you are saying that during both the eight-week training course at the simulator and during the one-week follow-up course you were using the TMI-2 tech specs?

A. Yes.

The standard technical specifications was what we were learning in our code license training program. They were our TMI-2 technical specifications. We were using the B & W procedures because the TMI technical specifications had not been revised.

Q. The only point I was trying to clarify to Mr. Fiske's inquiry was were you using your own plants' technical specifications at all times you were trained at the simulator?

A. Yes.

Q. Did any B & W instructor tell you there might be a time when the provisions in the technical specifications relating to maximum level in the pressurizer would not be applicable?

A. They are always applicable. Maximum level in the pressurizer cannot be exceeded under any circumstances.

MR. FISKE: I will object to that answer.

THE COURT: It is not responsive.

MR. FISKE: It is either yes or no.

MR. SELTZER: Can I ask the reporter to read the question back?

THE COURT: Put it again.

Did any B & W instructor ever tell you there would come a time when the pressurizer level was not applicable? Just yes or no.

THE WITNESS: No.

Q. What was your understanding about whether there was any indication on which it would be appropriate to exceed the tech spec limit on pressurizer level?

A. Once the pressurizer level is normal or slightly above, you have got plenty of water, there is no reason to go above any more water, no reason to exceed that limit.

Q. At the point in time where we are now that the pressurizer level is up above 300 inches, you are cutting back on high pressure injection, did you have any belief that the plant was experiencing loss of coolant accident?

A. No.

Q. Did the pressurizer level respond to your cutting back on high pressure injection?

A. Yes, it did.

The graph turned over and began to go down.

Q. What did you understand as to why pressurizer level was decreasing when you cut back on HPI flow?

A. I had decreased the amount of water going in and I had begun to letdown on drain water through the letdown system, so I was beginning to have the control of the pressurizer level and was going to be able to bring it back down to normal.

Q. After you saw pressurizer level begin to dip down, what happened next?

A. I guess a minute or so later it started to go back up again. It turned and began to increase again.

Q. What did you do when you saw pressurizer level begin to go up again?

A. I think I throttled back more on high pressure injection but I began to wonder what caused this second level experience, since I had corrected the first one, what was causing the second one.

Q. What was your thinking about why pressurizer level was now resuming its upward rise?

A. For the first few seconds I was thinking about it and I was wondering what could have caused it and then Mr. Faust shouted that he had found emergency feed isolated. So I thought that -- if there was no feedwater at all we had experienced a swell when the steam generators boiled dry. That is, the reactor coolant system expanded and caused that push up in the pressurizer.

THE COURT: What's the chronology, as you recall

it, between your throttling back on HPI? I gather you manually instituted it, right, sort of at half speed?

THE WITNESS: Yes, sir.

THE COURT: You throttled back on it, right?

THE WITNESS: Yes.

THE COURT: There comes a time where you say Faust says to you he's discovered the emergency feedwater block valve is closed, "the 12's", I think he yelled out as I have heard the testimony, the 12's are closed, right?

THE WITNESS: Yes.

THE COURT: What's the relationship of that in terms of time, how much later?

THE WITNESS: Very short time, few seconds.

But what had happened then, the increase and then the dip and then the increase in level and not very much later he announced it.

I don't really have the times.

THE COURT: Now, there was an automatic actuation of high pressure injection prior to Faust discovering this, wasn't there?

THE WITNESS: That was prior to my manual control of the high pressure injection.

When I throttled back, what I was throttling was the automatic initiation. It happened while the pressurizer level was still increased the first time.

THE COURT: Okay, go ahead.

Q. You said that when pressurizer level resumed rising, that was the point where Mr. Faust called out that the 12's were shut.

For how long a time did you attribute the rise in pressurizer level to the loss of emergency feedwater that Faust had just announced?

A. While he was trying to gain manual control over the feedwater system, I was waiting for him to stabilize his emergency feedwater flow rate, then I could -- erasing that variable, I would be able to determine what the steady stay condition of the reactor coolant system was.

It was several minutes until -- he was having trouble with the manual controls. So all during that time and then for a few minutes later, I attributed it to the emergency feedwater loss which was the cause of the swell.

Q. There came a point in time when emergency feedwater was put into the steam generators; is that right?

A. Yes.

Q. After you learned that there was emergency feedwater going into the steam generators, what was happening to pressurizer level?

A. Initially when he opened the 12's with the emergency feedwater control valves full open, there was a large in-rush of water to the steam generators and we heard

it on the noise monitor from the control building area and I saw a dip in pressurizer level. It showed me that we were shrinking some of the water in the RCS.

So until he could stabilize that in-rush of water, I wouldn't be able to get much sense out of the pressurizer level until he stabilized his flow rate.

Q. Did there come a time when he did stabilize the flow rate into the steam generators?

A. Like I said, it was several minutes. It took him awhile to do that.

Q. After he had done that, was pressurizer level still high?

A. Yes.

Q. What did you attribute the high pressurizer level to after you had learned that the feedwater into the steam generators had been stabilized?

What were your thoughts about the high pressurizer level then?

A. Well, then having stopped the variable of increasing and decreasing of emergency feedwater flow, the next thing to do was to drain out water from the reactor coolant system to get the amount of water, then putting in, to less than what I am taking out. I'm sorry, the other way. Taking more out than I am putting in so the level would go down.

I began to take the make-up flow rate down to a minute and get the maximum letdown.

Q. What significance, if any, did you attach to the fact that you had a rapidly rising pressurizer level above 300 inches?

A. It was very significant.

If I couldn't get control of it we would go solid in the pressurizer and that probably would cause damage to the plant.

Q. Do you know what level pressurizer water level had descended to before it started to turn around?

What was the lowest point that you were aware that pressurizer level went to?

A. I don't remember being aware of the numerical value of the level. I was just watching the direction of the slope on the graph.

Q. Were you aware that it went below -- withdrawn.

Before the transient started, did you have normal level in the pressurizer?

A. Yes.

Q. When the transient started and you got back to the panel that indicates pressurizer level, where was pressurizer level relative to the normal level at which you had started the event?

A. I'm sorry. When was this?

Q. The turbine trip has been announced, you walked over to see it on panel 17. Then you got back to the panel 4 station where the pressurizer level gauges are.

Was pressurizer level above normal, below normal? You said you started at normal before the transient?

A. Yes. It was below normal.

Q. What was your understanding about what was between the below normal water level and the top of the pressurizer?

A. About 300 inches or so.

Q. And what was filling that space?

A. Well, as the pressurizer level came down, that was filled with steam. As that, as I started to refill it with my manual make-up and with my subsequent automatic HPI, we refilled that whole region with cold water.

Q. What, if anything, do you think happened to most of the steam that had been in the several hundred inches of space as you were filling the space up with water?

A. It was condensing.

Q. Could you explain what process you understood condensed the steam?

A. As you push water into the pressurizer, the steam space is going to be reduced and the reduction of that space is going to cause the steam to transfer from the vapor state to the liquid state and just in order to

maintain the saturation state. It just occurs as a natural phenomenon.

Q. What, if any, training or experience had you had before the accident as to how quickly steam could be condensed in the steam space at the top of the pressurizer?

A. It could happen very quickly. In the transients that I have seen, it was a very quick response to the pressurizer.

Q. When you got back to the panel 4 station, were there gauges in front of you that recorded and reflected reactor coolant system pressure?

A. Yes.

Q. Is there also a gauge that recorded pressure in the pressurizer?

A. No. The gauge only shows reactor coolant system total pressure.

Q. Is the pressure that is maintained in the reactor coolant system -- withdrawn.

Is the pressure that exists within the reactor coolant system the same throughout the entire reactor coolant system?

A. No.

Q. Why is that? Why isn't it the same?

A. It is not the same because there is a flow in the system and because we have pumps operating to move the

water. The pressure at the discharge of the pump is high as it pushes the water into the reactor vessels.

Q. What pump?

A. The reactor coolant pump.

As you push water into the reactor vessel itself you lose about 35 pounds of pressure as it moves through the fuel assemblage.

So the pressure at the outlet of the vessel is lower than at the inlet and, as you move further on the loop, the pressure continues to drop until you come back to the lowest point which is the suction of the pump. In other words, there is a continuous decrease of pressure as you go around the loop.

Q. You said that when you got back to panel 4 the indicator light for the pilot-operated relief valve was off.

Did you take any steps at that point in the transient to verify that the pilot-operated relief valve had closed?

A. No.

The indication that it was off and the response of the instruments was enough to show that there was nothing abnormal going on in that respect.

Q. Response of what instruments?

A. I didn't see any indications that would say that the PORV was open.

Q. Did you have any reason to suspect that the light indicating pilot-operated relief valve position was giving you a wrong signal?

A. No.

I would be no more suspicious of that light than any other 50 or 100 lights that I told you about yesterday when what I was examining them during the beginning of the sequence. They are all the same type of lights and giving me the same status type information. It is not a particularly suspicious light.

MR. SELTZER: Your Honor, I'm about to switch to something else.

THE COURT: All right, we'll take our recess.

(Recess)

(Open court)

DIRECT EXAMINATION (Cont'd)

BY MR. SELTZER:

Q. Mr. Frederick, with the pressurizer filled up to a point where you were concerned about going solid, did there come a time when you thought that there might be a pressure spike in the reactor coolant system?

A. Yes.

I thought that if it was that solid we would see a pressure spike.

Q. Did you ever see a pressure spike in the first

couple of hours of the transient?

A. No.

Q. When you failed to see a pressure spike, what, if anything, did that indicate to you?

A. It indicated to me that the pressurizer -- it indicated 400 inches, but there was still some space in the pressurizer at the dome of the tank.

THE COURT: When you say a pressurizer spike, what are you talking about?

THE WITNESS: Pressure spike?

THE COURT: Yes. What are you talking about?

THE WITNESS: Sudden increase of pressure. It looks like -- if you are looking at a pressure gauge, you see a little pointed increase in pressure.

THE COURT: Because you see that the pressurizer level, as I understand it, in five minutes or less went from about 160 something to off the map, right?

THE WITNESS: Yes.

THE COURT: What do you call that?

THE WITNESS: That's not --

THE COURT: That's not a spike?

THE WITNESS: That's pressurizer level.

I was talking about reactor coolant system pressure. The other graph is indicating pressure.

THE COURT: I see. Okay.

Q. Just to recap.

THE COURT: Let me hear this.

Q. When the pressurizer water level was at solid, did there come a time -- with the pressurizer water level solid, you would expect that the pressurizer water system would spike up?

A. Yes.

Q. And you never saw that?

A. That's right.

Q. And could you just briefly recap it?

What ran through your mind as to why the system was not seeing the pressure spike that you thought might occur?

A. Because, as the level indicator was showing me, the pressurizer level was at or around 400 inches but there is more space above the indicated range, the straight portion of the tank. There is a dome on top of the tank that isn't indicated and I figured that there was still space up there that I couldn't see on the indicator.

Q. What would be the effect, as you understood it, of having that space above the water level in the pressurizer?

A. It would indicate that we didn't have the pressurizer just absolutely full of water. It would still act as a cushion for pressure transients.

Q. Had you had any training before the accident on solid conditions in the reactor coolant system? The whole reactor coolant system including the pressurizer?

A. There is no training on how to operate in any kind of solid conditions, no.

Q. Had you had any training on how long it would take for the -- withdrawn.

THE COURT: As I understand it, you testified that your training consisted of "don't let the pressurizer go solid except for hydrostatic test", right?

THE WITNESS: Yes.

THE COURT: That's essentially it.

We don't really need to go around that subject a third or fourth time. All right.

Q. When the pressurizer went to the top of its readable scale, where was reactor coolant system pressure?

A. The pressure was at about 1300 pounds or so.

Q. Did you have any understanding why the reactor coolant system pressure was at that level?

A. Well, the pressurizer normally maintains reactor coolant system pressure. What I had done was just flood in 300 inches of cool water. It would take sometime for the heaters to regain ability to maintain reactor coolant system pressure.

So, while the large amount of cold water was

injected, we would have the suppression of pressure.

Q. Had you had any experience before the accident with a slow recovery of pressure or pressure suppression as you called it?

A. Yes.

We had other transients where the pressurizer heaters just didn't seem to have the capacity necessary for a quick return of the reactor coolant system pressure and we had had some heater controller failures also.

Q. Now, after you had injected about, as you said, 300 inches of cold water into the pressurizer, did you eventually see the pressure start to come up?

MR. FISKE: Your Honor, I think there is a misstatement here that no cold water is injected into the pressurizer.

The testimony has been that what happens is --

MR. SELTZER: I will rephrase it.

MR. FISKE: Hot water at about 580 degrees is going into the pressurizer.

(Continued on next page)

Q. Mr. Frederick, what did you mean in a prior answer when you referred to cold water going into the pressurizer?

A. Just using in a relative sense cold as compared to 647. 550 to 560 degree water, 570 degree water, is colder than 647 degree water. It is cold water. It may not be what you are accustomed to as tap water, or anything, but compared to the 647, we are about a hundred degrees colder.

Q. Where does the number 647 come from? Where is there a temperature of 647 degrees?

A. Normal temperature in the pressurizer is 647 degrees fahrenheit. That's the temperature that is maintained under the steady state condition that we had just before this transient began.

Q. And the colder water that was coming into the pressurizer was at what temperature?

A. Whatever the TH was. Say 550 to 580 degrees.

Q. After the initial filling of the pressurizer with the colder water that was coming in, did you eventually see reactor coolant system pressure recover?

A. No.

Q. You said that initially you thought that it was taking awhile for the heaters to heat up the colder water that you had just injected into the pressurizer. Later on

as pressure continued to stay low, what if any thoughts did you have as to why pressure was staying down?

A. I began to think that the capacity of the heaters was just insufficient to raise that much -- to get the temperature of the water up or that I think even later on we checked for heater failures, heaters that were not operating for some reason. That we would check out in the turbine building. You would have to go out and look at the breakers for the heaters.

Q. While pressure was staying down low, where was pressurizer level?

A. It was high. It was in the approximately 400-inch range.

Q. What did you think was causing the pressurizer level to remain up very high?

A. For a long time, I already explained, I thought it was due to the emergency feedwater instability. As time went by, I began to suspect that -- we went through several analyses trying to figure out why the pressurizer level was high. We thought that the instrument had failed or for some reason was reading high and another time, whether it was before that or not I don't know, we suspected that our letdown or our drain line that I had opened up was not -- was blocked for some reason, that the water was not flowing from the reactor coolant system to the letdown system. So

we tried to verify our valve lineup both locally and here on the control panel, sending an auxiliary operator. We wanted to have the drain from the system and we weren't sure that we had it.

THE COURT: Let me hear that answer.

(Record read.)

Q. You referred to sending an auxiliary operator. Why was an auxiliary operator sent?

A. I believe we sent one of the operators to check the local indications on some of the valves in the letdown line to see if it was open.

Q. Did the high pressurizer level ever lead you to suspect that saturation had occurred in the reactor coolant system outside the pressurizer?

A. No.

Q. Had you had any training on the effects of saturation in the reactor coolant system on pressurizer level?

A. No, there was never any training that showed how a saturation condition in the system would affect the instruments on the panel.

Q. Had you ever seen saturation in the reactor coolant system modeled at the B & W simulator?

A. No.

Q. You have already testified to the fact that

Craig Faust called out in the control room that the 12 valves were shut. What if any effect did the problems with emergency feedwater have on your ability to control the primary side?

A. I would listen if Mr. Faust had something to say about what he was doing. It was our practice to keep each other informed about what we were doing. I wasn't involved in his analysis or his problem, other than that he was keeping me posted with what he was doing.

Q. Did it interfere with what you were doing in any way?

A. No.

Q. After the emergency feedwater flow was restored, and you described that Faust stabilized flow into the steam generators, what did you do next?

A. I already said that the feedwater stabilized, pressurizer level was still high. We went through those analyses trying to figure out what was happening with the pressurizer level, why was it so high, did we have letdown, is there something wrong with the instrument. I don't recall a specific incident that occurred next.

Q. Did you have an alarm printer attached to the computer in the control room?

A. Yes.

Q. What if any function did you understand that

computer alarm printer had during a plant transient?

A. It was our practice not to use the alarm printer during any kind of a transient because it had a rather slow typewriter on it. You couldn't get information out of it as quickly as it was occurring in the plant.

Q. When you attended simulator training at B & W did they have a control room computer in the simulator room?

A. Yes.

Q. During the transients that were simulated at B & W was the computer printer used?

A. No.

Q. Did there come a time when you checked the pressurizer level instrumentation to see if it was giving you accurate readings?

A. Yes. We asked an instrumentation technician to examine the instrument and determine if the reading we were getting was valid.

Q. What was the result of his investigation?

A. He was sure that the instrument was giving valid information, that the pressurizer level was high.

Q. Did you do anything at the panel to attempt to determine whether you were getting accurate pressurizer level indication?

A. Yes. All I could do was -- there is a switch and two meters that show pressurizer level. This switch

here selects one of the three pressurizer level instruments that you can read on this graph, and there are two pressurizer level gauges here that indicate an alternate signal for pressurizer levels not compensated for by temperature, and there are -- you compare them to see if they are reading the same and they tell you that it is the same thing, that it is a good instrumentation.

Q. Did you compare the various readings of pressurizer level that you could obtain in the control room?

A. Yes. That's what I did. You just have to look at the gauges on the panel.

Q. I am just asking, did you do that on the morning of the accident?

A. Yes, yes.

Q. Did there come a time after 4 a.m. when you received information about the operation of the reactor building sump pumps?

A. Yes.

Q. How did you get information about the sump pumps?

A. One of the phone calls I received was from an auxiliary operator in the auxiliary building, and he told me that --

Q. Could you fix a point in time, as best you can?

A. Around a half an hour, or so, after the beginning of the transient.

Q. What did the auxiliary operator calling from the auxiliary building tell you?

A. He told me that the reactor building sump pumps were running and the sump level was high.

Q. Did he tell you how much water had been pumped out of the sump?

A. No.

Q. Did you know how much water had been pumped out of the sump?

A. No.

Q. How many pumps are there that withdraw water from the sump?

A. Two.

Q. Did the auxiliary operator indicate whether one or both pumps were on?

A. I believe he said both were running.

Q. Did the auxiliary operator indicate anything about what the water level was in the sumps?

A. He said it was high.

Q. Did you do anything to check whether what he was telling you about the condition of the sump was accurate?

A. Yes. I used the digital computer display to find out what the level was in the sump on the instrumentation that I had.

Q. What did your check reveal as compared to what

the auxiliary operator told you?

A. Mine showed that the sump was full also.

Q. You said that the auxiliary operator didn't tell you how much water had been pumped out. Did the auxiliary operator tell you how long the sump pumps had been on?

A. No, he didn't.

Q. At the panel that is in the auxiliary building, was there anything from which the auxiliary operator would have been able to read how long the pumps had been on?

A. No. All he has down there are the sump level gauge similar to the ones that you see here on the control panel and a red and green status light for the pumps.

Q. Is there a normal water level that is maintained in the sump?

A. There is usually a couple of feet in there.

Q. Is there a point at which the sump pump automatically turns itself on?

A. Yes. I really don't know what that is, but it is a little above that normal level.

Q. Something above the two-foot level?

A. Yes.

Q. When you were told that the sump level was high and you confirmed it in the control room, what was your understanding as to how big the reactor building sump was? How large a holding space are we talking about?

A. It is a box about the size of the Judge's desk here, this indent where he is sitting. About 6 by 4 or 5, and then it is about 6 feet deep. There is some piping and things in the sump and the pumps themselves.

Q. What was your understanding when you got the report that the sumps were full as to how much extra water had flowed into the sumps above the level that otherwise would have been in the sump?

A. We had gained -- in terms of gallons, I didn't figure that out, but it was a few tubsful of water that raised the level from what was normally in there to above the actuation set point for the pumps.

MR. FISKE: Excuse me, your Honor, I didn't hear the answer.

THE COURT: You may have it read back.

(Record read.)

Q. When you heard that the sump level was high and the pumps were on, did that tell you that something was very wrong?

A. It showed that we had a problem, that something was wrong with the pumps, that either they weren't running or they weren't pumping enough water to keep the sump level down.

Q. Was having all that water in the sump a big concern to you?

A. No, it is not `0 that much water. It is just an area about this large that's the basement of a very large building. You are going to get a lot of water in a little sump like that.

THE COURT: Did you know at this time that the drain tank rupture disc had blown?

THE WITNESS: No.

THE COURT: I think you placed this information about the sump as being a phone call from the auxiliary operator about a half an hour into the transient, right?

THE WITNESS: Yes.

THE COURT: The chronology places the drain tank rupture disc as blowing at 14 minutes 51 seconds.

THE WITNESS: There are no indications of the disc status. There are no control room indicators or other indicators that tell you what the status of the disc is, whether it is blown or not blown.

THE COURT: Are there indicators that tell you that the pressure in the drain tank has gone I gather to zero, which is what happens when the disc blows?

THE WITNESS: We have a pressure gauge in the tank that would indicate whatever pressure is present, yes.

THE COURT: If the disc blows, it blows because the pressure is too great for the tank and on blowing, the pressure goes approximately to zero, correct?

THE WITNESS: Yes, but the normal pressure in the tank is zero, so it wouldn't really tell you if it were zero that the disc is blown.

THE COURT: Did you have any awareness that the tank had had a higher pressure prior to it going to zero?

THE WITNESS: Mr. Seltzer asked me if I remembered that sort of thing. I don't actually remember the trip back to look at the gauges, but I testified that I did go back and saw the pressure was up and the temperature was up. That was within, according to the testimony, a few minutes after the transient began.

THE COURT: Did you at the time that the auxiliary operator told you about the sumps, which is, you say, a half hour deep, did you have an awareness at that point that the pressure in the drain tank was now zero?

THE WITNESS: Again, not having a specific recollection of it, there is testimony that says that we are aware that the pressure was now zero.

THE COURT: No. As you sit here today, do you have any recollection of at that time having in your mind that the pressure in the drain tank was zero?

THE WITNESS: No, I don't remember it at all.

THE COURT: Where did you think the water came from in the sump?

THE WITNESS: At the time I knew that we had

been continuously been putting water in the sump during the shift. It pumps out a couple of times a shift anyway. We had water in there for -- normally there was water dumping in there, so there wasn't any abnormality. It just showed that the source of water either was putting water in faster than the pumps could pump it out now or that the pumps weren't actually even pumping. I didn't know what the source of the water was.

THE COURT: I see. Okay. Go ahead, Mr. Seltzer.

BY MR. SELTZER:

Q. Mr. Frederick, do you recall testifying before the House Committee, Congressman Udall's committee, in May 1979?

A. Yes.

MR. FISKE: Your Honor, I certainly have no objection at some point to Mr. Frederick being questioned on this testimony because I certainly intend to ask him a lot of questions about what he said on this occasion, but I would just like to inquire what Mr. Seltzer's purpose is for doing this now. Is he trying to impeach Mr. Frederick?

MR. SELTZER: No. This is, again, recorded recollection.

THE COURT: I don't know that he said he has a failure of recollection. What's the area in which he doesn't recall something?

MR. SELTZER: He was asked "where did you think this water was coming from," and he said "the drain tank, the reactor coolant draining tank" --

THE COURT: I know, but when I asked him now I think he said he didn't know.

MR. SELTZER: If he doesn't recall now, then this is recorded recollection --

THE COURT: His answer was "I don't know." It wasn't "I don't recall." His answer was "I don't know."

THE WITNESS: I thought I said "I didn't recall going back there."

THE COURT: Let's see what the answer is.

(Record read.)

THE COURT: I will sustain the objection.

MR. SELTZER: Your Honor, may I read this for the purpose of refreshing --

THE COURT: No. He doesn't indicate he has any memory to be refreshed. He hasn't indicated he doesn't recall or he needs his memory refreshed.

BY MR. SELTZER:

Q. Mr. Frederick, you testified many times about the Three Mile Island accident. Was --

THE COURT: Would you please go through that door?

(The witness left the courtroom.)

THE COURT: It is one thing to sort of try to massage an answer into the witness' consciousness, but he has given me an answer and what has happened is you want the answer to be something other than what was said to me.

MR. SELTZER: Not at all.

THE COURT: Yes, at all. It is at all. He has given me an answer and you believe the answer should be something else. That's your sincere belief. You think the answer should be something else.

MR. SELTZER: Your Honor, I don't really think the answer should be anything. The answer is whatever this man has previously said, it is what he says today --

THE COURT: That's what he tells me here now is his recollection.

MR. SELTZER: That's his recollection today.

THE COURT: So we will live with his recollection today.

MR. SELTZER: I think it is just going to be a pointless exercise to delay for a day getting him to discuss the fact that one month after the accident --

THE COURT: One of the issues that the Court has to deal with with all of these witnesses who frankly are giving me rather detailed evidence about things that were happening at breakneck pace under very pressing circumstances -- one of the things I am going to have to do

is to determine how I assess this testimony, so it is not a pointless exercise. It goes to how you assess the weight to be given what a witness says about a particular subject.

You had him here a minute or two ago saying he remembers something as happening in two minutes and in fact it happened in 35 seconds.

MR. KLINGSBERG: Your Honor, could I just jump in a second?

THE COURT: I'd rather you didn't. I'd rather deal with one lawyer on one side at a time, if you don't mind. Yes, Mr. Fiske?

MR. FISKE: Maybe I don't have to say anything if you sustain the objection, but this witness testified at his deposition twice. I asked him the question "did you think the water was coming into the sump from the drain tank," and he said "no, I didn't learn that until three days after the accident."

I said "I tell you what, I will give you another chance to answer that question and I will remind you you are under oath."

Mr. Seltzer objected to that, but the witness said "my answer is the same. Clearly I didn't know that the water in the sump was coming from the drain tank until three days after the accident."

Then I read him three different answers he gave

to that congressional committee where he said the water is coming from the drain tank and every time I read him the question he said, "Well, I was just telling them something I learned after the accident."

His position right through the deposition was that during the accident he didn't know the water was coming from the drain tank, and that's the answer he just gave to your Honor.

I don't think Mr. Seltzer can now try to sort of anticipate the cross examination by reading him this and saying "what did you mean then," and so forth. He has taken his position. He said the same thing under oath here that he said in the deposition, that he didn't think the water was coming from the drain tank.

I think he has to live with that answer in the face of what he said to the congressional committee and in the face of the fact that Mr. Zewe testified himself that he told Mr. Frederick while they were standing at the panel that the water was coming from the drain tank. Mr. Frederick has taken his position here the same way he did in the deposition. I think he has made his choice, and let's just get on with this in the way --

THE COURT: I think as a matter of trial procedure, I am going to sustain the objection for the reasons I stated before Mr. Fiske made his observations to

me. But what he does say to me as a matter of the procedural history of arriving at this point frankly confirms the view that I have.

MR. SELTZER: Your Honor, I'd only like to say that this is one event out of hundreds of events that transpired during that day, and I think he has given testimony previously that was shortly after the accident when his recollection was probably fresher. All that I was seeking to do was show him this and see if it refreshed his recollection. I am as aware as Mr. Fiske that he what he told your Honor --

THE COURT: He doesn't need to have his recollection refreshed. That's the problem. We are dealing with the timing of things and admissibility. He is dealing with an answer that doesn't need recollection refreshed. He is saying he doesn't know where it was coming from. That's his short answer at the very end. I will sustain the objection.

(The witness entered the courtroom.)

BY MR. SELTZER:

Q. Mr. Frederick, was it unusual for the sump pump to be on?

A. No.

Q. Before the accident started what had caused the sump pump to run when it did run?

A. It ran a couple of times a shift due to water accumulation in the sump just due to normal operation. We had -- everything in the whole reactor building that has a leakoff or a drain of some sort goes to the sump or --

THE COURT: This is identified leakage we were talking about, right?

THE WITNESS: No, no, this is mostly condensation because the building is so hot and full of humidity.

Q. Could you just explain in a sentence or two what the source of -- how that water gets into the sump?

THE COURT: I think I understand that.

Q. In addition to the condensation of humidity, were there any other sources that contributed water to the sump that had to be pumped out?

A. There were some valve leakoffs and pump seal leakoffs. Water that runs out of the pumps normally is collected in that sump and stored and then sent over to the auxiliary building for radioactive waste processing.

Q. What if anything did you do after you got the report that the sump was full and the pumps were running?

A. I checked the level on the computer digital readout and then --

Q. Did you take any action?

A. I told Mr. Daugherty, the auxiliary operator I

was talking to, to turn off the pumps.

Q. Had you conferred with anybody in the control room before giving Mr. Daugherty that instruction?

A. Yes. I explained the report that Mr. Daugherty had given to me to Bill Zewe, and then I told Daugherty to turn off the pumps?

Q. When you went to the simulator for training did you get any instruction on how you could tell if a rupture disc had burst on a reactor coolant drain tank?

A. No, the simulator doesn't have a drain tank rupture disc. They didn't show you that.

Q. How extensive was B & W's instruction on the drain tank?

MR. FISKE: I am going to object to that question, your Honor. It is very general.

THE COURT: Yes.

MR. SELTZER: I will rephrase it. Withdrawn.

MR. FISKE: Are all these questions on the training on the drain tank being limited to B & W?

MR. SELTZER: Yes.

Q. When you were at the simulator being trained by B & W, what was the extent of the instruction that you got from B & W, if any, on the reactor coolant drain tank?

A. Other than that event I described yesterday, I don't really recall any, any training on the reactor

coolant drain tank or its function or status during transients, or anything like that.

Q. Did the simulator have a panel of readings that was analogous to your reactor coolant drain tank gauges that are on panel 8-A?

A. No, they don't have a panel that models anything about the drain tank.

Q. Did the simulator have anything that continuously recorded what the parameters were in the drain tank?

A. No, they don't display or record any reactor coolant drain tank parameters.

Q. Was there a mockup of what the panel would look like in a control room that had gauges for a reactor coolant drain tank?

A. No, there is no representation of it at all.

Q. Was there a period of time during the transient when Mr. Zewe, the shift supervisor, left the control room?

A. Yes.

Q. Did there come a point in time when you noticed that there was an increase in reactor building pressure?

A. Yes, there was.

Q. Do you recall when that was relative to Zewe's leaving the control room and returning?

A. It was after he left and then he came back and

then we got into a discussion abou reactor building pressure.

Q. With whom did you discuss the increase in reactor building pressure?

A. Mr. Zewe was there and Mr. Faust, Mr. Scheimann. I think that's it.

Q. What was the substance of that discussion?

A. It was a discussion to determine the reason for increasing reactor building pressure and we --

Q. Did you reach any conclusions in that discussion?

A. We concluded that there was a steam leak in the reactor building that was causing an increase in temperature and pressure.

Q. Where did you think the steam was leaking from?

A. The steam piping from the steam generator that's inside the reactor building.

Q. This is piping that would normally carry steam from the steam generators to where?

A. The steam generators in the reactor building to the steam turbine in the turbine building.

Q. What was your basis for concluding that you had a break in that steam line?

A. We saw indicators on the steam generators that showed that the feed and steaming rates were uneven in the generators and that's an indication of a steam leak, and we

saw the raising pressure in the reactor building, and so between those indications, those panel indications and symptoms, we decided that there was probably a steam leak in the B steam generator.

MR. FISKE: Can we just have the time fixed for this determination?

THE COURT: This is when Mr. Zewe came back from his --

MR. SELTZER: His trip to the turbine building.

THE COURT: His trip to the turbine building.

Q. Did you consider any possibilities other than a steam line break as causing the building pressure rise?

A. I don't recall that I considered anything else, no.

Q. In the conversation that you participated in with the people you have identified, was there any discussion of other possibilities or any other possibility giving rise to the pressure increase in the reactor building?

A. I think the conversation addressed the possibility of loss of coolant, but it was discounted because there was no presence of radiation.

Q. Did you reach any conclusion in this conversation as to the size of the steam line break?

A. It was not very large because we weren't seeing

much of a pressure decrease or a feed rate change in the generator that we suspected was leaking, so we classified it as a small to medium steam leak.

Q. Did you take out any procedure that told you what you should do for a steam leak?

A. I didn't personally, but the procedure was taken out.

Q. Somebody else took it out?

A. Yes.

Q. You referred to not seeing a radiation alarm. What was the significance, as you understood it, of the absence of a reactor building radiation alarm?

A. The procedures for a loss of coolant and steam line break indicate that they can be so similar that there may be only a few ways to differentiate between one casualty or the other, so that one way you can determine between a steam leak and a loss of coolant accident is the presence or absence of the reactor building radiation alarm when the primary coolant, the reactor coolant system water, is exhausted due to a loss of coolant accident in the reactor building. It causes an increase in radiation products because that water is carrying radiation products whereas the steam which is on the secondary side is not radioactive.

Q. Did you take any action based on the conclusion

that there was a steam line break?

A. Yes. We isolated the generator which we suspected was leaking, that is we shut the feed lines going into the generator and the steam lines coming out, to eliminate it as a source of leakage. So eventually if it did have a leak it would empty out and there would be no more steam leak.

Q. Did isolating the B steam generator have any effect on reactor building pressure?

A. Yes, the pressure began to go down.

Q. Did there come any point in time when you believed you might have a primary side to secondary side leak?

MR. FISKE: Your Honor, I think these questions are just a little bit leading.

THE COURT: Yes, I do too. I sustain that.

Q. What was happening to the indications of reactor coolant pump function as the transient progressed?

A. At some point in the transient we began to see reactor coolant system flow degraded, starting to get less and less flow indicated on the graphs on panel 4. That drew us to examine the other reactor coolant pump operating parameters, and we saw high vibration on the vibration indicators over there by the clock and then we saw the current indicators, that is the electrical current

indicators, for the pumps were showing lower than normal current flow to the pumps, and I think those were all the indications that we were starting to have a problem with the reactor coolant pumps.

Q. Had you received any training on what to do if you were getting high vibration on the reactor coolant pumps?

A. Yes. The reactor coolant pump operating in emergencies procedures required that you manually trip the reactor coolant pumps if you exceed the vibration limits.

Q. After you noted the high vibration on the pumps did you take part in any discussions regarding the condition of the pumps?

A. As I remember there were several discussions about what action to take as a result of the degraded condition of the pumps, and we decided to turn off two pumps to see if it made any difference in the operating characteristics of the pumps that we left on.

Q. Who was involved in the discussions about what to do with the pumps?

A. Myself and Craig Faust and I think Mr. Zewe and George Kunder.

Q. I'd like to show you what's previously been marked as B & W Exhibit 261 in evidence as the reactor coolant pump operation procedure. Was this a procedure

that was in effect at the time of the accident?

A. Yes, it is.

Q. When you were having the discussion with others about the status of the reactor coolant pumps, was any part of this procedure being referred to?

A. The point of concern were the limits that I described in the section of the procedure called limits and precautions that begin on page 3, and in particular the limits of most concern are listed under -- on page 9 where the limits and precautions are continuing, it says -- 2.4 says "reactor coolant pumps must be tripped if," and then it lists the conditions under which you must trip your reactor coolant pumps.

So we were examining what would make us have to trip the reactor coolant pumps and see 2.2.4.5 and 2.2.4.8 and 2.2.4.7 are the vibration limits for operation of the pumps. That's what we were seeing in the meters over by the clock.

Q. In the training at Babcock & Wilcox had you gotten any instruction on the reasons why the pumps should be tripped if these vibration limits were exceeded?

A. Excessive vibration of this magnitude causes damage to the mechanical seals along the shaft of the pump, and if you damage those seals you can create a leakage up along the shaft of the pump from the reactor coolant system.

You also have --

Q. What happens if that occurs?

A. That's a leak that you can't stop. It will just leak, even when you cool down, it will still come out, because it is a low point in the system. Another situation is close tolerances in the motor and the pump shaft themselves. If you vibrate it excessive you are actually going to damage the bearings in the support of the pump and you could cause pretty good damage to the impeller that way.

Q. What did you understand from your training you should do if any of these vibration limits were exceeded?

A. If you exceed the limits on vibration, you have to manually trip the pump.

Q. Would you turn to the chart that is three pages from the back?

A. Yes.

Q. At the time you were discussing the status of the pumps did anybody have out this curve, this set of curves?

A. As I remember it, Mr. Kunder asked me for a copy of this curve so that he could see it while we were discussing the status of the pumps.

Q. Did you give it to Mr. Kunder?

A. Yes.

Q. Did you give anything else to Mr. Kunder?

A. I think he also asked me if we had any steam tables in the control room, and we didn't actually have a steam table book, but I had the xerox copy of a page or two in the operators' drawer, so I gave him that.

Q. What if any understanding did you have as to the purpose for which these curves were being consulted?

A. These curves represent an operational limit on the reactor coolant pumps. Depending what combination of pumps you are running it gives a net positive suction head limit for continued operation of the pumps, and Mr. Kunder was just reviewing -- I assume he was just reviewing the limit to see if we were near that.

THE COURT: Which was the printout that was 50 degrees high according to certain testimony of Mr. Zewe?

MR. FISKE: I think your Honor may be referring to what is tab 4 in our book which has those --

THE COURT: No. You remember in the course of some examination about Mr. Zewe's handwritten chart --

MR. KLINGSBERG: Your Honor, there was testimony that if you look at the pressure recorder before the accident on the strip chart, it looks like it is 50 degrees below what would be normal. So at the outset the chart might have been --

THE COURT: High?

MR. KLINGSBERG: Yes. I don't remember if it is

high or low.

THE COURT: High. As I remember, Mr. Zewe said he was using figures that were 50 degrees higher than they ought to be.

MR. KLINGSBERG: No. He said that at the beginning of the accident -- before the accident the pressure on the chart was 50 PSIG higher than the normal pressure in the reactor coolant system.

THE COURT: No. I think the question --

MR. KLINGSBERG: I don't know that you can infer from that that that continued throughout or not. It depended on what happened --

THE COURT: I understood him to say in response to some question by Mr. Fiske that the control room operators were aware that this thing was running 50 pounds higher than it actually was. Isn't that --

MR. KLINGSBERG: I don't think he did, but I'd have to check.

THE COURT: For a couple of days.

MR. KLINGSBERG: No. I am not sure of that.

MR. FISKE: Your Honor, there was a question as to whether Mr. Zewe was aware that the day before the accident it had been determined that the wide range pressure chart was 50 PSIG higher.

THE COURT: And he said he was aware of that.

MR. SELTZER: No, he said --

MR. FISKE: He said he didn't know that that had happened. I believe that was the testimony. He did know that the wide range pressure chart itself starts on the day of the accident 50 PSIG above what the pressure was.

MR. KLINGSBERG: He said he knows that today, looking at it.

BY MR. SELTZER:

Q. After Mr. Kunder had looked at the net positive suction head curves for the reactor coolant pumps, did he tell you anything about what he concluded?

A. As best I recall, he just said that we were near the net positive suction head limits for the pumps.

Q. When you learned that the plant conditions were near the net positive suction head curve, did you have any thoughts about whether to turn HPI on or turn it on more?

MR. FISKE: Could I hear that question again?

THE COURT: Before you get to that question, what did you understand was meant by near the net positive suction head limits? What did that mean to you?

THE WITNESS: Referring to this curve, these two lines, number 5 and number 6, represent net positive suction head or operating limits for the reactor coolant pumps, and he said that we were near --

THE COURT: If you exceeded those, what did you

understand would happen?

THE WITNESS: That's when you would start having cavitation of the pump. Should I explain cavitation?

THE COURT: No. Mr. Zewe explained cavitation.

THE WITNESS: Then if you are at or near this limit, you can expect that cavitation is going to occur or is occurring, depending on the other indications that you have on the panel. If you are at or near this net positive suction head curve and you saw no cavitation and no flow degradation and no amperage change, then you can assume you are not cavitating yet. If you continue to go beyond the limit, then you eventually will.

THE COURT: Mr. Frederick, did you attribute your pump vibration to these factors or what did you attribute them to?

THE WITNESS: Exceeding the net positive suction head?

THE COURT: No. Being the low pressure, etc., etc., that you were aware existed, low pressure and lower temperature.

THE WITNESS: Yes, that's what this limit shows, low pressure.

THE COURT: Is that what you people attributed the pump vibration to? In other words, you didn't assume the pumps had decided to pick this moment to become faulty.

You attributed their problem to something else, did you not?

THE WITNESS: That's right.

THE COURT: What did you attribute their problem to?

THE WITNESS: Being at or near this net positive suction head limit, that is the pressure limit at the suction of the pump.

THE COURT: Then did you have any discussion as to why you were at that limit?

THE WITNESS: The question of pressure control had been something we were discussing all along. This was just the result of the the low pressure.

THE COURT: I understand, but if you are at -- this is, what, about an hour and 15 minutes, 13 minutes, because you shortly stopped the pumps, right?

MR. SELTZER: Two of the pumps.

THE COURT: Two of them? We are talking an hour or an hour and 15 minutes, right?

THE WITNESS: Yes.

THE COURT: At that point the pressure in the system is about 1100 and the temperature is about 545. Were you saying to yourself, "Why have we got those pressures and why have we got those temperatures?"

THE WITNESS: Yes.

THE COURT: What kind of answers were you coming

up with, if any?

THE WITNESS: We had attributed our lack of pressure control to several conditions. As we were trying to analyze what that problem was, the pressurizer heaters, perhaps -- originally it was the insurge of water, cold water to the pressurizer, and we had the consideration of insufficient heater capacity or failed heaters, which was one of the things that Mr. Zewe investigated.

THE COURT: He found they hadn't failed, right?

THE WITNESS: As I recall now, I think the testimony shows what he found when he went out there. So we had attributed lack of pressure control to things like that. There we were with low pressure and it was beginning to have an effect on the components, that is the reactor coolant pumps. So now we did have low pressure up to this time and now we are beginning to see that low pressure is affecting these components, the reactor coolant pumps.

THE COURT: You say you attributed the low pressure to the adding of the water and the fact that the pressurizer heaters weren't working, is that what you are telling me?

THE WITNESS: At first we thought it was the water.

THE COURT: Then you decided it wasn't?

THE WITNESS: We decided it was probably --

since it was taking so long to get the pressure back, it might be the capacity of the heaters was insufficient or that some of them wasn't working, so that was investigated.

THE COURT: What did you learn from that investigation.

THE WITNESS: Eventually we learned that the pressurizer heaters were working -- pressurizer heaters were working properly, that I can recall.

THE COURT: Was that before the time you are now sitting around discussing the fact that you are near the point of minimum net positive suction head limits on the pumps? Was it before that time?

THE WITNESS: No, I don't think so.

THE COURT: You think it was after that time?

THE WITNESS: The determination about whether the pressurizer --

THE COURT: About the heat, yes.

THE WITNESS: I know that determination wasn't made -- when Mr. Zewe came back to the control room we still hadn't figured that out. It was sometime later that that decision was made, that the heaters were working right. I don't know how that ties in to this time frame, whether that was at this time or later.

THE COURT: What I am trying to get at is, you are sitting here at roughly 5 o'clock or 5:15, you have got

pressure at 1100, you have got temperature at 545, you have got a pressurizer that's up at 375, 80, 90 inches, and you have pumps that are starting to malfunction because they aren't pumping, they don't have enough product to pump; right?

THE WITNESS: No, there is plenty of product, there is plenty of water in the system. The pressurizer is full.

THE COURT: I understand, but they are down to this point where you are starting to have the risk of cavitation, which I gather, without getting into too much detail, is that steam bubbles are going to start forming in the pumps, right?

THE WITNESS: Yes. It is a long term corrosion type problem. You don't want it to exist for very long.

THE COURT: The flow through the pumps is slowed way down.

THE WITNESS: The flow was degraded. I don't remember to what degree.

THE COURT: So what are you people saying to yourself is causing this, because you added water, as I recall it --

THE WITNESS: There is plenty of water.

THE COURT: You had the manual HPI, you have the automatic HPI, you have added water and presumably you

haven't lost any water, and yet these pumps all of a sudden are starting to shake themselves off their bearings to the point where you have got to close them down or you are risking cracking the pipes and having major leaks at the bottom of the system that you can't do anything about.

What are you saying to yourself about how come with this system full of water, no leaks, sound system, no LOCA's, what are you saying to yourself explains all of this?

THE WITNESS: The inventory of water in the system is completely independent from the cavitation process. You wouldn't have to lose inventory in order to have cavitation. So that the fact that the system is full, the only problem you have is that the pressure is low and you are approaching the cavitation limit on the pump.

THE COURT: Why should pressure be low if you have a sound system?

THE WITNESS: We were trying to analyze that. We were trying to figure out why pressure was low. We just hadn't determined that --

THE COURT: Theoretically if you had a sound system you wouldn't have low pressure, would you?

THE WITNESS: A sound system meaning no leaks?

THE COURT: Yes, meaning no leaks.

THE WITNESS: Leaks or no leaks does not

determine the system pressure. System pressure is normally determined by the pressurizer status. That is the heaters -- you can have a full system, 220 inches in the pressurizer, with heaters on and have a very low pressure or you can have a very high pressure, depending on what the set point of the heaters is. You can control pressure at any level, whether the system is full or at normal level or a little bit higher, or whatever.

THE COURT: I take it you had your heaters running to the maximum allowed by the system, did you not, given the fact that you were concerned with all of this cold water?

THE WITNESS: Yes. We had the heaters turned on and we were investigating whether or not they were working.

THE COURT: So it wasn't a question of not putting -- or was it a question that you felt you weren't adding enough heat?

THE WITNESS: That was one of the considerations, the capacity of the heaters as a heating capacity was probably insufficient.

THE COURT: What were the other considerations

THE WITNESS: If if it is not capacity, then it is the number of heaters that were operating.

THE COURT: What were other considerations that would account for this rather unusual accumulation of

circumstances, if I can call it that?

THE WITNESS: That was, indeed, the crux of the problem. We had no conditions in the plant after our final investigation that would cause low pressure, but in fact we had low pressure. How do you remedy a situation for which there is no reason? That was our problem. Low pressure with no apparent reason.

THE COURT: So when you have no apparent reason, what do you start thinking might be the reason? What are the things that you would tick off on your finger that would cause low pressure?

THE WITNESS: We had examined the steam leak and found that there was a steam leak. That is a source of low pressure.

THE COURT: That would account for the water in the sump, but that was not a loss from the reactor coolant system, right? That was a loss from the secondary system.

THE WITNESS: Yes, but one of the symptoms of a steam leak is low pressure in the reactor coolant system. Remember I said that the symptoms of a steam leak and a LOCA are just about the same, low pressure, low level, that sort of thing. So we were examining steam leak as a possibility for a large number of the symptoms that we were seeing. We had eliminated that and waited to see if it affected all of those parameters.

In the course of waiting for these things that we tried, that is pressurizer heaters we were investigating, we were trying to see what effect the steam generator change had on it and then these problems with the pumps develops, so that not knowing the cause for the low pressure does not tell you that you shouldn't take the action based on the indications of the pump.

We had low pressure. The pumps were starting to shake badly. You have to turn them off whether you know what is causing the low pressure or not because the condition --

THE COURT: I appreciate all of that. What I am trying to ascertain, Mr. Frederick, is, what was the individual and collective thinking of you men as you looked at this array of disorganization, if I can put it that way? What were you saying to yourself? I can just imagine some of the language that was flying around in that control room at 5:10 in the morning, if I put my mind to it.

THE WITNESS: Actually, the state of the operators was rather calm and analytical at that time. It wasn't a state of panic. What we had was a relatively stable situation with low pressure. The instability occurs or the concern starts to occur when we have to secure the reactor coolant pumps and lose our flow and move to a situation --

THE COURT: And that's what you were looking at right at that moment?

THE WITNESS: Yes, that's right.

THE COURT: You were faced with the problem of shutting down the pumps with a sump full of water and a pressurizer level that was up at the top.

THE WITNESS: Way at the top, yes.

THE COURT: And I assume some awareness of possible saturation?

THE WITNESS: No, sir.

THE COURT: No? No awareness of possible saturation?

THE WITNESS: Saturation has no significance.

THE COURT: I mean somebody had asked for the steam tables, right?

THE WITNESS: In an effort to examine net positive suction head of the pumps.

THE COURT: But if you are going to have that in the pumps, you are not far away from saturation in the system, are you?

THE WITNESS: It is a long way from cavitation to saturation of the system, if there is no consideration that saturation in the system can occur. The situation of cavitation in the reactor coolant pumps is not a logical premise to saturation in the reactor coolant system. It is

neither a point in training nor mentioned in any of the procedures as being a significant event. Therefore, why conclude that that is occurring or it is even a significant possibility?

THE COURT: Let me ask you this. Were you ever given any instruction on what saturation in a reactor coolant system is or means?

THE WITNESS: As a control room operator?

THE COURT: Yes.

THE WITNESS: What does it mean to me?

THE COURT: No. Were you ever given any training? In the course of any training, Met Ed, B & W, Navy, were you ever told that you were not to permit the system itself to get boiling?

THE WITNESS: No, sir. That's a function of the design of the system and not an operator action. There is no procedure or step that says prevent saturation. It doesn't tell you to do that.

THE COURT: I know there isn't, there doesn't appear to be, but didn't you at some point somewhere along the way learn that there is a certain point where if the temperature is high and the pressure drops low enough, you will have boiling in your reactor coolant system? You had an awareness that that could occur at some relationship of the temperature to the pressure, correct?

THE WITNESS: The only context of boiling that we had was the latter stages of an MHA type LOCA where the system is evacuated of inventory and begins to overheat the core, where you have steam production which leaves the system through the leak.

THE COURT: Did you never learn of a relationship of -- does the word saturation mean something to you?

THE WITNESS: Yes, sir. I know the precise definition of the term.

THE COURT: What does it mean?

THE WITNESS: Saturation is the pressure and temperature relationship at which a fluid can exist as a liquid or a vapor.

THE COURT: Did you ever get any instruction on that in relation to the inventory of the reactor coolant system?

THE WITNESS: No, sir.

THE COURT: And you are saying that at roughly 5 o'clock to 5:15 with the pumps now facing the necessity of shutdown, your thought was this was -- you tell me again so I have got your actual thinking. What were you visualizing as the cause of the situation in which you found yourself 5 o'clock to 5:15 with the pumps malfunctioning.

THE WITNESS: The situation we were in was a

condition which low pressure existed in the reactor coolant system and we were beginning to encroach on the net positive suction head of the pumps and we had to shut them down due to high vibration.

THE COURT: But did you have any answers to the "why"?

THE WITNESS: Only the several avenues that we were examining, pressurizer heater failure or steam leak that we were piling up somewhere --

THE COURT: Steam leaks from pipes on the secondary side?

THE WITNESS: Yes, a steam leak in the secondary system, actually from the steam generator, inside the reactor building.

THE COURT: Counsel, it is 2 minutes of 1. Let's recess until a quarter past 2.

(Luncheon recess.)

P. M. S E S S I O N

(2:15 p.m.)

(Open court)

DIRECT EXAMINATION (Cont'd)

BY MR. SELTZER:.

Q. Mr. Frederick, Mr. Zewe and possibly others have already explained what is cavitation, so I don't want you to give a long description of it.

Can you give a very specific description of what you understood constituted cavitation prior to the accident?

A. Cavitation is the formation of vapor bubbles in the suction of the pump and the subsequent collapse of those pumps in the water and the discharge of vapor in the impeller veins.

Q. What did you understand before the accident was the condition of the water outside the pump if cavitation was going on inside the pump?

A. If cavitation is occurring, then the process itself assumes that the suction of the pump and the discharge of the pump are both filled with fluid, that is a liquid, water. If you have vapor bubbles forming in the water and then subsequently collapsing in the water, that's what causes the vibration and the erosion of the impeller blades.

Q. Why did you understand that there had to be

liquid water both on the suction side and the discharge side if there was cavitation going on in the pump?

A. I guess the basic process of cavitation says that you have the liquid being drawn in and exposed to the low pressure at the eye of the pump and that causes formation of bubbles in the liquid. Bubbles travel along the veins to the discharge of the pump and then they collapse in the water and that shock wave causes erosion and vibration in the pump impeller.

Q. What, if anything, did you understand caused the bubbles to collapse?

A. They collapsed at the discharge of the pump because that is the highest pressure that is developed by the pump at the tips of the impeller blades. When that pressure is forced on the vapor bubbles, they collapse on the liquid and cause a small implosion.

THE COURT: What do you understand permits cavitation in the first place?

THE WITNESS: Inadequate net positive suction head.

THE COURT: What does that mean?

THE WITNESS: It means that the static pressure applied to the suction of the pump is insufficient to prevent the formation of the vapor bubbles when the pump is running.

THE COURT: So, in other words, low pressure.

Is it the combination of pressure and temperature or just low pressure?

THE WITNESS: It is static pressure or head measured in feet.

THE COURT: Well, is there a relationship between temperature and pressure that permits this, that's really what I am asking you?

THE WITNESS: The primary way to prevent it is pressure. The mechanism that is occurring is a combination of low pressure and the same pressure it was before it entered the pump. The pressure is decreased below the saturation point for the water at the eye of the pump.

THE COURT: Well, as I understand, this can occur at differing temperatures depending upon the pressure, is that correct?

THE WITNESS: If you understand it from this curve, it means that it can occur depending upon the number of pumps that are running, the combination of whether they are both in the same loop or in different loops and as a result of pressure at the eye --

THE COURT: And temperature?

THE WITNESS: Yes. It can occur at different temperatures. But this doesn't follow through that way for the entire curve. You see it flattens out at the bottom.

That's the different consideration for the pump operation. It is not a direct pressure/temperature relationship. It has to do with the elevation in the pipes as well because just the difference of the height of the water creates pressure in itself.

THE COURT: Just a minute now.

THE WITNESS: You see in other systems, we have the same problem, cavitation and the way we prevent cavitation is by elevating the source of water above the pump, that applies a certain amount of pressure in the suction. You could have a very cold water refrigeration system, it could cavitate. It is due to the suction pressure applied to the pump.

It is a situation which can occur in a very cold system or a very hot system. It is mostly dependent upon the head that you supply to the pump.

THE COURT: If you take --

THE WITNESS: Any centrifugal pump can cavitate.

THE COURT: If you would take your chart.

If you are running 545 say at 1100, you are right up here, right?

THE WITNESS: Yes.

THE COURT: Now, you are on the wrong side of what would be an extension of this dotted line; is that right?

The dotted line is for single pump and this line is for two pumps, as I understand it?

THE WITNESS: This is --

THE COURT: This is the two pumps?

THE WITNESS: This is one pump in each loop and this is two pumps in one loop.

THE COURT: So if you are running a 545 or 550 at 1100, you are then on the wrong side of either of those, are you not?

THE WITNESS: Yes.

THE COURT: And you should be on the other side of them to avoid that problem?

THE WITNESS: To avoid the cavitation?

THE COURT: Right.

THE WITNESS: Yes.

Q. What relationship, if any, did you understand the net positive suction head curve had to the occurrence of saturation in the reactor coolant system outside the pumps?

A. There is no relationship involved between the net positive suction head curve which was a graphic representation of a localized occurrence inside the reactor coolant pump. There is no relationship between that and the entire system as a whole.

Q. Did you get any instruction from B & W, the navy

or Metropolitan Edison or anybody else about whether detecting -- withdrawn.

Did you get any instruction from anyone, B & W, the navy, Met Ed that by looking at the net positive suction head curve and seeing where the plant was in relation to the NPSH curve you could detect saturation in the reactor coolant system?

A. No.

Q. After you turned off the first set of reactor coolant pumps, what happened to the remaining two pumps?

A. We left them running for awhile and monitored their condition to see if it improved as a result of turning off the first two pumps; to see if the vibration was reduced or the flow had better characteristics.

Q. Did there come a time when you -- withdrawn.

Were you monitoring boron concentration in the reactor coolant system during the transient?

A. We did draw some boron samples during the morning.

Q. What, if anything, did you observe happening with boron concentration?

A. The analysis that the chemist brought back showed that the boron concentration had been drastically reduced.

Q. What action did you take in response to the low

levels of boron concentration?

A. After the second sample, I believe we began emergency boration, that is, addition of highly concentrated boric acid to the reactor coolant system to raise the total concentration back to where it should have been.

Q. Where did you get the boric acid from?

A. The boric acid is added from the boric acid mix tank which is a special tank in the auxiliary building and we used two pumps which are specifically identified for the purpose of adding highly concentrated boric acid. So all we had to do was start the pumps in automatic.

Q. Is this boric acid mix tank the same tank as the borated water storage tank from which you said HPI is pulled when you have a full actuation of HPI?

A. No.

The borated water storage tank is a different tank located outside the building. This tank I am referring to now, the boric acid mix tank, is a much smaller tank located inside the storage building where we store highly concentrated boric acid.

Q. When you were adding boron to increase the level of concentration, what was the rate of flow?

MR. FISKE: Excuse me. Could I have that question clarified?

Flow of what?

MR. SELTZER: The flow from the boric acid mix tank, the flow of the fluid you were withdrawing from that tank?

MR. FISKE: The flow into the system?

MR. SELTZER: Into the reactor coolant system.

A. The boric acid pumps put the water into the system at the rate of about 10 or 20 gallons per minute, I think.

Q. Why were you concerned about the level of boration?

A. When the reactor is shutdown, that is, the control rods are inserted after the reactor trip, the boric acid concentration in the reactor coolant system is the only variable then in how to add more shutdown capability to the reactor, keep it in a shutdown state.

The depletion or the reduction in the boron or boric acid concentration indicates that positive reactivity or startup potential is being added to the reactor core. So it is going to restart to get a sufficient amount of positive reactivity added. So that decrease in boric acid is moving as closer to a startup state with the reactor. It is going to be starting nuclear heat again.

Q. You mean it is going to go critical?

A. Yes.

Q. What is the source range monitor?

A. The source range monitor is a neutron count indicator that monitors the level of operation of the nuclear core.

Q. Did there come a time when you observed the source range monitor?

A. Yes.

At about the same time that we received the low boron concentration reports we examined the source range indicators and saw an increase in count rate, which indicates a startup of the reactor.

Q. What did you think was happening when you saw the level going up on the source range monitor?

A. Well, the source range indicator was increasing because the boric acid had been removed and we were observing a spontaneous or inadvertent restart of the reactor.

Q. Did you have procedures that covered such an unanticipated approach to startup of the reactor or recriticality?

A. Yes, we did.

There is an emergency procedure which you use when you identify that a restart is occurring. It is called unanticipated criticality. And the manual action is to do what I did. I started adding boric acid to the

system in a highly concentrated form.

Q. You described a moment ago the process that led to tripping two of the four reactor coolant pumps.

At some point were the other two tripped?

A. Yes.

Sometime later the vibration, flow degradation and amperage condition was still sufficiently bad that we had to secure the last two reactor coolant pumps as well.

Q. Up until the time when you secured or shut off the last two reactor coolant pumps, you had a forced flow of coolant water around the core.

What, if any, flow did you understand would be maintained after you shut off the last two reactor coolant pumps?

A. The flow would initially go to zero. There would be no flow. Then if we could establish natural circulation flow, I really didn't know what the rate would be but it would be some slower rate than normal.

Q. Can you succinctly state what your understanding was of natural circulation? Just what is it?

A. That the circulation is movement of the water through the reactor coolant system which is motivated only by the conductive flow of water from the less dense high elevations or where warm water would exist, and when you have colder water in the lower elevations or in the steam

generator, that colder water would move down into the core and displace water out of the core and into the steam generators where it would be cool.

So this conductive flow would exist just due to a change in temperature across the steam generator with no pumps running.

Q. After you shut off the last two reactor coolant pumps, what indications did you expect to see, if any, that natural circulation flow to have been established?

A. Well, there really weren't any guidelines on what you would see or how long it would take to you see the change in parameters due to natural circulation. But I knew there should be a difference in temperature between the hot region of the piping and the cold region and there is -- that's called the delta T or the differential temperature.

There is a procedure that we had for natural circulation after blackout which gave a limit to that differential temperature and that's what we had to go by.

We were supposed to develop that maximum differential temperature and hold the steam generator levels at a high level so we could have heat removed by the water -- through the water that is adjacent to those steam generator tubes and that would initiate and sustain the natural circulation state.

Q. Did you know how long it would take before the temperature differential between the hot legs and the cold legs had increased to the level that would be sustained during natural circulation?

A. Did I know the time how long it would take?

Q. Yes.

A. I didn't know how long it would take.

Q. Was there -- withdrawn.

What was the next action that was taken with respect to the reactor coolant pumps?

A. Some long while later when we decided that natural circulation had not occurred we started or tried to restart the reactor coolant pumps in an effort to start forced circulation because we didn't have any circulation at all.

Q. Were you able to restart one or more of the reactor coolant pumps?

A. We couldn't get any of the reactor coolant pumps to indicate that they were running when we turned the switches.

I know that post-accident data shows that one of them did start but we had no indication that it was operating, other than that the red light changed position, but there was no flow or anything like that.

Q. Did you form any understanding as to why the

pumps were apparently not restarting?

A. There are a lot of interlocks or special conditions that must be met before you could start a reactor coolant pump, about 13 or 15 of them, and it was my understanding that we weren't meeting all of the prerequisites for a manual startup reactor coolant pump. We had to go through each interlock separately and clear it and set up the prerequisites for the startup before they would start successfully.

Q. Did there come a time when the pilot-operated relief valve block valve was closed?

A. Yes.

Q. What, if anything, was your understanding as to the circumstances that led to that?

A. There was a suggestion by the supervisors to shut --

MR. FISKE: I have no problem with any of this as long as Mr. Frederick --

THE COURT: It is direct evidence.

MR. FISKE: If we're letting in something that he knew was happening at the time.

THE COURT: Would you phrase your question in the kind of way that would elicit that kind of understanding?

Q. What did you see and what did you personally

hear regarding the closing of the block valve?

Just your personal experience that day.

A. Okay.

While we were stationed at the panel, Mr. Mehler, Brian Mehler who is a shift supervisor, approached the panel and began conversation with Mr. Scheiman and myself. He said that it was suggested that we try closing the PORV block valve to see if it has any result or any change of indications in the reactor coolant system parameters and Mr. Scheiman closed the block valve.

Q. What, if any, consequences did you see as a result of the block valve being shut?

A. After the PORV block valve was shut, the system pressure began to increase, the reactor coolant system pressure began to increase.

Q. When you saw that, did you have any thoughts about whether the pilot-operated relief valve had been opened prior to the block valve being shut?

A. Whether it was at that moment or not, I don't know. But I began to think about the consequences of, perhaps, it being partially opened or fully opened for that entire time since the trip began and I tried to add that information into our analysis of the transient so far and figure out how it had influenced the parameters' indications.

Q. What, if any, indications did you have at that point in time as to the inventory in the reactor coolant system?

A. As I remember, the inventory was still indicating that the system was full, overfull, actually.

Q. How were you interpreting that?

A. By pressurizer level.

Q. At or about -- withdrawn.

Were you still the operator who was in charge of the controls on the primary side of the panel?

A. Yes, I was. Mr. Scheiman was assisting me in monitoring some of the primary, keeping me informed of trends.

Q. At the point where the block valve was closed, did you consider at that time turning on high pressure injection?

A. I don't recall considering it.

Q. You mentioned this morning the absence of radiation alarms when you had high reactor building pressure.

Were you continuing throughout the transient to look for radiation alarms?

A. Yes.

We were checking the the whole panel for additional information that could help us analyze the

situation, additional alarms, exhibited on panel 12 right in the center of the room, and that we looked at quite often.

Q. Did there come a point in time during the accident when you did receive radiation alarms?

A. Yes.

Q. When did you first notice radiation alarms?

A. It was right around the time when we declared a site emergency shortly after attempting to start the reactor coolant pumps. Somewhere around there.

Q. You say it was shortly before a site emergency was declared?

A. Yes, as I remember.

Q. So --

MR. SELTZER: If your Honor please, I think the record showed that that was at about 7:30 in the morning. I won't ask this witness for his recollection as to precisely what was that emergency.

Q. Prior to receiving those radiation indications, did you have any thoughts about whether there had been radiation released into the containment building?

A. I remember scanning the panel looking for indications of radiation and not seeing them.

So what I was looking for was indications of just that nature. I didn't see any.

Q. Before you got those indications, just before the site emergency was declared, had you received any kind of radiation alarm, whether in the reactor building or elsewhere?

A. I don't recall the inception of the alarm but we had indicated intermediate closed cooling system radiation alarm sometime in the transient before all of these other alarms came in.

(Continued on next page)

Q. Based on your experience before the day of the accident did you have any experience about what caused an intermediate closed cooling monitor alarm?

MR. FISKE: Just before Mr. Frederick answers this question, I am not really sure I understand the last answer.

THE COURT: You may have it read back.

(Record read.)

A. Yes. Receiving that particular alarm was an expected event after a reactor trip.

MR. FISKE: Excuse me, your Honor. That's what I don't understand. I thought he said he didn't receive the alarm. Maybe I am out of order, but I just don't understand what's going on.

THE COURT: Read back the answer.

(Record read.)

THE COURT: Mr. Fiske, do you need the rest of that?

MR. FISKE: No, I think I have it now. I am sorry.

Q. I believe you just said that an intermediate closed cooling monitor radiation alarm could be caused by a reactor trip. Could you explain that?

A. A reactor trip is a transient which causes both mechanical and thermal shock to the reactor coolant system.

That is, change in temperature and a mechanical shock of the control rods causes the release of corrosion products from the walls of the piping, just microscopic type particles, wear products from valve operations, that sort of thing.

These products are highly radioactive. That's why the general radiation level in a reactor coolant system greatly increases following a reactor trip. That radiation, even though the coolant is not coming out of the piping, or anything, can be detected outside the piping because it penetrates the pipes, just like x-rays, and this particular monitor located where it is is sensitive to this increase in x-ray type radiation and it will make an alarm after a reactor trip.

It is not really sensing more radiation in the system than it is monitoring, but the radiation around the sensor itself is causing it to go into an alarm state.

Q. Just so I understand, is the radiation that the alarm is detecting from the particles being discharged radiation that is within the reactor coolant system or has it escaped from the reactor coolant system?

A. Again, these little particles floating in the reactor coolant system water are emitting x-ray or gamma type radiation, and it can penetrate the pipe walls and then be detected by an exterior detector like this.

Q. Is the detector detecting a loss of coolant accident? That's what I am driving at.

A. No. All it is seeing is an increase in background radiation inside the reactor building due to the trip.

Q. Is there a name or a phrase that's sometimes used to describe the release of these radioactive particles?

A. Again -- oh, the particles in the water?

Q. Yes.

A. That's called a crud burst because the corrosion products and wear products on the walls of the piping are referred to as crud.

Q. Is there any action that you understood was dictated by the reseat of a radiation alarm coming from the intermediate closed cooling alarm?

A. Well, under different circumstances, that is when we don't have a reactor trip, the actuation of the intermediate closed cooling water alarm tells you that the intermediate closed cooling water system, that is the system that cools the control rod drive motors and other portions of the reactor system, is for some reason having an increase in radiation level in the water of that cooling water system.

But in the context of this reactor trip it is telling us that the gamma radiation coming from the entire

system is causing this alarm to go off. So in this situation it doesn't require any action.

Q. When you came on shift at 11 p.m. on March 27 you were in charge of panel manipulation, did you say?

A. Yes.

Q. Did you check the status of the indicators on the panel when you took over the panel?

A. Yes, I did. As I explained before, I examined the key parameters that indicate the current operating condition of the plant and I looked over important things that the person I was relieving told me were important to look at and reviewed the logs and paperwork that they were using to do whatever work was in progress.

Q. Are there indications on the panel that show the open or closed status of the 12 valves which are the block valves on the auxiliary feedwater system?

A. Yes.

Q. What kind of indicator is on the panel for that?

A. It is a red and green light above the switch that controls the position of the valve.

Q. How is it that you did not initially notice that those panel indications showed the valves were shut?

A. My observation of the panel at that time was to observe, like I said, the key parameters for the operating systems, and not having seen any disorder in those

parameters, I didn't get into specific valve locations because I wasn't looking for a problem at that time. I was looking for any abnormalities in the normal maintenance of those key parameters.

Q. After the 12's were discovered shut, did you ever state that the discovery of the closed feedwater block valves --

THE COURT: Wait, wait, wait. Why don't you go through the door.

MR. SELTZER: I will withdraw it, your Honor.

THE COURT: All right, sit down.

MR. FISKE: I will withdraw my anticipatory objection.

Q. What does the phrase feed and bleed mean to you?

THE COURT: Do we need to get into all of this? I thought Mr. Zewe went into this at quite some length.

MR. SELTZER: Let me just go through these questions myself --

THE COURT: Will he do anything more than tell me about it or is he going to bring it in to some new context?

MR. SELTZER: In light of that, your Honor, I can skip this.

THE COURT: I don't want to cut you off from anything that's new, but if it is just a further

description of the same thing we have already had by another witness, we don't really need that, as we discussed.

Q. You said that you were in charge of the primary side of the panel throughout the accident. You have described the automatic actuation of emergency safety features that occurred very soon after the 4 a.m. start of the transient.

Was there any point during the time that you were still on duty the morning of the accident where you manually initiated a full HPI injection?

A. Yes.

Q. How many times did you initiate a full manual actuation of high pressure injection?

A. Once.

Q. When relative to any other events that would fix it in point of time do you recall the one full manual actuation of high pressure injection?

A. It was around the time of the site emergency.

Q. When you say site emergency, as I understand it, there was a site emergency and then there was a subsequent general emergency. Do you distinguish in your mind between those two terms?

A. Yes, I know the difference.

Q. What was the site emergency and what was the general emergency?

A. There are three grades in the emergency escalation when you declare a radiation type emergency or a problem at the plant. There is local emergency and then site and then general. The declaration of the general emergency really isn't clear to me. I know that once you are in the site emergency state we were beginning to take a lot of the actions in the emergency plan, and I don't clearly remember the declaration of a general emergency.

MR. SELTZER: I may have misspoken earlier, your Honor. The general emergency was declared 7:24 and a site emergency was declared at 6:50. I didn't want to mislead the Court or the witness by my having confused those two events. I think the general emergency was declared after Gary Miller, the station manager, arrived in the control room.

I am not offering that as testimony, but I think that's what the record reflects.

Q. Let me show you the computer alarm printer and ask you if on that you can identify the point at which there was the manual actuation of the full high pressure injection?

A. The pages in mine are numbered. Manual initiation is indicated on page 31.

Q. What is the time that's shown for the point at which there was manual actuation of full HPI?

A. It would be at 07:20:22.

Q. So that would be approximately 20 minutes after 7 in the morning?

A. Yes.

Q. Do you remember anyone else during the first four hours of the accident operating the controls that would initiate a full HPI actuation?

A. No.

Q. Based on the routine and the procedures that you were following that morning in the control room, is it possible that someone else stepped up to the panel and took control of HPI?

THE COURT: Sustained.

Q. What routine and procedures were you following for manning the panel that controls HPI?

A. During the morning I was, as I said before, in charge of control of the primary system, with Mr. Scheimann's assistance. I was stationed at panel 3. When I wasn't at panel 3 and was going to move to panel 4, for a minute, or so, I would inform Mr. Scheimann I was leaving. If he was going to shift his position, he would tell me.

Conversation was constant in that when you are asking someone to take over your duties on a panel, you do a turnover, you say "this is what I am doing right now," then you leave. After that he says "okay, I have got it."

So that in each case when you shift your position on the panel, the person that you are leaving in charge of that panel has some knowledge of what you are trying to accomplish before you turn it over to him.

Q. Based on what you were doing, if you turned over the panel to someone else and had started HPI, is that a piece of information that you would communicate?

A. Yes.

Q. Based on your understanding of how the routine was being followed in the control room, if you reassumed control of a panel that had the HPI controls after having stepped away for some interval, would the person from whom you were assuming control tell you whether he had initiated HPI?

A. Yes.

Q. Are the high pressure injection pump and the makeup pump the same pumps or different pumps?

A. They are the same pumps, just a different name for the same piece of equipment.

Q. I think you probably gave the answer to the Court this morning. If it is operating in its makeup mode from what water source does it draw?

A. It draws from the makeup tank.

Q. If the pumps are operating in their high pressure injection mode, where is the water being drawn

from?

A. The borated water storage tank.

Q. If the pumps are drawing from the borated water storage tank, are there any other pumps that could be simultaneously withdrawing water from the makeup tank?

A. No.

Q. Are there any valves that could be letting water out of the makeup tank while the HPI pumps are pulling water from the borated water storage tank?

A. No. When HPI is drawing from the borated water storage tank, the outlet of the makeup tank, the pipe that comes out of the bottom, is isolated.

MR. SELTZER: Would you get the chart, please?

THE COURT: I can see it. It is right here. Mr. Seltzer, you don't need to get that chart. I have got it right here. Valve 12, right? Right there?

THE WITNESS: No, sir, that would be 137 that does the isolation.

THE COURT: MUV 137, right above it?

THE WITNESS: Yes, sir. That's the swing check --

THE COURT: How come you have it marked down to here? That's the valve that doesn't let it go back? You are talking about this one which is the one that isolates it, that's the valve that doesn't let it go back, right?

THE WITNESS: Yes, sir. This shows automatic

injection mode assuming operator action in accordance with the --

THE COURT: When you isolate the makeup tank, you close this one here, right?

THE WITNESS: That's the operator's action. The automatic action is that this valve closes.

THE COURT: I understood that from Mr. Zewe to be a one-way valve that would let stuff through but not let it back.

THE WITNESS: That's correct.

THE COURT: Anyway, we are all together now.

Q. What happens to that valve if water is being drawn from the borated water storage tank?

A. The valve we are talking about, MUV 137, upon initiation of flow from the BWST closes and does not allow water to exit the makeup tank.

Q. Have you reviewed charts that show what was happening to makeup level during the morning of the accident?

A. Yes.

Q. Do you know what that chart shows was happening to make up tank level at 5:41 a.m.?

A. Yes, I do.

Q. What was happening?

A. Makeup tank level was decreasing, going down.

Q. Based on your understanding as you have testified today as to how the systems work, what does the data that you have reviewed on makeup tank level indicate about whether HPI could have been on full manual actuation at 5:41?

A. It could not.

MR. FISKE: I am going to object to that, your Honor. I don't think that Mr. Frederick is being called here as an expert witness on whether this could or could not have happened. He is supposed to tell us what his recollection is of the events, and apparently he has done that. Now they are trying to go beyond that to show that based on these charts, or whatever, it didn't happen or couldn't have happened. I am not sure that is appropriate for Mr. Frederick.

MR. SELTZER: May I be heard, your Honor?

THE COURT: Yes. I think this objection is going to cause a witness trip.

(The witness left the courtroom.)

MR. SELTZER: Your Honor, I can explain our position from this chart very quickly, and then your Honor can rule. The witness has just indicated that when the makeup pumps are operating in a makeup mode, they draw down water from the makeup tank, and we have reproduced here from B & W reactimeter data, this is their machine, this

shows what was happening to makeup tank level during one part of the accident. We have drawn a line at 5:41, which is the point where the last reactor coolant pumps were turned off and where there were entries describing what was happening.

Mr. Frederick has just testified from his understanding --

THE COURT: Let me ask you this. I see what you are saying over there. On the other hand, if you look at this valve diagram, is there any reason that they couldn't have hit the HPI and gotten to turn off valve number 12 and had drawn off all sources?

MR. SELTZER: I think Mr. Frederick would say that is impossible.

THE COURT: Why is he prepared to say it is impossible?

MR. SELTZER: He will describe the system's operation. As an operator and now an instructor he is extremely familiar with how these systems function.

THE COURT: Is he prepared to say that if you open up valves 5-A and 5-B that there is an automatic closure of valve 12? If you open up these, does that mean that that one is automatically closed?

MR. SELTZER: I think it is 137 that shuts.

THE COURT: I am not sure that I agree with you

about 137 because Zewe testified to something quite different about 137 than this witness has testified to.

MR. KLINGSBERG: No, it is exactly the the same.

THE COURT: If this witness testifies that 137 is the manual one, then it would appear that there is no reason to have valve number 12 at all.

MR. SELTZER: 137 is not manual. It is an automatic check valve and when it sees backpressure from the borated water storage tank --

THE COURT: That's exactly what Zewe told me, you are right. That's what Zewe told me. When the thing starts to back up, it closes. You are a hundred percent correct.

This witness, however, said that you could manually operate 137 to close. I am not sure, that he may not have made a mistake about that. If he is right about that, then there is no reason to have valve number 12, because then you would have two valves serving the same function right next to each other in the line and --

MR. SELTZER: I am sure this wouldn't be the first time that this plant has had two valves performing the same function.

THE COURT: You have this here. I suppose you can make an argument from that chart, which is Exhibit 3022, you can make the argument from that, if you want to, but it

does seem to me that unless a witness is prepared to say that this system is going to close off 12 at the same time as it opens up 5-A and 5-B automatically, that then it doesn't necessarily follow that you aren't drawing down from both borated water and the makeup tank at the same time.

MR. SELTZER: Your Honor, I think one of us has to ask Mr. Frederick whether it must follow that either valve 137 or valve 12 shuts whenever there is full actuation of HPI. If that were so, then the makeup tank level could not be drawn down when there is full HPI initiation, and this decline on 3022 would show that there could not have been a full HPI actuation at 5:41.

THE COURT: I don't know that it necessarily shows that at all. Unless this witness tells me that, I haven't heard that from any source except from you.

MR. FISKE: There is one other problem here, your Honor. There is in effect the same problem that was outlined previously with respect to Mr. Zewe.

You heard Mr. Zewe's testimony how in the week or two or a couple of months after the accident --

MR. SELTZER: Wait, we don't have to get into that.

MR. FISKE: We certainly do. Mr. Frederick repeatedly told everybody at GPU, and it is right in their

own chronology based on what Mr. Frederick insisted on, in the words of one of the GPU people, that HPI went on full at 5:40. So Mr. Frederick, side by side with Mr. Zewe and Mr. Faust, was telling people at GPU in the preparation of this official chronology that HPI was in fact turned on on full at 5:40. The people at GPU who recognized that he was insisting on that put that in the chronology a year and a half later after there had been exhaustive investigation of this and filed it with the Nuclear Regulatory Commission as GPU's official statement of what had happened at 5:40.

I don't think it is appropriate for Mr. Frederick, who is so deeply involved in the credibility questions, at the very least, that go into this, to now be coming in and acting as some kind of an expert witness to undermine his own credibility in terms of what he was telling people in the spring of 1979.

If this is really going to be the subject now of expert testimony that somehow it was absolutely impossible, it couldn't possibly have happened that HPI went on at 5:40 and this is something that GPU now has suddenly discovered, which they obviously didn't know in September of 1980, a year and a half after the accident when they filed it with the Nuclear Regulatory Commission -- and I might say that was six months after this lawsuit had been brought, they still were saying that HPI had gone on at full at 5:40

based on the statements of Frederick, Zewe and Faust -- I don't think that it is up to Mr. Frederick to come in here now and act as some sort of on-the-spot expert witness to say that this couldn't have happened.

MR. SELTZER: Let me respond --

THE COURT: Let me ask you this. I suppose it is conceivable that in the tensions of that morning Frederick believed that something had happened at a particular time and after the event --

MR. SELTZER: I think it is Zewe, your Honor. Frederick has never testified --

THE COURT: Frederick.

MR. SELTZER: Zewe is the one who said there was a 5:41. Frederick never --

THE COURT: Mr. Fiske says that Frederick said that it happened.

MR. SELTZER: I think he misspoke. Frederick has never on the record with any testimony said that he thought there was a 5:41 --

MR. FISKE: Mr. Zewe testified here just three or four days ago that they had a meeting with the PORC, that Mr. Zewe as at, Mr. Frederick was at and Mr. Faust was at, and all three of them, Zewe, Frederick and Faust, all told the PORC that HPI had come on at 5:40.

You may remember further that Mr. Zewe testified

that according to both Mr. Frederick and Mr. Faust there had been a countdown at 5:40 at which when one of them hit the reactor coolant pumps, the other one hit high pressure injection. That's the detail that they were going into.

THE COURT: You are getting, though, into questions of credibility of the witness on which you are obviously going to cross examine and which you are entitled to urge upon the Court. But it seems to me it is open to this witness, subject to your cross examination on credibility, to say to me, for argument's sake, Zewe is wrong when he says 5:41. It is open to the witness to say "I thought I had at 5:41, but in looking back at it, in looking at these records, I realize that I must have been mistaken."

How that leaves the issue of weight of the testimony is perhaps then another matter, but as far as the admissibility of the man saying "from looking at these records I conclude that it was another way," that's a different matter at this particular point which only has to do with whether the witness shall be permitted to be asked the question.

I think I will let him be asked the question, although I must confess that it is an unusual wrinkle that the person is, if he has at some time in the past, and you haven't asked him this, Mr. Seltzer, whether or not he did

not in fact tell the PORC that it was 5:41 -- I guess somebody is going to ask him that before the witness finally leaves the stand -- but if he says he did tell them, if he says "yes, I did tell them it was turned on at 5:41," it is unusual for him to then be permitted as a quasi expert to say "I am contradicting that statement based upon my review of the records," but I am going to let him do it.

Bring the witness in.

MR. SELTZER: Your Honor, I might add that Mr. Zewe testified in no uncertain terms that you could not be drawing down makeup pumps while HPI --

THE COURT: I will be interested to see what he says about these valves.

(The witness entered the courtroom.)

BY MR. SELTZER:

Q. Mr. Frederick, could you take a look at the diagram of the valves that connect to the makeup tank and explain what happens to those valves when there is full HPI actuation?

A. All the valves on the --

Q. The valves that connect directly to the makeup tank, the 137 and the 12?

A. The 12 is an electrically operated valve that has a motor on it to open and close it, but it is only actuated by a manual signal. I would have to go to the

panel and turn the switch to make the valve move.

THE COURT: When you close 12 -- excuse me. How do you turn on 5-A and 5-B? How do you open 5-A and 5-B?

THE WITNESS: Several ways. When ES is automatically initiated, they open automatically.

THE COURT: If you manually initiated HPI, do you push a button to open 5-A and 5-B?

THE WITNESS: No. What you do to get -- maybe the term I am using is wrong -- manual initiation, that is full manual initiation of the high pressure injection, occurs when you push these red buttons right here.

THE COURT: What does that --

THE WITNESS: It is just a matter of pushing two buttons.

THE COURT: What does that do, that opens up 5-A and B and energizes the pumps?

THE WITNESS: It actuates several dozen components, not just the pumps and those valves.

THE COURT: That's all I am asking about so far. It opens up 5-A and 5-B and opens up makeup pumps 1-A and 1-C, turns them on, right?

THE WITNESS: Yes.

THE COURT: Does it do anything else? What else does it do when you hit those buttons?

THE WITNESS: It takes automatic control of the

discharge valves in the makeup pumps and sets them at their prethrottle automatic set points. It opens into a prethrottle position, 250 GPM's, approximately. Then it also controls the recirculation valves in the makeup pumps that are shown there as 36 and 37 about in the center of the diagram, it closes those valves.

THE COURT: Okay.

THE WITNESS: On this picture I believe that's all is going to happen right now. There are other systems that are affected by pushing those buttons. All we are doing is lining up the makeup pumps A and C so that they trace back there through 138-A and 5-A, borated water storage tank, that flow path is open and it is opened on the C pump through the B valve. Then you have the presence of -- that pressure from the borated water storage tank is felt through 5-A, through 139 and 40 and it pushes up against 137 and it closes it.

Do you see 139 and 40 there, the suction head pumps? Here. Once this 5-A opens the pressure from this tank is felt all the way back through there and closes it, closes the check valve. It seems that all they are showing on this diagram is where the water is coming from to get into the system, but these other systems are not shown -- it does not show the effect on that.

All we are seeing is this pressure, that's about

60 feet of water, which is roughly 30 pounds, or so, pushing down on all this piping here and back up against that check valve, back around that loop. As long as 12 is open you will have a force against the check valve.

THE COURT: I don't understand this one respect. Why is it that if makeup pump 1-A is pumping full blast, it doesn't pull water from any pipe that puts water into it? Pump 1-A is pushing water on this chart to the right, correct?

THE WITNESS: Yes.

THE COURT: It is drawing from the left, correct?

THE WITNESS: Yes.

THE COURT: Why is it putting backpressure on the makeup tank when it is pulling water from that direction?

THE WITNESS: The assumption cannot be made that pressure in this line will be zero or a vacuum just because it is pumping. The pressure in this line will be a function of the elevation of water in this tank and this tank combined. If the elevation of water in this tank is much superior to this elevation, then this will be the controlling pressure. If this pressure is 30 pounds and the pressure on this tank is less, then that pressure will overrule this check valve back here and shut.

THE COURT: Are you prepared to say that that's

what in fact happened at 5:41 a.m. on March 28, 1979?

THE WITNESS: I wasn't aware that I had said that.

MR. SELTZER: Wait a second, your Honor.

THE COURT: Please, please.

(Record read.)

THE COURT: I am saying, are you prepared to say that that is what indeed happened at 5:41 on the morning of March 29, 1979?

THE WITNESS: No. In reviewing these charts, what I am prepared to say is that that in fact did not happen, that whatever condition existed at 5:41, it was such that we were still able to pull water through the makeup tank. If HPI were initiated, that would be impossible because this check valve would be backseated.

THE COURT: You don't know that the pressure on that check valve would have been 30 pounds backwards, do you?

THE WITNESS: It is how the system is designed to function. That is how we were set up on that day.

THE COURT: I know, but do you know from your own experience or knowledge or engineering background that that is is fact what happened?

THE WITNESS: Yes. I have seen it happen many times.

THE COURT: What?

THE WITNESS: That when HPI is initiated, the makeup tank level stops decreasing. It happens that way every time. It is just a function of the elevation of the two tanks. One is lower than the other one and is therefore overruled.

THE COURT: Okay. Thanks very much.

BY MR. SELTZER:

Q. Would you take a look at GPU Exhibit 3022 --

THE COURT: Let me just stop you. Does this happen with -- I take it HPI involves two pumps, correct?

THE WITNESS: Automatic initiation would involve two pumps, yes.

THE COURT: Suppose you only had one pump.

THE WITNESS: Which one, sir?

THE COURT: For example, here, you have got 1-A and 1-B going and you have got that connecting line between them. I take it 1-B is doing the pulling from the makeup tank while the 1-A is doing the pulling from the storage tank, right? We are talking about Exhibit 3020, for the record.

THE WITNESS: No, sir. In this condition we would be drawing water out of the borated water storage tank.

THE COURT: This indicates that you are drawing

water out of the makeup tank as well.

THE WITNESS: I don't know why it shows that.

THE COURT: Go ahead. I gather I will await hereafter on this.

THE WITNESS: It might help if it was laid out just a little differently and you could see the difference. Should I redraw it for you?

THE COURT: I will let Mr. Seltzer put questions to you. This is an exhibit that's already in evidence, but I can't let you redraw it for me. They will have to do that.

BY MR. SELTZER:

Q. Based on the understanding that you have explained of when makeup tank level can decrease and when it cannot decrease, what does the data from the B & W reactimeter shown on GPU Exhibit 3022 indicate as to whether high pressure injection could have been on a full actuation at 5:41 a.m.?

THE COURT: He answered that already several times, Mr. Seltzer. He said it was impossible. That's what he told me in an earlier answer. Let's go on.

Q. Did there come a time when you attended a meeting of the PORC with Mr. Zewe and Mr. Faust after the accident to discuss what had happened during the accident?

A. Yes.

MR. FISKE: Your Honor, I am going to put that question in the same category as two or three others that we have objected to. I think we are entitled to develop that on cross examination.

THE COURT: No, let's see. Apparently he has not been specifically asked that as to himself, and I will let him answer this one. Go ahead. I will overrule that objection under these circumstances. Go ahead.

A. Yes.

THE COURT: Were you at such a PORC meeting?

THE WITNESS: Yes, sir.

Q. At that PORC meeting was there a discussion of full manual actuation of high pressure injection?

A. It was one of the topics that we discussed, yes.

Q. Did any of the control room operators who had been in the control room on the morning of the accident say anything at that meeting about when high pressure injection had been put on a full manual actuation?

A. Yes. Mr. Faust, Craig Faust, said that he felt there was a high pressure injection actuation at about the time that we closed off the -- at the time when we turned off the reactor coolant pumps.

Q. The first two pumps or the last two pumps?

A. The last, the final pumps, the last two pumps.

Q. So that would be at about 5:41 a.m.?

A. Yes.

THE COURT: That's about this time we are talking about, right?

THE WITNESS: Yes. The chronology shows it at exactly this time, yes.

Q. What is your best recollection about what if anything you said when Mr. Faust said he believed there had been a full manual actuation of HPI at or about 5:41?

A. I didn't say anything. I didn't agree or disagree.

Q. What was the state of your knowledge at that time about whether there had been a full manual actuation of HPI at 5:41?

A. We were working strictly from memory at that meeting trying to come up with fresh information, and I didn't have a memory that coincided with his, but I couldn't remember clearly enough what time I did the manual actuation to tell that it wasn't at that time. I needed more information to precisely figure out when I did the manual actuation.

Q. So what did you say about it when the topic was raised?

A. Since there was no data available, I didn't say anything. I didn't offer a dissenting opinion.

THE COURT: Mr. Frederick, this caption on GPU

3020 reads, "Manual injection mode following reactor trip." What does that caption mean?

THE WITNESS: If you recall, I described starting an additional makeup pump and closing the letdown isolation valve immediately after the reactor trip when I arrived back at panel 3. I had gone over to the other panels and --

THE COURT: That's what you are talking about, the manual injection of HPI, right?

THE WITNESS: That's manual injection. I guess the terminology --

THE COURT: Is this a good time for a recess?

MR. SELTZER: Yes, your Honor.

THE COURT: Very good. We will take a ten-minute recess.

(Recess.)

(Continued on next page.)

(Open court).

Q. Mr. Frederick, looking at GPU Exhibit 3020, which is the diagram of the make-up pumps and HPI pumps drawing from pumps A and B, when the pumps are lined up so that A and B are drawing HPI flow, full HPI flow, where does that water come from?

A. It comes from the borated water storage tank.

Q. Can you explain from diagram 3020 how the water effects the make-up tank?

A. When you start flow through the 5, ES-35 A valve, just by opening the valve, you take the pressure that's in the borated water storage tank, a very large tank, about 60 feet high, outside the building, and elevate it about 20 feet above the make-up tank, all that pressure is exerted on the check valve which is at the discharge of the make-up tank and it closes that check valve.

Q. What number is the check valve?

A. 137. That's the small tank at a low elevation and this pressure backseats the check valve and prevents water from coming out of the make-up tank.

In this particular diagram, what you are going to see, all these colored and dashed lines show that the water in the make-up tank, the levels are going to be increasing slightly due to the sealed return and the resurge in the pump. The resurge going through 36 and 37

and the resurge --

Q. Which tank?

A. The make-up tank.

Q. I think you made a remark that there was something you would change on this chart.

What were you referring to?

A. When I was speaking to his Honor I didn't mean to change this chart or redraw this chart. I wanted to draw a picture that shows the difference in size of the tanks and difference in elevation so it would be a little more obvious why the check valve can't be opened. I didn't mean to change the exhibit. I didn't want to do that.

Q. How would you change the size of the tanks to illustrate what you wanted to illustrate?

A. Well, as I have said, the borated water storage tank is about 60 feet high. The make-up tank is about, what did we say, 100 inches or 120 inches. It is a very small tank in comparison to the borated water storage tank. It is a significant low elevation. The reaction of that check water is going to backseat it every time.

Q. Let me turn to another subject.

Before March 28, 1979, was there a method by which operators were informed if control room procedures were being changed?

A. Yes.

There were several ways that we were informed of procedure changes. We had a required reading book in the control room which -- into which all procedure changes were entered and we were to review them and initial a sheet that showed that we had reviewed them.

We had -- well, there was a procedure review, kind of like a surveillance on a regular basis, that you had to go through and read all the procedures whether they were changed or not. Of course, we had the requalification training where they would point out the significant changes in the procedures that had happened over the last period of time since you had training on procedures.

So in those three ways we would learn about all kinds of procedure changes.

Q. In learning about procedure changes, did you know before the accident whether any procedure changes for your unit had originated with Babcock & Wilcox?

A. Yes. That was one source of information that caused procedure changes.

Q. Prior to the day of the accident, what training did you get at Metropolitan Edison on other events that had occurred at Three Mile Island?

A. Well, that type of information was relayed to us in a similar manner.

We had required reading book which would include

bulletins or information from any source that supervision thought it was appropriate for us to be aware of. We also had the supervisor's memos, in which if he was apprised of some situation that had occurred that was relevant to our plant, then he could let us know through one of those memos.

We also had LER, that is Licensee Event Report reviews in training and they were part of our reading and study cycle in the requalification.

Q. Before the accident, did you receive any training on events that occurred at other company's nuclear plants?

A. Yes. In the same way. They would be included with the information about local LER's.

Q. In 1978, did you learn that a change had been made in the small break loss of coolant accident procedure?

A. Yes.

Q. What was the nature of that change?

A. It was an insertion of a special section of the loss of coolant accident procedure which addressed a response which was necessary to a small break LOCA when it was in conjunction with other indications. That is, a failure of a diesel operator or failure of a make-up pump to start during a LOCA.

Q. Did you receive training on that change of loss of coolant accident procedure?

A. Yes, we did. I received it through all the avenues I just discussed. The review on-shift, the required reading, the requalification training and specific drills that we had to run on that procedure. They gave us a drill scenario that we had to act out and be able to accomplish the tasks outlined in the drill within a specified time period.

THE COURT: I hate to come back to this. But my memory about this chart 3020 -- do you still have that there?

THE WITNESS: Yes, sir.

THE COURT: You know, this chart indicates that coming from the make-up tank at this point is up to 160 gallons a minute through this line and up here 95 gallons a minute through this line.

That's what that chart tells me, does it not?

THE WITNESS: These are right but it is not coming from the make-up tank. The blue indicates water --

THE COURT: No. This says normal make-up.

THE WITNESS: Because that's not a high pressure injection line. That's the normal make-up line. That's the pipe. That's the reactor coolant system inventory control valve and this is the normal make-up -- this is the line we normally control pressurizer level and the system inventory through. We don't usually use these 16 A, B, C

and D lines. We use these lines. This is the normal flow path or make-up so we call it the normal make-up line. We're labeling the pipes.

THE COURT: You see, when you had the make-up pump going all alone, Mr. Frederick, and I'm now looking at 3018, when you had the make-up tank going all by itself, it is pumping the 95 gallons per minute up to the top. It is pumping up to 160 gallons per minute on this line that goes straight across through valve 17, et cetera.

THE WITNESS: Yes.

THE COURT: Now, you have the same thing happening here in 3020, you have the same flow, the same pipes and this diagram has the line identically open. It is now shaded in blue but whereas heretofore it was shaded in red.

THE WITNESS: Well, the shaded --

THE COURT: Are you saying to me that the flow that is listed here that is going through these lines now comes from a different source?

THE WITNESS: Yes, sir, that's exactly what --

THE COURT: Coming from a different source?

THE WITNESS: Yes. It can't come out of here any more.

This red and green mixture is the water that's being added from resurge and is trapped in the tank and

water that is still coming from the system to the return is --

THE COURT: That doesn't show that it is trapped in the tank. This valve is opened here, 137. I would think a diagrammer if the valve was closed, would have had the little thing which is obviously hinged at the upper right, correct?

THE WITNESS: Yes.

THE COURT: It is hinged right there. If that were diagramed as closed, it would be hinged up against the bottom of the make-up tank, right? Right. Showing that it had in fact closed instead of being a 45 degree angle down.

THE WITNESS: No, sir. The check valve position change is not indicated on the standard schematic. It has to be understood.

THE COURT: But you are saying to me then there should be some way on this chart of showing me that this valve was in fact closed.

You see, closed valves here are marked like the big ones, are marked in black when they are closed and they are not marked in black when they are open.

THE WITNESS: That's a standard schematic.

THE COURT: Are you telling me that a check valve is left in the same position on a chart whether it is closed or open?

THE WITNESS: That's correct.

THE COURT: So that one reading the chart can't tell whether it is closed or open, that's what you are telling me?

THE WITNESS: One can tell if he understands how the system operates.

THE COURT: But the chartist has not gone to the trouble to tell you that, is that what you are telling me?

THE WITNESS: That's correct.

THE COURT: You saying that notwithstanding that the same amounts go through the same lines, apparently coming from the same pumps, that, in fact, those lines are no longer being furnished water from the make-up tank? That's what you are telling me. They are getting it from some other source?

THE WITNESS: That's correct. That's the design of the system.

THE COURT: Okay. I'm sorry to get back to this. I just want to understand these charts.

MR. SELTZER: I'm pleased, your Honor. I can see that you were looking at that and I would rather clear it up if we can.

MR. KLINGSBERG: In case your Honor wants to look at it, at 1913 and 1917 Zewe, who talked about these charts, initially explained the same thing.

THE COURT: Thank you.

MR. KLINGSBERG: 1912 but I think it starts on 1911.

Q. You said, Mr. Frederick, that you did receive training on a change that was made in the procedure for handling a small break loss of coolant accident in 1978.

Did you have any understanding as to where, in what company that change of loss of coolant accident procedure originated?

A. Yes. It came from B & W.

Q. I would like to show you what has been previously marked as GPU Exhibit 2074.

Can you identify this document?

A. Yes.

This is a letter which is from Mr. Floyd who was the operation supervisor or supervisor of operations explaining that Unit 2 operation department personnel had reviewed the change that you just described and the fact that everybody understood it and that the equipment had been physically located. That the people had signed here understood it.

Q. It indicated what, I'm sorry?

A. It indicates that the change, the 22021.3 had been reviewed and that the equipment involved in the change had been located by the people who initialed the sheet.

Q. What is the change referred to here?

A. That's the small break LOCA change that B & W recommended to our loss of coolant accident in 1978.

Q. And is the second page of the document a signoff sheet?

A. Yes, it is.

Q. Are your initials on it?

A. Yes, they are, the right-hand column near the center.

Q. What do your initials indicate?

A. It indicates that I reviewed and understood the change and I had located the equipment and understood the terms, dedicated CRO and that sort of thing, that applied to the procedure.

Q. Was this a procedure change that had any effect on the connection of high pressure injection during a loss of coolant accident?

A. Had any change in the connection of it?

Q. In how HPI was connected or cross connected?

A. Oh, yes.

The procedure change mandated a change to the standard or the standard operating valve lineup that closed the discharge cross connects on make-up pump between B and C pumps.

Q. Apart from this information on HPI during loss

of coolant accidents, did you receive any other suggested changes from Babcock & Wilcox in 1978 or 1979 before the accident affecting the operation of HPI?

A. I don't specifically recall any now, other than this recommendation here.

Q. I'd like to turn now to an event that took place on December 2, 1978.

Do you recall that there was a reactor trip on December 2, 1978?

A. I knew there were transients in that timeframe but the date doesn't really signify any particular event.

Q. Let me show you the licensee report for that transient, marked GPU 2059 for identification.

Do you recognize this report?

A. Yes.

This is just a description of the transient and the initiating events for the December 2 trip.

Q. Did you see this report in the regular course of business?

A. Yes. This was part of our required reading.

Q. Can you tell -- withdrawn.

Did you learn whether high pressure injection had automatically initiated during this reactor trip?

A. It did occur during this transient after the reactor trip, yes.

Q. What did you understand had caused high pressure injection to actuate?

A. This was an overfeed transient due to blocked open, I mean, feed regulating valve and the overfeed of the steam generators is what initiated the transient that caused the ES to actuate after the reactor trip.

Q. Do you recall a reactor trip that took place on November 7, 1978?

A. Again, the dates aren't that -- aren't part of my recollection. I just usually recall what occurred during the transient and not necessarily the date that it occurred on.

Q. Let me show you what has been marked as GPU Exhibit 2060 for identification and ask you if you recognize this -- excuse me, 2160.

A. Yes. I remember this was a reactor trip and ECCS actuation caused by the initiating event was the heater drain pump trip.

Q. Did you review this Licensee Event Report GPU 2160 at or about the time that it was issued?

A. Yes, I did.

Q. And did you say that HPI had automatically actuated during this event?

A. Yes.

Q. Did you receive training on this event?

A. Yes, along with the review, we were trained on transients like this to review the panel indications and see how the transient progressed, review something like this on the panel.

Q. What was the point of that review?

A. Just to insure that I understood both the automatic and the operator response to a transient like this.

Q. You said that there was an automatic actuation of high pressure injection.

Was there also a reactor trip?

A. Yes.

Q. Did you ever learn in connection with this event on November 7, 1978, that the reactor coolant system may have had some limited saturation at a time when pressurizer level was below the bottom of the readable scale?

A. I don't remember any reference to saturation in the training that I ever received.

Q. If you had been told that there had been such limited saturation at a time when pressurizer level was below the bottom of the readable scale, would that have been useful information for you on the day of the accident?

MR. FISKE: I object to that, your Honor.

THE COURT: Yes. Sustained.

Q. Do you recall an event that took place on April

23rd, 1978?

A. That particular day I do remember, yes.

MR. SELTZER: I would like to mark for identification GPU Exhibit 2061, the Licensee Event Report for the April 23rd, 1978, event.

Q. Can you identify GPU Exhibit 2061?

A. This is the same type of report about the transient that occurred on April 23rd in which there was a reactor trip due to an NI failure and then a subsequent ECCS actuation.

Q. Did this event involve the steam safety valves in any way?

A. Yes.

What happened after the reactor trip, subsequent to the turbine trip, it caused a rise in the steam pressure and the steam safety valves opened and some of them failed to reset. And that caused an overcooling and an ECCS actuation.

Q. Was a review of this Licensee Event Report included in any of your training?

A. Yes.

This was a report that I was familiar with and the same type of training that I had on the other incidents plus there were reports issued about this one that I reviewed.

Q. Is this the event that you were describing in yesterday's testimony where you were the panel operator who initiated second make-up pump and then throttled back on high pressure injection?

A. Yes.

Q. Will you turn to the fourth page of Exhibit 2061 where there is a narrative of the event and I would like to call your attention to the fourth paragraph beginning with the words "the operator", do you see that?

A. Yes.

Q. It says there: "The operator took the proper immediate action in manually cutting back feedwater demand shutting the letdown isolation valve, starting a second make-up pump and opening the high pressure injection valves on the side of the operating make-up pumps".

Were you aware that there was that appraisal of the operator's conduct in the Licensee Event Report?

A. Yes.

Q. And who was the operator that's being referred to there?

A. Myself.

Q. Yesterday you testified that you were aware that there was a B & W appraisal of your conduct during this transient.

I'd like to show you GPU Exhibit 2048 for

identification -- excuse me, it is in evidence.

A. Yes.

Q. At the top of page three of a letter from L.C. Rogers, the B & W site operations manager, to Gary Miller, the station's superintendent at Three Mile Island, and it states: "Based on the arguments and observations outlined above, B & W's conclusion is that the pressurizer was never emptied. It appears that only the operator's timely initiation of HPI prevented this from occurring, but the data seems to support our contention that the pressurizer was never entirely drained".

Is this the report from B & W that you were referring to yesterday?

A. Yes.

Q. And who was the operator whose timely initiation of HPI was being commented upon as you understood this document?

A. That was me.

Q. From the comments -- withdrawn.

Do you recognize the chart that is the fourth page of GPU Exhibit 2048 as the same chart that we were discussing yesterday?

A. Yes.

Q. From the comments that you received from Babcock & Wilcox and Metropolitan Edison, did you believe that you

had handled the high pressure injection and pressurizer level correctly on April 23rd?

A. Yes, I did, both the evaluations had stated that I had taken the proper actions.

Q. From the comments by B & W and the chart that B & W attached to GPU Exhibit 2048, what, if any, understanding did you have about whether your throttling of HPI had been consistent with what should have been done?

MR. FISKE: Can I hear the question again?

(Record read)

THE COURT: You may answer.

A. I understood that my actions were consistent with what was expected and what was considered the proper response for the indications that were present on the panel.

Q. What's the role, if anything, of previous successful handling of a transient situation in an operator's mind?

MR. FISKE: I will object to that, your Honor. The April 23 transient was a totally different transient. It was an overcoolant.

THE COURT: I will sustain that objection.

Q. What was the event that led you to start a second make-up pump as shown on the last page of B & W's letter, GPU Exhibit 2048?

A. In response to the reactor trip, I was taking

actions dictated in the reactor trip procedure which dictate that I should attempt to control the pressurizer level using the make-up system and so, in response to the drop of pressure, I was controlling high pressure injection.

Q. What was motivating your action when you throttled high pressure injection at the point at which it is indicated on the last page of B & W's report and throttled high pressure injection?

MR. FISKE: I think the record should reflect that the throttling reduced the flow from 1000 down to 500 pounds per minute.

Q. Can you indicate what was the throttling that you did?

THE COURT: And what was your motivation to do it?

A. The motivation was that the pressurizer level was recovering and the continuing full flow was not necessary and if I reduced flow to 500 or so to start tapering back on high pressure injection, then I could move smoothly into a control mode, that is, a smooth transition back into normal control of the pressurizer level by steadily decreasing the high pressure injection flow as we approached the 100 pound set point.

Q. What happened to the reactor coolant system pressure at the time you throttled high pressure injection

on April 23rd?

A. The chart shows that it was decreasing.

Q. Did you understand from this document that B & W had reviewed your conduct in handling HPI as depicted on B & W's chart?

THE COURT: Please, Mr. Seltzer, he's already told us that he understood that referred to him. All right. Let's not go into that again.

MR. FISKE: This is a 30-second time period in any event, your Honor, that we're talking about when it was going down.

THE COURT: Put another question.

Q. Did the reports which you received on your handling of high pressure injection on April 23rd effect your understanding of how you should control high pressure injection following subsequent reactor trips?

A. Yes.

It indicated to me that the actions that I was taking were proper and I should continue them in the future. If I saw the same situation, I would do the same thing.

Q. Do you recall that there was an event at Three Mile Island Unit 2 on March 29, 1978?

A. Yes.

Q. Did you receive training on that event?

A. Yes, we did.

Q. What was the event?

A. The event on March 29, 1978, was a loss of power to vital power supply and that caused -- also loss of bus on quite a few of the indicators on the panel, and the reactor trip. I guess I remember the significant event is the loss of vital power. I can't recall the entire scenario right now.

Q. Do you know if the indication on the pressurizer level gauge was effected by the loss of power?

A. I don't think it was.

Q. In your training, what, if any, significance did you attribute to the March 29 event?

MR. FISKE: I don't think Mr. Frederick has yet described what it was other than a failure of some bus. I think we ought to learn a little bit more about it.

THE COURT: It is premature.

Q. From your training, what did you learn were the most significant features of the March 29, 1978, event?

A. The most significant feature was the training and -- what we learned from it was on loss of the vital bus, some of the indicators would fail in different directions and we had to be able to identify through the loss of a vital bus which instruments would be effected.

We were instructed to identify the power supply for each indicator so that if a vital bus failed in the

future, we could identify the common failure on instruments which come from the same power supply. We also had additional panel instruments installed to indicate the position of the equipment that had failed as a result of the transient.

Q. In the March 29, 1978, event, was there any effect on the operation of the pilot-operated relief valve?

A. Yes. As a result of the power loss, the pilot-operated relief valve opened.

Q. Could you explain just succinctly how that happened, how you understood that happened?

A. The signal that feeds the control for the pilot-operated relief valve was fed from a vital power supply, that is a normally uninterruptable power supply. When it lost power, it gave a false signal to the pilot-operated relief valve to open which is not as a result of pressure but as a result of the control signal failure. It told the valve to open and it opened.

Q. Is that the same as saying that its fail safe position was a failed open position?

A. That's one way of saying it, yes.

Q. Do you know whether there was any change in the electrical logic to the pilot-operated relief valve after the March 29, 1978, event?

A. I know that there were some wiring changes but

I'm not really familiar with the details.

Q. After the March 29, 1978, event, what, if any, additional instrumentation was installed in the control room with respect to the pilot-operated relief valve?

MR. FISKE: I think we went through that yesterday. It was the light. We'll stipulate to that.

MR. SELTZER: I'm not sure that we had done that, but fine.

Q. Turning to a different point.

Before the accident did you have any knowledge whether any of the valves on the top of the pressurizer were leaking?

A. Yes.

The reason that I was doing the manual operation with the pressurizer system as I described yesterday were because it had been determined that one of the valves on top of the pressurizer was leaking.

Q. Was it part of your responsibility to determine which of the valves on top of the pressurizer was leaking?

A. No, that determination was made by the engineering department, based on the data that was supplied them from the control room.

Q. Did you have any understanding as to whether the engineering department was receiving any data from the control room?

A. Yes, they were. We would package information for them every night and give it to them in the morning.

Q. Among the data that you were packaging for the engineering department, what pieces of data contained information that would be applicable to determining leakage from the top of the pressurizer?

A. Well, besides this specific package that we sent them, they were reviewing leakage data by itself.

We sent them chart recorders and -- those on panel 10 over by the clock. Of course, the information we accumulated on the morning reports was available for them.

Q. What information was on the morning reports that would be useful in reviewing leakage at the top of the pressurizer?

A. We took daily readings on the relief valve discharge temperatures and posted them on the morning report.

The temperature report I'm referring to is one that also prints out that data and it can be reviewed.

Q. What type of temperature recorder are you referring to?

A. The analogue recorder on panel 10 that monitors those continuously. Strip chart report.

Q. You say it was an analogue recorder on panel 10.

What were the data points that were reflected on

that analogue recorder?

A. It is a -- there are many, many points on the recorder, 50 or 60 or so. And it records all kinds of leakage data from specific points in the waste disposal systems, most of the stuff or if not all the stuff that goes into the reactor coolant drain tank and other leakage collection drain points.

Q. Were you informed before March 28, 1979, as to which of the valves on top of the pressurizer was leaking?

A. Well, as I said, it was engineering who was making that determination. It is my understanding that some of the supervision and engineering thought it was code safety, one of the code safeties and some thought it was the PORV.

The determination had been made that it was or at least it appeared that the determination they made was because they got a code safety in the warehouse.

Q. When you say there was a determination, what do you base that understanding on?

MR. FISKE: That's what I was going to ask and not Mr. Frederick to sum up the evidence but simply what he was told and by whom.

MR. SELTZER: That's all I want to elicit.

Q. What do you base your understanding that somebody had identified it as a code safety valve that was

leaking?

MR. FISKE: In all due respect, I think the question is who told him and what did he tell him.

MR. SELTZER: Exactly.

THE COURT: No, your question was more general. Who told you it was a code safety?

THE WITNESS: I knew just from my discussions in the Operations Department that the code safety had been identified in the warehouses as available for the upcoming outage. It was an outage item that had been selected. I was aware of work that was being planned for the outage.

Q. Do you know whether any replacement valve for any of the valves on top of the pressurizer had been located?

A. Yes. The A code safety valve had been located in the on site warehouse, spare parts warehouse.

Q. Did you have any understanding what that spare code safety valve had been located for? What they were going to do for it?

MR. FISKE: It seems to me the question is who did he have these conversations with and what did they say?

THE COURT: I will sustain that objection.

Q. How did you know that there had been a search in the warehouse for a replacement pressurizer code safety valve?

THE COURT: No. Who told you? Who told you and what were you told?

THE WITNESS: I'm fairly sure that I remember receiving information through a watch turnover but I don't know who I was relieving at the time. In other words, as we come in on-shift, we get information concerning jobs that are done and the jobs that are planned, from the person that we relieve and you get a list of information. That's where I got information of that kind and I just don't know who it would have been, what individual person would have been that I was talking to because I relieved a different person every few days.

Q. Did you ever see a letter from Lee Rogers to Gary Miller which said on March 23, 1979 --

MR. FISKE: Did he ever see the letter, Mr. Seltzer?

Q. That a spare code --

MR. FISKE: Wait a moment. Did he see the letter?

THE COURT: Yes.

Did you see the letter?

THE WITNESS: I have seen letters and lists like this, but specifically to say I have seen this list would not be part of my recollection. I have seen ones like this.

Q. You referred to morning reports.

Did you ever participate in filling out the information in the morning report?

A. Yes.

Q. Were you familiar with the tailpipe temperatures that were being reported in morning reports prior to the accident?

A. Yes. If I didn't make the recording on the report, I at least gave the data to Mr. Scheiman so he could record it. I was aware that it had to be withdrawn from the panel every day.

Q. What was your understanding, if any, as to what temperature you would see in the tailpipe or discharge pipe beyond the pilot-operated relief valve if it were leaking?

A. It would be elevated above its normal temperature by some amount, depending upon the size of the loop.

Q. What did you understand -- withdrawn.

From your review of data in the control room and from filling out morning reports or seeing morning reports, what had you observed was the temperature being recorded for the pilot-operated relief valve discharge pipe before the accident?

MR. FISKE: For how far back, Mr. Seltzer?

Q. Going as far back as you remember the plant was in service?

A. It was in the 170 to 190 range.

Q. You testified a moment ago that from information you received on-shift changeoffs from possible documents that you had seen, you knew that a code safety valve had been located to replace a leaking code safety valve on Unit 2.

Did you have any personal knowledge one way or the other as to whether or not it was a code safety valve or a pilot-operated relief valve that was leaking on the top of the Unit 2 pressurizer?

A. Well, I knew that it was one or the other. It was just not part of my job to figure out which one it would be. I knew that the engineering department was making a determination.

(Continued on next page)

Q. Did you have any opinion before the accident as to how it could be determined which valve was leaking?

A. I think so. By cycling the pilot operated relief valve block valve, you could take a leakage determination and see if it made any difference while the valve was shut.

Q. Were you aware of any discussions at the plant about whether to cycle the block valve?

A. Yes, there are some that felt that if you close a block valve, it would stick, stick shut.

Q. Did you have any training before the accident as to what action should be taken if it was suspected that a pilot operated relief valve was leaking?

A. Well, it would be very similar to what I just told you. If you have suspicion that that valve is leaking, contributing to your leakage in the system, then you could cycle the valve to get a leakage determination and then that would tell you whether there was a real problem or not as far as leakage goes. Just shut it, take the leakage reading.

Q. Where did you receive that training?

A. I picked it up first at B & W.

Q. Let me show you what's previously been marked as GPU Exhibit 2165, which is the OFR procedure for pressurizer abnormal operations. You testified yesterday

that this was the procedure that you used when you were at the simulator for the two-month training program.

Let me show you a copy that I have which is 2165 marked for identification yesterday. Do you see the section that deals with a leaking pilot operated relief valve?

A. Yes.

Q. What does that B & W Old Forest Road procedure say about when, if ever, you have to close a block valve if the PORV is leaking?

A. It gives as an action after you determine that there is a leaking valve in there. It says "close the relief valve block valve if leakage is greater than that allowed by technical specifications."

Q. Is that the procedure on which you were trained during the two-month training course that you had at B & W?

A. Yes, these are the ones that we had to memorize for the initial test.

Q. It refers to leakage in excess of that allowed under the technical specifications. Were you familiar at the time that you were at the two-month B & W training course with Met Ed's technical specifications on allowable leakage?

A. Yes. We were using the Metropolitan Edison TMI-2 technical specifications.

Q. At the time that you were being trained on this procedure which says close the block valve if the leakage through the PORV exceeds text specs, what was the allowable text speck leakage? This would be leakage coming from a valve at the top of the pressurizer.

A. Yes. I think it was 10 GPM. I could review the text spec to refresh my memory a little bit. It's been awhile since I had to use them. I think it is 10 GPM.

Q. If the leakage were less than 10 GPM, subject to correction on whether the amount is right, what did you understand from the OFR procedure was required with respect to the block valve?

A. If your PORV is not exhibiting a leakage problem which is in excess of that which is allowed by the technical specifications, you can leave the block valve open. If you start exceeding that limit, then you are going to have to leave it shut.

Q. When I was asking you a minute ago about what your opinion was of what should be done at TMI-2 just before the accident, you said you thought they should cycle the block valve to see if there was leakage from the PORV.

If the block valve had been shut and there was the same amount of leakage, do you have an opinion as to what should be done with the block valve then?

A. Yes, that would indicate that the PORV was not

contributing to the leakage and you could leave it open.

Q. Taking it on the other hand, if the block valve were shut and from readings that were taken it was determined that in fact the PORV had been leaking, did you have an opinion on what should then be done with the block valve?

A. Yes. Then as long as the leakage is not in excess of the technical specifications, then you can leave the block valve back open and reopen it.

Q. What's your understanding, if any, as to whether the allowable leakage limits in the text specs for TMI Unit 2 were the same in 1979 as they had been somewhat earlier when you took the two-month B & W training course?

THE COURT: Mr. Seltzer, can I ask how this is relevant to our issues?

MR. SELTZER: Yes, your Honor. Counsel for B & W have taken the position that under the procedures, if there is detected leakage from the PORV, the block valve should have been shut and left shut.

We are establishing that under B & W's own drafted procedures under which this operator was trained and all of our operators were trained, the instruction was if the leakage is not in excess of text spec limits, then the block valve does not have to be shut and certainly doesn't have to remain shut.

THE COURT: But you went through a lot of business about testing here before. This does not have to do with this man's knowledge, but general principles. Mr. Zewe has given a lot of testimony about this. On this last one, what are you getting into that for, whether there has been a change for since '78 to '79?

MR. SELTZER: I will withdraw that.

MR. FISKE: The other point, your Honor, this is typical of what's gone on. Mr. Seltzer hasn't asked Mr. Frederick one question about the procedure that in fact was in effect on the day of the accident. Mr. Frederick has testified that he went back to B & W in 1977 and then was trained on the TMI-2 procedures as they were on the day of the accident and Met Ed eliminated this language in the B & W simulator procedures which B & W used for people that didn't have any, Met Ed rejected that and adopted their own procedure which specifically unequivocally says without any talk of text spec limits if the PORV is leaking, close the block valve.

Mr. Seltzer isn't even asking him about that. He takes him back to some draft procedure at an earlier stage in the simulator. I think the crucial thing, the important thing, is what was the procedure on the day of the accident and how did Mr. Frederick understand that procedure.

THE COURT: How much more do you have of this witness? Are you almost through?

MR. SELTZER: We are almost finished.

THE COURT: Why don't you finish up with this witness.

MR. SELTZER: I think it is going to take -- it might take half an hour to finish, but I could finish this point that Mr. Fiske raises?

THE COURT: What more do you have, because this last little bit, we didn't need to spend time on this. Let's go for a little bit or finish with this witness.

BY MR. SELTZER:

Q. Could you open up your compendium of TMI-2 procedures to tab 5 which is pressurizer system failure procedure.

A. Yes.

Q. Is this the procedure that would cover leaking pilot operated relief valve that was in effect on the day of the accident?

A. Yes, it is.

Q. Which is the section that deals with a leaking PORV?

THE COURT: Mr. Seltzer, it is only going to be of value if you tie it in with some action that he did or should have done or some thought that he had. But just to

tell me what's in here is not needed.

MR. SELTZER: That's exactly what I am coming to.

THE COURT: Let's go quickly.

Q. Looking at section A, leaking pilot operated relief valve, what did you understand from section A, leaking pilot operated relief valve, should be done if the operators operating pursuant to this procedure thought there was a leak coming from the pilot operated relief valve within the 10 GPM text spec limit?

A. If you are not exceeding the limit, you can open the valve, open the block valve.

Q. The manual action says close the electromatic relief valve.

THE COURT: Isolation valve.

A. Yes.

Q. How do you construe that manual action if the operators are closing it because they believe there is a leaking PORV?

MR. FISKE: Your Honor, it seems to me that the procedure speaks for itself.

THE COURT: I sustain that.

MR. SELTZER: I don't see how it speaks for itself.

THE COURT: I assume the Court can read it as well as anyone in this room.

MR. SELTZER: This is a technical document.

THE COURT: No. He has added a condition, and you are saying you want him to add this condition as he sits here on the witness stand and urge upon me that that is something that's in the writing. You are saying how does he construe it. There is nothing, it seems to me, to construe, there is nothing to construe.

MR. SELTZER: Your Honor, these are procedures drafted for operators, operators who were trained on the operation of these systems principally by the vendor on how to handle emergencies, and this is an emergency procedure.

Q. Let me ask, what was the basis of your understanding that you testified to on how this manual action B-1 was interpreted?

MR. FISKE: I object to that, your Honor. We are right back where we were before. The procedure is very simple. If you have a leaking PORV, it says close the block valve, period.

THE COURT: Can I put two questions?

MR. SELTZER: Certainly.

THE COURT: Do you find anywhere under sections A-1 or A-2 anything that permits you to not close this when there is some leakage? Is there any language that gives you that leave? Do you find any such language?

THE WITNESS: That says you should not close it

if you have --

THE COURT: Yes, that says you don't have to close it, even if you have leakage. Do you find any language that says that, that under certain circumstances it can leak and you don't have to close it? Do you find any language that says that? In here. It is either on the page or it isn't on the page.

THE WITNESS: It doesn't say that you don't have to close it, but it doesn't say it must remain closed. That's what I thought the point here was.

THE COURT: Okay.

THE WITNESS: Maybe I --

THE COURT: Put another question. At least we don't have any language to construe. What's your next question?

Q. Was there anything else in the pressurizer system failure procedure, in addition to the training you received from Babcock & Wilcox, that led you to believe that the block valve did not have to remain shut if it had been closed to diagnose a leaking PORV?

A. Other sections that refer to relief valve leakage tell you that once you have made the leakage determination, you can reopen. Other sections which require manual actions don't require that the manual actions have no termination point.

They say take the manual action and then it is just intrinsically implied that at some point you are going to evaluate the length for which that manual action has to be continued.

Q. Can you give me an example of that?

A. Sure. Let's look at some of these other manual actions here. Look over here on inoperative pilot operated relief valve page 2. If you have a failed closed RC R-2 it says "shift spray valve to manual and open. Open further for additional spray flow."

MR. FISKE: Your Honor, we are not talking about spray flow. There is a very simple one section, one page, that tells you --

THE COURT: I will sustain that. Strike that out.

MR. SELTZER: Your Honor, if I may be heard, the witness is pointing out that there are other instructions here, for example, "open further for additional" --

THE COURT: Wait.

(The witness left the courtroom.)

MR. SELTZER: "Open further for additional spray flow." I take it he is suggesting that that is not a command to leave the spray flow on indefinitely.

THE COURT: No. What you are doing is you are trying to say that some practice had crept up that

permitted this, and we all concede that this language doesn't say that. He said it doesn't say that. He agreed. He said it doesn't say that. He says it doesn't say how long you have to keep it closed, but it doesn't say you can leave it open if you have a leaking PORV. If you have a leaking PORV, it says close. He agrees that that is what he says.

MR. SELTZER: But the jugular, if you will permit me, your Honor, is that whether the PORV is leaking or not leaking, if they follow the immediate manual action and close it, no matter whether it is leaking or not leaking, they are going to reopen it. Therefore, on March 28, 1979, the day of the accident, whether that was a leaking PORV --

THE COURT: Why would they open it? The followup action says repair it during the next shutdown.

MR. SELTZER: They will do that, your Honor, but --

THE COURT: Then until you have had a shutdown where it is repaired, then I suppose the block valve should be closed.

MR. SELTZER: No, your Honor --

MR. FISKE: It is meaningless if it says close it and then open it 20 seconds later again. What's the point in opening it in the first place?

MR. SELTZER: I will tell you what the purpose

is. It is a diagnostic step. It helps diagnose whether there is a PORV leak and then you can put in a repair ticket for it. But if the leakage is within text spec limits, why defeat the operation of a valve that was intended to protect the code safety valves?

The leakage is within all allowable limits, they have diagnosed whether it is leaking. Now open it and get the advantage of having a pilot operated relief valve --

THE COURT: Where is the text spec?

MR. FISKE: The text spec doesn't say anything about the block valve, your Honor.

MR. SELTZER: Here it is, page 3/4 4-15 under D, it says --

THE COURT: That doesn't say you can have 10 gallons leakage from the PORV notwithstanding pressurizer system failure procedure 2205-1.5.

MR. SELTZER: The technical specifications are the paramount instruction on how the plant can be operated.

THE COURT: But 10 GPM I assume, Mr. Seltzer, has to do with leaks from flanges, leaks from code safeties.

MR. SELTZER: That's right. It is the totality.

THE COURT: When you get down to this specific valve, this specific valve, they say if you have a leak, isolate the valve and fix it on your next shutdown. That's what it says.

MR. SELTZER: Yes. But --

THE COURT: It doesn't say you can let it leak. It says you close the block valve.

MR. SELTZER: If there is a block valve there, you might as we will see if the valve is leaking, but there is no reason to defeat the operation of that valve if the leakage is within operational limits.

THE COURT: It might occur to somebody that one of the reasons to do that is that -- Mr. Zewe said if you leave these things leaking, after awhile they become damaged and then they don't function properly.

MR. SELTZER: Apparently Babcock & Wilcox who supplied the valve trained people that you didn't have to close the block valve at all.

THE COURT: No, no. The instructions that were in the control room the night of the accident were that the leaking pilot operated relief valve, if it leaked, you should have the block valve closed. The instructions that were in that room that night said that. We all concede that. That's what this page says.

MR. SELTZER: I absolutely concede that's what the words say. But the point that Mr. Frederick was making, with all deference, your Honor, is that an instruction that says do something doesn't always in the context of the way procedures are written have to tell you when it is time to

stop doing it. Just as it says initiate spray, it didn't say when to suspend spray. You don't have to leave the spray on until the room is flooded, presumably.

THE COURT: No, it does. It does. It says in A-3, "Repair during next shutdown." It does tell you when is the termination point. Close the valve, repair during next shutdown.

MR. SELTZER: It doesn't say that you have to leave it closed until the next shutdown, though. You could diagnose it, then open it and repair it during the next shutdown. We would be happy to submit that if B & W, the vendor, had thought that this procedure mandated keeping the valve shut, then I suggest that their simulator procedure certainly would have said and they would have been training the operators that you must close it and keep it closed.

Instead they don't even require as a diagnostic step closing the block valve. They don't even suggest that it would be a prudent thing to do to close it just to check whether it is open. They say don't even touch the block valve unless the leakage exceeds text specs.

MR. FISKE: Your Honor, that's incorrect. That was what was in that simulator procedure in 1976. This specific procedure was revised to eliminate that, and your Honor was absolutely correct, that on the night of the

accident in the control room they were told if you have a leaking PORV, close the block valve.

I might say, your Honor, that the NRC agreed completely with your Honor's recent analysis of this and they fined Met Ed for not having the block valve closed for precisely the argument that we are making here. The procedure says if you have a leaking PORV, close the block valve. "This is your procedure, Met Ed, you adopted it, you had it in the control room that night, and you didn't follow it and therefore you are fined." That's precisely our argument here, your Honor.

THE COURT: The evidence point that we had before us, which is this fellow is going to construe this language, it doesn't seem to me that there is anything there to construe, so I am going to sustain the objection to any claimed instruction of that language, and we will be in recess until 10:15 tomorrow morning.

(Court adjourned.)

WITNESS INDEX

Name	Direct	Cross	Redirect	Recross
Edward Russell Frederick (Resumed)	3378			

EXHIBIT INDEX